



AMERON
INTERNATIONAL

FIBERGLASS - COMPOSITE PIPE GROUP

Dualoy® 3000/L Installation

Installation Practices

for 2 through 6-inch piping systems



Bulletin 7501

FP104H (11/07)

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i. Training for Ameron Dualoy® Piping Systems

1. Installation training for Ameron Dualoy 3000/L piping systems, including secondarily contained systems and Dualoy 3000/LCX, shall be done by an Ameron employee, sales representative or distributor.
2. Training shall, at minimum, consist of a thorough review of the installation instructions (Bulletins, 7501, 8702 and/or 9903) as applicable for the systems on which the installer is to be certified. It is recommended that an installation video, (such as "Dualoy 3000/LCX Installation") be used during the training session. Also recommended is an examination of the installation tools, a demonstration of the joint preparation and bonding and, if possible, a "hands-on" execution of the installation procedures for a sample connection.
3. Upon completion of the training, each individual being trained shall complete the written examination for the systems on which they are to receive qualification.
4. The examinations will be signed by the trainee and the instructor and forwarded to Ameron for grading and registering of the individual as a "Certified Installer."
5. Ameron will issue a training certificate with the individual identified and will include their name on a registration list. Wallet-sized certificates and hard hat stickers may also be provided. Training certifications are valid for 3 years

ii. Glossary & Abbreviations

SC – Secondary containment fittings or pipe	MV – Motor vehicle fuels
NV – Normal vent line from tank	CF – Concentrated fuels
PC – Primary Carrier	HB – High blend fuels
PS – Primary/Secondary combined into one unit	AM – Aviation and marine fuels
VR – Vapor recovery	

iii. Pressure Ratings & Specifications of Products

Dualoy 3000/L pipe specifications and ratings

Pipe Size (inches)	Nominal O.D. (inches)	Wall Thickness (inches)	Weight lb/ft	Pressure Rating (inches)
2	2.38	.080	.5	200
3	3.50	.085	.7	200
4	4.50	.090	1.0	175
6	6.63	.120	1.9	140

Dualoy 3000/L couplings & adapters ratings

Pipe Size (inches)	Couplings (psig)	Adapters BxF (psig)	Adapters SxM (psig)	Adapters SxF (psig)
2	200	200	200	200
3	125	125	125	125
4	100	100	100	100
6	100	100	100	100

Dualoy 3000/L fittings & adapters ratings

Pipe Size (inches)	45°,90° Elbows (psig)	Reducer Bushings (psig)	Tees (psig)	Adapters BxM (psig)
2	200	200	200	200
3	125	125	125	125
4	100	100	100	100
6	100	100	100	100

2-Piece Clamshell Fittings

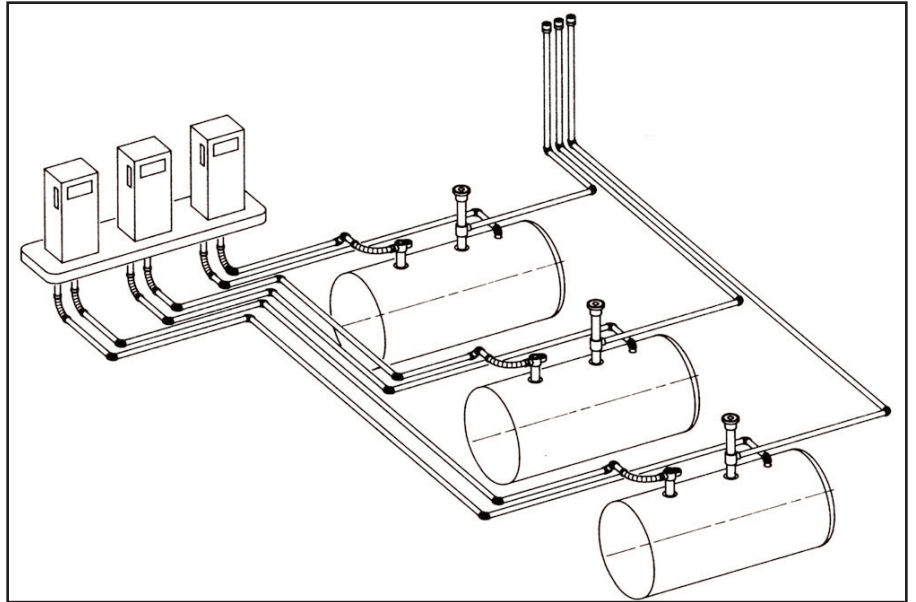
Pipe Size (inches)	Dualoy 3000/L Repair Coupling	Dualoy 3000/L Containment Fittings	Dualoy 3000/LCX Containment Fittings
2	200	–	50 **
3	125	50	20
4	100	50	20
6	100	50	–

