

## SOLVENT CEMENT WELDING JOINTS

### Joining Equipment and Material



- Cutting Tool  
Saw & Pipe Cutter (Ratchet Type, Wheel Type)
- Pipe deburring & beveling tool, file or knife
- Solvent Cement  
PVC cement for PVC materials, CPVC cement for CPVC materials
- Primer
- Cleaner
- Cotton Rag
- Square
- Marking Pen
- Tape Measure
- Brush



①

### 1. Cutting ①②

Pipe ends must be cut squarely.

Check the pipe end with a square to make sure it has been cut squarely.

**Note:** A diagonal cut will reduce bonding area in the most critical part of the joint.

Wheel type cutters are not recommended for large diameters since they tend to raise flare at the pipe end.

Flares **must** be removed with a file or deburring tool, since it will scrape the cement away while inserting pipe into the fitting.



②

### 2. Deburring ③

All burrs, chips, filings, etc. around the pipe must be removed before joining.

Use a knife, deburring tool or a half-round coarse file.

All pipe ends should be beveled by 45 degrees.

**Note:** Failure to chamfer the edge of the pipe may remove cement from the fitting socket, causing the joint to leak.



③

### 3. Inspection and Cleaning ④⑤

Visually inspect the inside of the pipe and fitting sockets.

Remove all dirt, grease or moisture with a clean dry rag.

Check pipe and fitting for potential damages such as splits or cracks and replace if necessary.



④

### 4. Testing Dry Fit of the Joint

Check pipe and fitting for dry fit before cementing.

The pipe should be inserted to the fitting easily for about 1/3 to 2/3 of the socket depth.



⑤

### 5. Depth-Of-Entry Mark ⑥

Mark the socket depth of the fitting on the pipe O.D..

This reference mark can be used to ensure the pipe is completely bottomed into the fitting when joining.



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## 6. Priming ⑦

This step is necessary to penetrate and soften both pipe and fitting socket surfaces for cementing process.

Apply a layer of primer to the surface of the pipe and fitting socket with a natural bristle brush.

Proceed immediately to the cementing procedure before the primer dries.



⑦

### Recommended Brush Size for Primer and Cement Application

Nominal Pipe Size	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	4"	5"	6"	8"	10"	12"
Brush Width	1/2"	1"	1"	1"	1-1/2"	1-1/2"	1-1/2" to 2"	1-1/2" to 2-1/2"	2" to 3"	3" to 5"	3" to 6"	4" to 8"	6" to 8"	6" to 8"

\* Use Only Natural Bristle

### Applicators

Select a suitable pure bristle type paint brush. Use a brush or roller with proper width to apply the primer and cement.

Speedy application of cement is important due to its fast drying characteristics.

**IMPORTANT NOTE:** A dauber type applicator should only be used on pipe sizes of 2" or below. For larger diameter pipe, a brush, swab, or roller must be used.



⑧

## 7. Application of Solvent Cement ⑧

While the primer is still wet, apply the solvent cement evenly and quickly around the outside of the pipe at a width a little larger than the depth of the fitting socket.

Lightly coat the inside of the fitting socket with the cement.

Apply a second coat of cement to the pipe end.

**NOTE:** Read all warnings on primer and cement containers before the installation.



⑨

## 8. Joint Assembly ⑨

Insert the pipe into the fitting socket bottom with a one-quarter turn to evenly distribute the cement. This procedure should be operated quickly and smoothly.

Do not continue to rotate the pipe after it has reached the bottom of the fitting socket.

A good joint will have sufficient cement to make a bead all the way around the outside of the fitting hub.

Hold the pipe and fitting together for at least 30 seconds to make sure the pipe has a good bond with the fitting.

## 9. Clean Up

Remove all excess cement around the pipe and fitting with a dry cotton rag while the cement is still soft.

## 10. Initial Set Time

Initial set time is the necessary time to allow the joint to create enough bonds before it could be carefully handled.

### Recommended Initial Set Time

Temperature Range	Pipe Sizes 1/2" to 1-1/4"	Pipe Sizes 1-1/2" to 2"	Pipe Sizes 2-1/2" to 8"	Pipe Sizes 10" to 15"	Pipe Sizes 15"+
60°F to 100°F / 15°C to 40°C	2 min	5 min	30 min	2 hrs	4 hrs
40°F to 60°F / 5°C to 15°C	5 min	10 min	2 hrs	8 hrs	16 hrs
0°F to 40°F / -17°C to 5°C	10 min	15 min	12 hrs	24 hrs	48 hrs

**Note:** In damp or humid environment, please allow 50% more set time.

## 11. Joint cure time

Joint cure time is the necessary time for the joint to be strong enough before pressurizing system.

### Recommended Joint Cure Time

Temperature range during assembly and cure periods	Pipe Sizes 1/2" to 1-1/4"	Pipe Sizes 1-1/2" to 2"	Pipe Sizes 2-1/2" to 8"	Pipe Sizes 10" to 15"	Pipe Sizes 15"+
	up to 150psi / 1MPa	up to 150psi / 1MPa	up to 150psi / 1MPa	up to 100psi / 0.7MPa	up to 100psi / 0.7 MPa
60°F to 100°F / 15°C to 40°C	1 hour	2 hours	6 hours	48 hours	72 hours
40°F to 60°F / 5°C to 15°C	2 hours	4 hours	12 hours	96 hours	6 days
20°F to 40°F / -5°C to 5°C	8 hours	16 hours	72 hours	8 days	14 days


### Helpful Hints

1. Process quickly and carefully.
2. Use enough amount of fresh cement.
3. Do not attempt cementing in the presence of moisture or in the rain.
4. Do not cement when the temperature is below 40°F/5°C or above 90°F/32°C under direct sunlight.
5. Do not take shortcuts or bypass recommended steps.
6. Consult your cement manufacturer for specific questions or problems.

### Applicable Specification for Solvent Welding

- ASTM D 2564 : Solvent cements for PVC thermoplastic pipe and fitting.
- ASTM D 2855 : Marking solvent cemented joist with PVC pipe and fitting.
- ASTM A 493 : Solvent cements for CPVC thermoplastic pipe and fitting.
- ASTM A 656 : Primers for use in solvent cement joints of PVC thermoplastic pipe and fitting.

## 12. Hydrostatic Pressure Testing

WARNING	
	<p>Failure to follow the safety precautions below may result in misapplication or improper installation and testing which can cause severe personal injury and/or property damage.</p>

1. All joints should be fully cured before filling the system with water.
2. All valves should be opened and air relief mechanisms should be installed at relative high points angles. Fill the system slowly with water and precautions; flow velocities should be slower than 1 foot per second. This will prevent surge, water hammer, and air entrapment.
3. Continue to fill water until all entrapped air is completely flushed out. Maintain the 1 ft/s velocity until every valve is checked. A sudden fluctuation of pressure (indicated by gauge needle) during pressure rise may be an indication that entrapped air still remains in the system. Systems should include proper air relief and vacuum breaker valves to vent air out during normal operations after installation. Entrapped air is the major cause of surge and burst failure in thermoplastic piping systems.
4. After the system is filled, do not pressurize until the responsible engineer is present to witness the test. All personnel should wear safety glasses and helmet. High voltage electrical equipment should be protected in case of leak or spray.
5. The piping system should be pressurized to 1.25 times of its maximum designed operating pressure. This pressure must not exceeds 1.5 times of the working pressure of the lowest rated component in the system, such as flanges, unions, thread parts, valves, etc.
6. The pressure test should be under 1 hour. This should provide enough time for inspections of leaks or other potential defects of the system. If leaks are found, pressure must be relieved for repair. The system should then be recharged and retested. Consult the factory if you have any questions concerning these steps.

## THREAD CONNECTIONS

### 1. Cutting and Deburring

PVC or CPVC pipe should be cut squarely and smooth for easy and accurate threading. A miter box or similar guide should be used when sawing is done by hand. Burrs should be removed from inside and outside using a knife or thermoplastic pipe deburring tool.