** Pressure rating with stiffening rings.

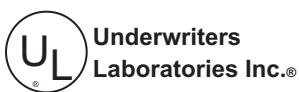
1 Introduction

Dualoy 3000/L pipe and fittings are manufactured from chemically inert thermosetting epoxy resins reinforced with high tensile strength fiberglass filaments. The pipe is produced by filament winding. The pipe incorporates a resin-rich inner liner that is resilient and holiday-free and a resin-rich outer coating that protects the resin-glass bond of the structural wall from UV radiation during storage and installation. The structural wall strength of Dualoy 3000/L pipe is unsurpassed in the fiberglass pipe industry. Fittings are manufactured by filament-winding or compression molding; injection molding is not employed.

Dualoy 3000/L pipe and fittings are electrically nonconductive and never require cathodic protection or sacrificial anodes. Installed systems are immune to external corrosion from stray-current electrolysis and cathodic interference. They are unaffected by alkaline or acidic soil conditions.



2 Listings and approvals



Dualoy 3000/L is Listed in the United States with Underwriters Laboratories Inc. (UL) for nonmetallic underground piping for motor vehicle fuels (MV), concentrated fuels (CF), high blend fuels (HB) and aviation and marine fuels (AM). It is also Listed with Underwriters Laboratories Canada (ULC) for the same fuel categories. It can be used for primary carrier (PC), normal vent (NV) and vapor recovery (VR) under UL File No. MH 9172. It can be used for secondary containment (SC) under UL File No. MH 15596. The ULC File Number is CMH 715.

3 Inspection, handling and storage

Inspection

Upon receipt at the jobsite, inspect the pipe fully. Locate, cut out, repair or replace damaged pipe. Impact damage is usually recognizable as rounded pale areas just under the surface or as deep gouges, scratches or cracks. Remove end protectors to inspect tapers for damage and then replace protectors.

Handling

Fiberglass pipe is susceptible to damage if handled improperly. Adhere to the following recommendations when handling:

- Do not transport pipe without proper protection against impact.
- Truck pipe racks should be padded with carpeting, inner tubes, or the like to prevent damage.
- Tie the pipe down during transport to prevent it from bouncing on the racks and suffering impact damage.
- Do not use chains to tie down the pipe on a truck: Use nylon straps or hemp rope.

3 Inspection, handling and storage (cont.)

- Do not drop the pipe from truck bed when stringing: Lay the pipe down by hand.
- Pipe loads that are properly separated and supported can be unloaded by padded forklifts.

Storage

Dualoy 3000/L pipe incorporates a resin-rich reinforced outer coating which provides outstanding UV resistance. Pipe stored out-of-doors for extended periods may assume a chalky appearance. However, this change in appearance is superficial and does not affect the pipe's performance. Protect stored pipe from impact damage by stacking on padded racks.

4 Materials

Pipe

Manufacturer tallies pipe on the basis of overall length. Allow for cutting losses and wastage when ordering.

Fittings

Primary pipe fittings are sold in the following boxed quantities.

Primary Fittings per Shipping Box

Nominal Pipe Size (in) (mm)		90°	45°	Tees	Sleeve	Adapters	Nipples	Bushings
		Elbows	Elbows		Couplings			
2	50	10	10	10	15	15	15	15
3	80	5	5	5	10	5	10	10

Adhesives

Ameron supplies PSX•20 and PSX•34 adhesives. PSX•20 and PSX•34 adhesives are polysiloxane-modified epoxy formulations. Both are designed to make permanent bonds in primary systems transferring MV, CF, HB or A&M fuels. They are also approved for use with MTBE fluids. Each is supplied as a two part system consisting of a resin and a hardener. PSX•20 is preferred for tapered joints and will be assumed for further references.

Each adhesive kit contains

- resin
- Hardener
- mixing stick
- Spatula and brush
- Detailed usage instructions
- Emery paper
- Gloves
- Paper towels

Refer to the layout drawings to estimate the number of adhesive kits required. Include bonds for all fittings, elbows, tees, reducers, adapters and couplings plus a waste factor. Short pot life at higher temperatures may not allow as many bonds to be made as indicated in the table: allow a greater waste factor at higher temperatures. For further information refer to the adhesive product data sheet.