### 2. Threading Pipe

Threading PVC and CPVC pipe can be accomplished easily using either a standard hand pipe stock or a power operated tool. Cutting dies should be clean and sharp. Power threading machines should be fitted with dies having a 5° negative front rake and ground especially for thermoplastic pipe. Self-opening die heads, and a slight chamfer to lead the dies could speed up the operation; however, dies should not be driven with heavy pressure or at high speeds. In case of using a hand held cutter, the pipe should be fixed in a pipe vise. To prevent crushing or scoring of the pipe by the vice jaws, protective wrap should be applied such as canvas, emery paper, rubber, or light metal sleeve. For hand stocks, the dies should have a negative front rake angle of 5° to 10°. PVC and CPVC material could be threaded easily; caution should be taken to avoid over-thread.

### 3. Apply Teflon\* Tape

After threading, a ring gauge should be used to check the accuracy of the threads. Tolerance should be within  $\pm 1\text{-}1/2$  turns. The threads should then be cleaned. After cleaning, apply a thread lubricant such as Teflon\* tape to the threads. Wrap the tape around the entire length of threads beginning with the second thread from the end. The tape should slightly overlap itself while going in the same direction as the threads. This will prevent the tape from unraveling when the fitting is being tightened on the pipe. Overlapping in the wrong direction and the use of too much tape can affect tolerances between threads. This could generate stress on the wall of female fittings and cause failures during operation.

### 4. Assembly of Thread Joints

After applying Teflon\*, screw the thread fitting onto the pipe. Screwed fittings should be started carefully and hand tightened only. Threads must be properly cut and covered with good quality thread Teflon\*/tape. If desired, the joint may be tightened with a strap wrench.

Do not use a stillson type wrench. The jaws of this type of wrench will scar and damage the pipe surface. Thread assembly should be tighten until hand tight with an additional 1 to 1-1/2 turns. Avoid stretching or distorting the pipe, fittings or threads from over tightening.

#### NOTE:

- (1) Never apply solvent cement to thread pipe or thread fittings. Do not allow cleaners, primers, or solvent cements to "run" or drip into the thread portion of the fitting.
- (2) Some Teflon pastes contain chemicals that may be harmful to the pipe and fittings. You should consult the supplier or manufacturer of the paste before use.
- (3) Avoid screwing metallic male threads into thermoplastic female threads. We recommend flanged end connections for joining a metal system to a plastic system.

There are a variety of thermoplastic fittings that are designed with metallic male or NPT female thread inserts. The corrosion resistance of the metal insert will have to be taken into consideration. Consult the factory or your LD sales person for the availability of these metal-insert fittings.

\*Trademark of the E.I. DuPont Company.

## FLANGE CONNECTIONS

### 1. Selection of Materials

LD Gasket must be resistant to chemicals flowing through it.

Fasteners-bolts, nuts, and washers also need to be resistant to the chemical environment.

(Threads should be well lubricated.)

Torque Wrench is required for tightening bolts in a manner that prevents excessive torque.

### 2. Flange Assembly

1. Join the flange to the pipe as outlined with the solvent cementing or the threading section depending on the joining method desired.

2. Align the flanges and gasket by inserting all of the bolts through the matching bolt holes. Proper mating of flanges and gaskets is very important for a positive seal.

3. Use a torque wrench and tighten each bolt in a gradual sequence as outlined by the flange sketch. For final tightening of all bolts, find the recommended torque value in the chart below.



#### CAUTION

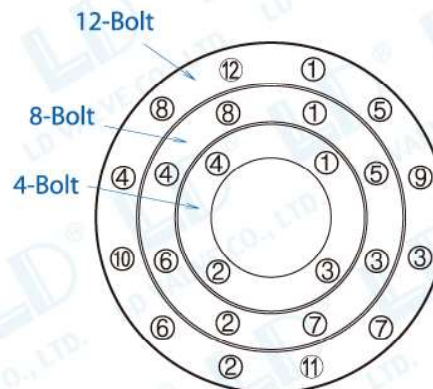
1. Do not over-torque flange bolts.
2. Use the proper bolt tightening sequence.
3. Make sure the system is in proper alignment.
4. Flanges should not be used to draw piping assemblies together.
5. Flat washers must be used under every nut and bolt head.

#### Recommended Torque

Size	Approx. Bolt Length* in.	Recommended Torque ft./lbs.
1/2"	2-1/2	10-15
3/4"	2-1/2	10-15
1"	2-1/2	10-15
1 1/4"	3	10-15
1 1/2"	3	10-15
2"	3-1/2	20-30
2 1/2"	3	20-30
3"	3-1/2	20-30
4"	4	20-30
6"	4	33-50
8"	5	33-50
10"	5	53-75
12"	5	80-110

Bolt lengths were calculated using two LD flanges. Additional accessories or different mating surfaces will alter these numbers

**NOTE:** Flange's bolt hole pattern meets ANSI B16.5



Piping systems made of PVC & CPVC will provide an excellent, maintenance-free performance over many years of use, as long as the application and system design is correct and properly installed. It is important to know the properties and limitations of PVC and CPVC thermoplastic pipe when selecting these materials. Always start with reading and following installation indications first. It is very important to know the reputation and abilities of your installation crew or contractor. Professional engineering design of the system and close supervision of the installation process is highly recommended.

Any questions about the installation procedure and applications of PVC and CPVC piping products should be directed to your supplier, manufacturer or consultant.

## WARNING

Failure to follow the safety precautions below may result in misapplication or improper installation and testing which can cause severe personal injury and/or property damage.

### General

#### 1. Avoid contact with hard and/or pointed objects to protect thermoplastic pipe

Impact resistance is lower than metal pipes.

#### 2. Keep pipe away from extreme heat and cold.

Extremes heat and/or cold can cause failure. If liquids freeze inside PVC/CPVC and/or metallic piping can cause the pipe and/or the joints to crack. Freeze protection should be designed into the system. Heat beyond designed limits can also cause failures.

#### 3. Protect pipe from sunlight.

PVC and CPVC pipe compounds normally do not provide extended protection from the ultraviolet rays of the sun. Therefore, unless the material has been specially formulated to sustain in this environment, the product must be protected from sunlight or it may reduce product's durability.

#### 4. Avoid bending pipe

Pipe should not be bent in trenches or in above ground installations. Pipe and joints that are stressed reduce pressure rating and can cause failures.

### Application

#### 1. PVC and CPVC piping system is not made for transporting compressed air or gases.

Compressed air or gases can surge to high pressures and cause explosive failures that could seriously injure personnel. PVC and CPVC pipe and fittings are excellent products in transporting water and corrosive chemicals.

#### 2. Only use chemicals that are proved to be safe to transport with PVC/CPVC pipes.

Certain chemicals, especially petroleum distillates and derivatives, can cause damage to the system. Every chemical should be verified and approved in the manufacturer's chemical resistance chart.

### System Design

#### 1. Allow for flexibility in the design of the system.

Expansion and contraction is greater than metals. This can cause cracks and leaking points if system is not designed flexible enough to absorb movement. When laying smaller diameters of pipe below ground, the pipe should be "snaked" in the trench to allow for expansion and contraction. If solvent cement welding is used for the method of joining, snaking, pressure testing, and pipe movement should not be done until after the joints have been given sufficient time to set.

## **2. Design safeguards into the system to prevent excessive surge pressures.**

Water hammer (surge) in a PVC and CPVC system can cause pipe, fittings, and valves to burst. Liquid velocities should not exceed the maximum speed of 5 ft/s.

### **Installation**

#### **1. Carefully follow solvent cement welding instructions.**

Failure to follow application indications can reduce the strength and integrity of joints and cause joint failures. By far, the majority of failures in PVC and CPVC systems are the result of shortcuts and/or improper joining techniques.