Primary Bonds per Kit¹

Nominal Pipe Size		Adhesive Kit Size (oz)		
(in)	(mm)	3	5 ²	8 ^{2,3}
2	50	7	12	—
3	80	4	8	14
4	100	3	6	9
6	150	1	2	4

¹ The average number of primary system bonds obtainable by an experienced crew at 75°F.

² Available in six-pak kits.

³ Excessive waste may result when using the 8-oz kit to make 2-inch bonds.

4 Materials (cont.)

When using pneumatic tools, the air supply must be dry and oil-free as moisture or oil on bonding surfaces will interfere with the adhesive.

Tools

The following tools are recommended to install Dualoy 3000/L piping:

- $\frac{3}{8}$ -inch electric drill or equivalent air-driven motor
- 4-inch hole saw for installing sump penetration fittings
- Heavy-duty heat guns, hot air blowers, heat blankets or Chem Cure Paks for cool- or cold-weather installation.
- $1\frac{1}{2}$ -inch diameter by 1-inch wide coarse grit flapper sander

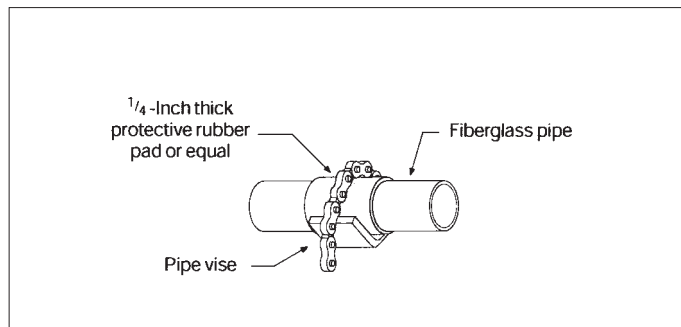
5 Field cutting and tapering primary pipe

Cutting

Use a fine-blade hacksaw, radial cut-off saw or circular saw with abrasive wheel to cut pipe in the field. The cut end must be square to within $\frac{3}{16}$ inch (5 mm).

Hold pipe securely for all cutting and tapering. When using a pipe vise, always wrap the pipe with a protective material such as a $\frac{1}{4}$ -inch thick rubber pad as shown in Fig. 5-1. Take care not to damage or over-deflect the pipe when tightening the vise.

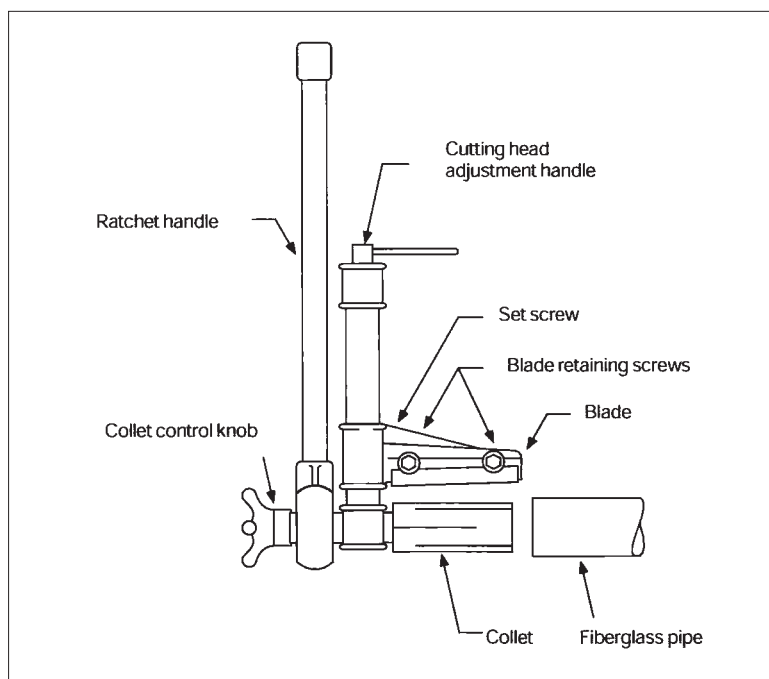
Fig. 5-1. When mounting Dualoy 3000/L pipe in a vise, use rubber pads or the equivalent to protect the pipe wall from crushing or abrasion.



Tapering with Ameron Taper Maker

Pipe ends may be tapered in 2 through 6-inch sizes using the Ameron Taper Maker. The Taper Maker employs a single carbide blade on a movable head at an angle of $1\frac{3}{4}^\circ$ to the axis of the pipe. After the blade has been adjusted to touch the pipe surface, the end is tapered by rotating the tool clockwise until the proper taper length is obtained.

Fig. 5-2. The Ameron Taper Maker is used to prepare pipe ends in 2 through 6-inch diameters.