#### **2. Remove rocks and other debris that may damage pipe before burying pipe in trenches.**

Precaution should be taken to remove all rocks, boards, empty primer and cement cans, brushes, bottles and other debris from the trench when laying PVC and CPVC pipe below the ground. Backfilling and top loading should be supervised.

#### **3. Follow recommended support spacing for PVC and CPVC piping systems.**

The modulus of elasticity of PVC and CPVC pipe is smaller than metals. Maximum working temperature and room temperature should be considered when determining the required support spacing.

### **Testing**

#### **1. NEVER use compressed air or gas or air-over-water boosters to pressure test PVC or CPVC piping systems.**

ONLY hydrostatic pressure testing should be conducted on PVC and CPVC piping systems. Compressed air or gases can surge to high pressures and cause explosive failures that could seriously injure personnel.

#### **2. Carefully follow all instructions for hydrostatic pressure testing.**

Failure to follow these instructions can result in a system failure.

#### **3. Always remove all entrapped air from system before water-testing a system.**

Entrapped air is a major cause of surge and burst failure in thermoplastic piping systems.

## **STORAGE AND MANAGEMENT**

### **Buyer's Acceptance of Materials**

Upon receiving the pipes, the person in charge should always inspect the products as much as possible before unloading. The receiver should check for transportation damage such as a shift in the load, tie-down straps over-tightened, or signs of rough treatment. LTL (less than truckload) pipe shipments that arrive in a closed trailer should be checked as soon as the trailer is opened. Make sure that the pipe has not been top-loaded with metallic pipes, crates, machinery or any other objects that might crush or damage the thermoplastic pipe. The ends of the pipe should be visually inspected for cracks, cuts, gouges, or heavy deformations. In some cases, especially for large diameter pipe (4" and above), it would be advisable to inspect the opening of the pipes for internal cracks or splits that may have occurred as a result of loading or transportation. The use of a strong flashlight may be necessary to inspect the inside diameter beyond the ends of the pipe. Any and all damages should be witnessed by the truck driver and clearly noted on the transportation documentation with a copy retained by the receiver. The carrier and LD should be immediately notified of any damages or missing pipe, or items incorrectly shipped.

## Unloading and Handling

While transporting pipes, please make sure they are well palletized and will not rolling around when the truck is moving. Upon arrival to the destination, the person in charge to receive the delivery should inspect the goods for any damage occurred during the transportation. After the pipe has been thoroughly inspected and inventoried, it should be unloaded according to the following indications. The person receiving the pipe must decide the method to unload the pipes and is responsible for any damage that occurs during the unloading process. Never push or drag a palletized load of pipe from a truck bed. Do not throw the pipes directly to the ground from the truck bed. This could cause serious damage to the pipe's outer surface such as scratches and bends on the openings. Pipe should not come into severe contact with sharp objects such as edges or corners of truck beds, loading docks and buildings, forks on forklift trucks, and rocks or other objects on the ground.

Forks of forklifts must never be inserted straight into the openings of the pipe for lifting or moving the loads. Any unbalanced force during the unloading process could cause permanent bends to the pipe. And it's potentially dangers since the pipe may be bouncing and cause personal injury.

**NOTE:** The impact resistance and flexibility of PVC and especially CPVC pipe are weakened by low temperature environments. The impact strength for both types of piping materials will decrease as temperatures drops to 32°F (0°C) and/or below. Extreme care should be taken when unloading and handling pipe in such cold weather. Dropping pipe from a truck or forklift may cause cracks or other damages. Methods and techniques normally used in warm weather may not be appropriate at the lower temperature range.

## Pipe Storage

While storing the pipes indoor, use pipe rack that offer sufficient support to the whole length. Loose pipe lengths should be stored in racks or dunnage that will evenly support the pipe to prevent longitudinal sag. If pipe is not well supported, especially in warmer weather, it will become permanently bowed and could increase installation difficulties. It's recommended to have support at least every three feet and keep the pipe stack lower than eight feet.

While storing pipes indoor is preferred but that may not always be convenient. In case of storing pipes outdoors, choose a flat and dry location that will minimize dirt and foreign matter accumulation in the bore. Wooden pallet bracings should be used to hold the pipes in place. It's recommended to support the stack with a minimum space of three feet between each wooden pallet bracings with a minimum width of 75mm. Stack height will depend on the pipe diameter, the slope of the terrain, and the weather conditions. As a general precaution, palletized pipe should not be stacked higher than the recommended height in the indoor situation which is eight feet. This should be determined and approved by the site engineer or responsible management official. The pipe must be protected from the sun and extreme heat. Protect the pipe by covering it with an opaque tarp, leaving the ends open to allow for air circulation through and around the pipe. This will provide a shade that keeps the sun light away. If pipe is not protected from the sun, discoloration may occur due to extended exposure to ultraviolet rays. This may take years to happen depending on the geographic location and the orientation of the pipe to the sun.

## Fitting Storage

Upon receiving the fittings, the person in charge should take an accurate count of the incoming order and report any discrepancies to LD and the carrier. Fittings packaged in damaged boxes should be closely inspected. Always store fittings in their original package, if they must be removed from their boxes, categorize them by material type (PVC or CPVC), geometric configuration, and diameter size.

Never combine your thermoplastic fitting inventory with metallic materials. Keep fittings away from open flame or source of extreme heat.



## LIMITED WARRANTY

LD products are warranted to be free from manufacturing defects in material and workmanship for a period of 5 (five) years from the date of original purchases.

If the customer receives any goods that appear to be defective, upon receipt written notice to LD VALVE, the customer with permission can return prepaid such questionable goods. After examination, if the goods are proven to be defective due to manufacture or material provided by the company, LD VALVE may repair, replace or reimburse the customer for such goods. The customer must make all claims under these warranties, and no claim will be accepted from a third party. Warranties are non-transferable. Any product repaired or replaced under warranty is only warranted for the period of time remaining in the original warranty for the product. All costs of shipping such questionable goods to or from LD VALVE shall be borne by the customer.

**This shall be the customer's only remedy.**

The acceptance by LD VALVE of any product returned is not an admission that the product is defective, and if LD VALVE determines the product is not covered by this Limited Warranty, the product will be returned to the Buyer at Buyer's expense.

Failure to meet payment obligations voids all warranties and does not extend the Limited Warranty period when payment is made. Warranty ceases to exist immediately if the object delivered is altered or overhauled.

Warranty does not cover damage caused by one or more of the following:

1. LD products that have been subject to abuse, misuse, neglect, accident, fire, improper installation, storage, handling or adjustment, or corrosion.
2. Natural disaster, including but not limited to, fire, flood, hurricane, tornado, earthquake, electro-static or any other similar natural cause beyond the control of LD VALVE.
3. LD products that have been modified or altered outside of or beyond LD's specifications.
4. LD products used in application other than those recommended by LD.
5. Damage by liquid with temperature lower than 4°C/40°F or higher than 60°C/140°F (PVC) and 95°C/203°F (CPVC) at no pressure.

For detail, please refer to temperature/working pressure graph.

LD VALVE's liability is limited to the replacement cost of product and is not responsible for consequential damages. Freight charges, installation cost, labor cost, damage to related components, and cost incurred due to down time, from normal wear and tear of the valve is not covered by this warranty. There are no other warranties provided other than stated herein. LD VALVE reserves the right to change dimensions, specifications, or prices without prior notice.

**DO NOT USE LD PRODUCTS FOR COMPRESSED AIR OR GASES.**

**DO NOT TEST THERMOPLASTIC PIPING SYSTEMS WITH COMPRESSED AIR OR GASES.**

**DO NOT USE PIPING SYSTEMS WITH LIQUIDS NOT RECOMMENDED BY LD.**

**MODIFICATIONS OF LD PRODUCTS VOIDS THE WARRANTY.**