5 Field cutting and tapering primary pipe (cont.)

Observe the following procedures when operating the Taper Maker. Refer to Fig 5-2.

- Check blade angle by using a factory taper as a guide. When properly adjusted, the blade should be in contact with the taper over the entire taper length. If adjustment is required, loosen the blade retaining screws and adjust the blade angle with the set screw.
- Note that the cutting blade has four cutting edges.
- Mark the required taper length on the pipe. Refer to the taper length table below.
- Insert the threaded collet shaft through the base casting and the mandrel.
- Select the appropriate size collet and slide it onto the mandrel, making sure the key inside the collet engages the slot of the mandrel.
- Hold the collet and turn the collet control knob clockwise until the collet begins to expand. Note that it may be necessary to adjust the cutting head to accommodate different size collets.
- Insert the collet into the pipe until the back end is flush with the end of the pipe.
- Expand the collet to grip the inside of the pipe by turning the collet control knob clockwise.
- Lower the cutting blade until it contacts the pipe by turning the cutting head adjustment handle clockwise.
- Using the ratchet handle, turn the tool clockwise, gradually lowering the cutting blade by turning the cutting head adjustment handle clockwise.



Continue until a smooth taper of the proper length is obtained. The thin edge of the completed taper should be no less than 1/32 inch (0.75 mm) thick.

For complete operating information, refer to the appropriate Taper Maker Product Data/Operating Instructions.

Fig. 5-3. Dualoy 3000/L can be tapered in all sizes using the Ameron Taper Maker. The ratchet handle makes Taper Maker convenient to use in confined spaces when repairing existing lines.

Tapering with powered tapering tools

Pipe in 2, 3 and 4-inch sizes is most often tapered using one of several powered tapering tools. Manufacturers' names and addresses may be obtained from Ameron distributors. Pipe tapered with these tools should be periodically checked against a factory taper for taper length and taper angle. The correct mandrel must be used for Dualoy piping.

Taper lengths			
Nominal Pipe Size		Taper Length	
(in)	(mm)	(in)	(mm)
2	50	1 1/2	38
3	80	1 3/4	44
4	100	1 7/8	48
6	150	2 3/4	70

Fig. 5-4. Pipe in 2, 3 and 4-inch sizes is typically tapered using one of several powered tapering tools available from outside sources.



6 Piping system layout

Trenching, bedding and backfilling

Although fiberglass pipe has excellent strength, it must be protected against impact which may occur from improper handling or during backfilling.

- Provide a trench width equal to the pipe diameter plus six inches on each side. Separate multiple lines by at least 4 inches. Refer to Fig. 6-1.
- Provide a minimum of 18 inches of select backfill between the top of the pipe and unpaved ground surfaces.
- Provide a minimum of 4 inches of select backfill between the top of the pipe and reinforced concrete pavement (4 inches minimum thickness).
- Provide a minimum of 8 inches of select backfill between the top of the pipe and asphalt pavement (2 inches minimum thickness).
- Slope the trench bottom evenly from the dispensers back to sumps or tanks at a minimum $\frac{1}{8}$ in/ft of slope. The use of "batter boards" is a very good way to achieve a proper slope.
- The trench bottom must be free of hard or sharp objects.
- Grade the trench bottom with at least 6 inches of select backfill to provide firm, even support for the pipe. Compact the subgrade well to prevent differential settling.
- Protect the pipe from impact during backfilling and abrasion during operation by surrounding it with a minimum of four inches of select backfill such as washed sand, pea gravel ($\frac{3}{4}$ -inch maximum) or crushed stone ($\frac{1}{2}$ -inch maximum).

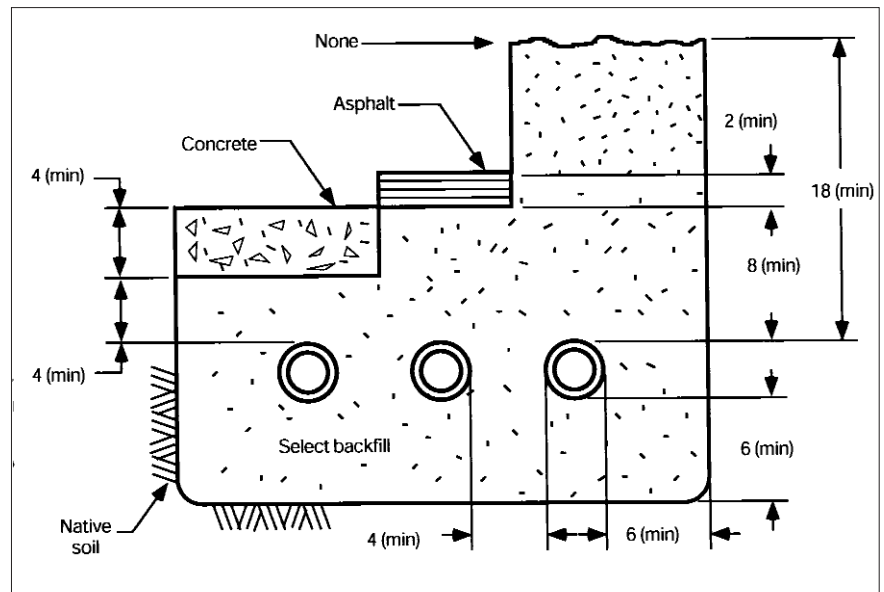


Fig. 6-1. Use only select materials for bedding and backfilling Dualoy 3000/L fuel handling systems. Native materials are rarely suitable and should not be used.

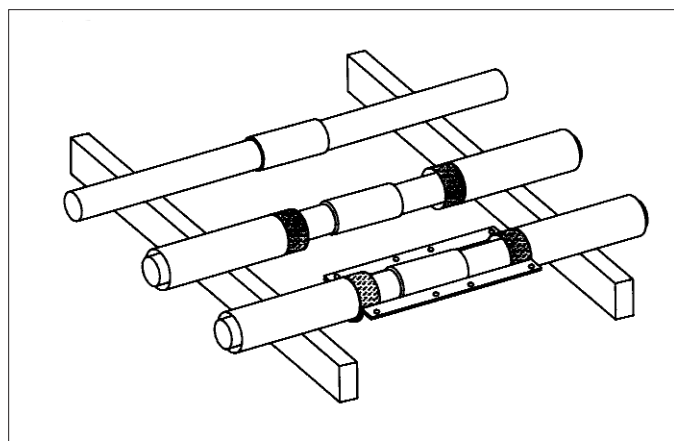


Fig. 6-2. During layout, bonding and inspection, support the piping on 2x4 blocks to keep the joints clean and to keep bedding out of the pipe.

6 Piping system layout (cont.)

Supporting valves, accessories and vent lines

Do not use fiberglass pipe to support the weight of heavy items in a line such as valves, strainers and steel vent riser pipes. Provide separate supports for valves and accessories.

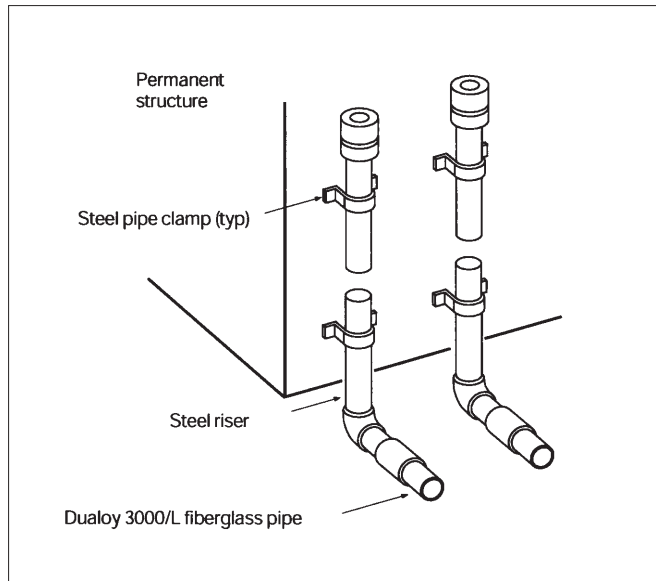


Fig. 6-3. Support risers by attaching them directly to structure walls.

Never use metal swing joints.

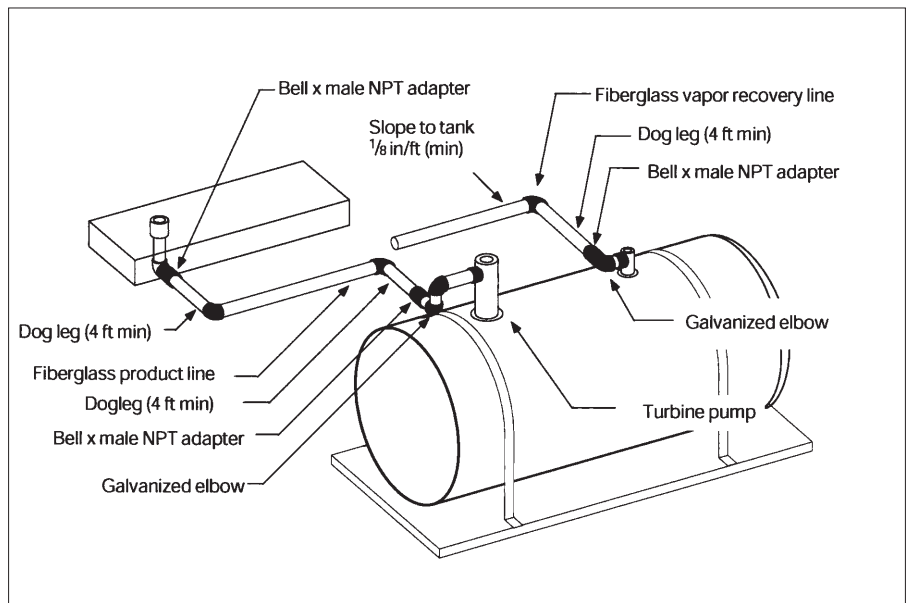


Fig. 6-4. Use flexible connectors to connect fiberglass pipe to tanks, turbine outlets at tanks and to shear valves at dispensers. A 4-ft length of fiberglass pipe (dogleg) is allowable per API Specification 1615 in lieu of a flexible connector.

Precise alignment and make-up

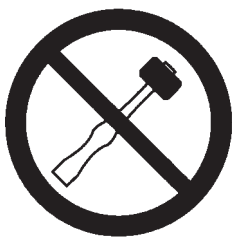
The matched taper bell and spigot joint does not always result in a precise and predictable insertion depth. This variation results from:

- Manufacturing tolerances in the bell
- Differences in length of tapers prepared on the jobsite
- Difference of insertion depth when dry fit and after adhesive has been applied.

7 Bonding primary systems

The hardener contained in the adhesive kit may burn the skin. Avoid inhaling the vapors. Read and observe the label precautions.

Begin by coating the cut ends of the pipe with adhesive. Then apply a thin, even coat of mixed adhesive to the inside of the bell and to the tapered spigot ends (indicated by shading) or to the entire tapered section in fittings or adapters, completely wetting all machined surfaces with the adhesive. Wipe off excess adhesive with the spatula or brush provided in the kit.



Do not directly strike the joint with any type of hammer or mallet to make it up.

Joint preparation

All tapered systems must be clean, dry and warm for a proper bond.

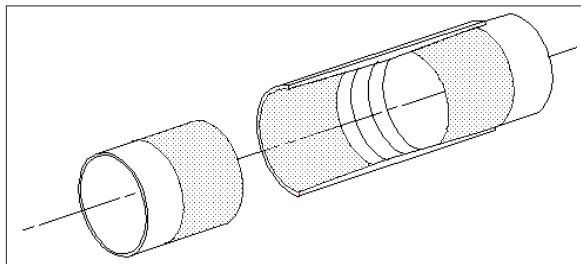
Clean: Pipe is shipped from the factory with end protectors. Avoid contamination from fingerprints, petroleum fumes, mist and condensation as these are adverse to good bonding. If a taper becomes dirty, sand it with emery cloth. Never touch the bonding surface with bare hands after cleaning or sanding as this will leave an oily deposit.

Dry: Adhesive will not bond to a wet surface. If the taper is wet or moist, dry it with a blow dryer or heat gun. Do not overheat or burn the pipe.

Warm: Below 50°F (10°C), warm the taper with a blow dryer or heat gun. For best results, adhesive should be at least 50°F when used. Do not store kits in areas above 100°F (38°C), below 32°F (0°C), or in the direct sunlight during warm weather. In cold weather warm the resin to at least 50°F but not above 100°F to permit good mixing and easier application.

Mixing Ameron PSX•20 adhesive

- Combine all of both components in the mixing container in the supplied proportions.
- **Never try to split a kit.**
- Mix thoroughly with the mixing stick until all streaks are gone and the adhesive has a smooth, uniform color. Mixed adhesive color is red.
- **Do not allow moisture to get into the can.**



Applying Ameron PSX•20 adhesive

Excessive amounts of adhesive may cause flow restriction inside the pipe when the adhesive has cured, or may result in 'hydraulic backout' as the adhesive cures. Hydraulic backout occurs when excess adhesive prevents the joint from maintaining an interference fit and the spigot backs out of the bell during a cure.

Making the joint

After aligning the mating surfaces so that they may be brought together in a straight line:

- Insert spigot all the way into the bell.
- Twist one quarter of a turn when pushing together to distribute adhesive evenly and to achieve an interference fit. A slight reverse turn will then lock the joint.
- Do not cock the joint.
- Over-insertion of the joint may collapse the spigot and cause a leaky joint.
- Under-insertion of the joint may also cause a leaky joint.
- Do not drive the joint together with a hammer. If locking cannot be done as described above, place a "soft" object, such as a 2x4 on the fitting and lightly rap it.
- Do not disturb the joint while the adhesive is uncured.
- Do not move adjacent pipe and fittings until adhesive has set.

Pot life/cure times for Ameron PSX•20 adhesive

Pot life is measured from the time the hardener and resin are first mixed until the adhesive starts to thicken and harden and no longer can be used. Do not use adhesive once the can has become hot.

7 Bonding primary systems (cont.)

The table indicates the adhesive pot life under various temperature conditions. In hot weather, pot life may be extended by wrapping a damp rag around the can of mixed adhesive or by spreading the adhesive on aluminum foil to dissipate the heat.

Pot life/cure times for Ameron PSX•20 adhesive

Minimum Ambient Temperature		Adhesive Pot Life	Minimum Joint Cure Time*
(°F)	(°C)	(minutes)	(hours)
40	5	70	12
65	18	40	5
75	24	30	4
95	35	20	3

* Cumulative totals. Cure time at listed temperatures need not be uninterrupted, but total time must equal the tabulated time before

Force curing adhesive

At temperatures below 50°F (10°C) or if the temperature will not be above 50°F (10°C) during the entire period of cure, an external heat source must be used to force cure the adhesive. The adhesive and the bonding surfaces should be warmed to 50°F (10°C) before mixing and applying the adhesive.

Below 50°F (10°C) force cure the adhesive with an external heat source such as:

- Chem Cure Pak (US Pat. No. 3,475,239)
- Ameron heating blanket sufficiently large to cover the joint
- Forced air heater if the trench is covered to contain the heat
- Hot air gun

Using Chem Cure Pak with Ameron PSX•20 adhesive

The Chem Cure Pak is a self-contained, nonelectrical heat source for curing adhesive-bonded joints. Instructions are printed on the Pak wrapper. The Pak is designed so that sufficient heat is generated to cure Ameron PSX•20 adhesive in one hour at ambient temperatures as low as 0°F (-18°C). The Chem Cure Pak is manufactured in different sizes corresponding to the diameter of the piping being installed. Use the correct size Pak for your installation. Refer to table on page 11 when ordering.

In cold weather, wrap insulation around the Pak as soon as it has stopped steaming. For lower temperatures or when installing extra-heavy fittings, consult Ameron for specific recommendations.

- Assemble pipe and fittings using standard field installation procedures.
- Mix the chemicals thoroughly as directed on the Pak wrapper.
- Wrap the Pak around the connections, centering it over the tapered section of the joint, not over the end of the fitting. Cover the entire bonding area to which adhesive has been applied. Refer to Fig. 7-1.
- Use one Pak per bond: sleeve couplings in 3-inch sizes and larger require two Paks. However, a single Pak is sufficient for curing both bonds in a 2-inch sleeve coupling.
- Secure the Pak with tie wires.
- Cut one slit at least 1 inch wide (25 mm) on each upper side of the Pak.
- Inject water into the slits with the activator syringe - approximately one half into each side
- Aluminum foil may be wrapped directly over the joint to prevent the Pak from sticking if it is necessary that the expended Pak be removed from the trench.

Follow the precautions printed on the Chem Cure Pak wrapper:

- Do not get ingredients on skin, in eyes, or on clothing.
- Do not breathe dust or vapor.
- Use only outdoors where adequate ventilation is provided.
- Do not take internally.
- **Keep out of reach of children.**

Temperatures may be lower in a trench or out of direct sunlight.

Chem Cure Pak contains oxalic acid. Harmful if swallowed. Causes skin and eye irritation.

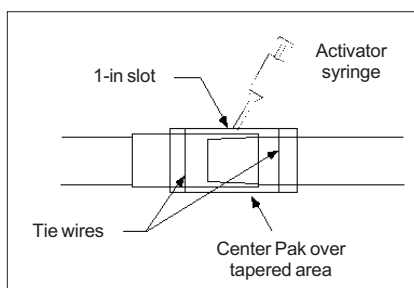


Fig. 7-1. The Chem Cure Pak should produce steam in about 30 seconds after injecting water. If no reaction occurs, discard the Pak and use another one.

7 Bonding primary systems (cont.)

Using heating blankets

Ameron heating blankets provide an efficient means for curing adhesive-bonded joints. Two sizes are needed for installing Dualoy 3000/L systems. Refer to following table when ordering.

The heating blanket reaches a maximum temperature of 250°F (120°C), which will cure Ameron PSX•20 adhesive in approximately 30 to 40 minutes. Detailed instructions are included with the blanket. Observe the following points:

Chem Cure Pak quantities and heating blanket sizes

Nominal Pipe Size		Chem Cure Pak	Heating Blanket
(in)	(mm)	Units per Carton	Size
2	50	30	I
3	80	30	I
4	100	20	I
6	150	20	II

- Use one heating blanket per bond: sleeve couplings in 3-inch sizes and larger will require two blankets. However, a single blanket is sufficient for curing both bonds in a 2-inch sleeve coupling.
- Tie the blanket in place with nonconducting ties.
- Before connecting to a power source, inspect the blanket and cord for loose wire connections and bare wires.
- Do not plug the cord into a power source when standing in water or on a wet surface.
- Check that the heating blanket has the correct AC voltage rating for your locality. Do not use direct current.
- Mark the starting and disconnect time on the pipe with a grease pencil so that you will have a record of cure for each joint.
- Verify that the blanket actually heats up after being plugged in.

Fig. 7-2. Place the thermostat end of the blanket against the joint with thermostat facing out. Wrap the rest of the blanket around the joint so that the overlap covers the thermostat.

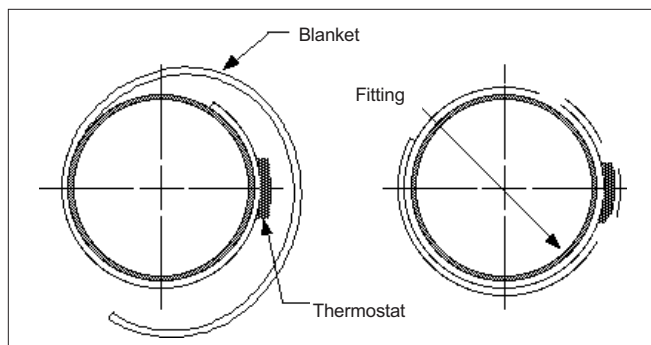
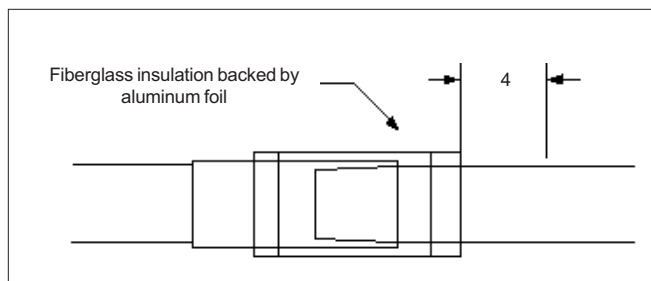


Fig. 7-3. When it is windy or below 50°F (10°C), close the pipe ends and insulate around the blanket. Overlap the blanket about 4 inches on each side and tie down the ends of the insulation.



Connecting to non-Ameron fiberglass piping

Connect Dualoy 3000/L fiberglass piping and non-Ameron UL-listed fiberglass piping by means of threaded adapters. Do not adhesive bond Ameron piping to that of another manufacturer. Bond the appropriate adapter from each manufacturer to the manufacturer's pipe using that manufacturer's adhesive. Complete the threaded connection using thread sealant, not pipe adhesive. By following this procedure you can use Dualoy 3000/L piping to extend an existing line that employs the pipe from another manufacturer without voiding the UL listing of either system.

8 NPT threaded connections

In general, threaded connections should be made up before adhesive-bonded joints to minimize the possibility of damage to bonded joints caused by torquing the threaded connections. However, when installing molded threaded bushings (tapered major nominal pipe size x threaded minor nominal pipe size) make the tapered bonded joint first and allow it to cure before making up the threaded joint. This order of joint make-up will prevent damage to the bushing.

Never use a pipe wrench directly on the pipe: wrench up only on adapters.

Thread preparation

- Inspect threads on fiberglass adapters and threaded bushings. Do not use if threads are damaged.
- Inspect threads on steel fittings for burrs.
- Remove burrs from steel fittings by making up to mating steel threads. Unmake the steel fitting and reinspect.
- Always dry fit fiberglass and steel threads without sealing compound. It should be possible to dry fit the threads as shown in the following table. If the proper number of threads cannot be made up, select a new steel fitting.

Making the joint

Threads must be clean and dry before applying thread-sealing compound.

- Use a nonhardening, solvent-free Teflon based thread sealant such as Jomar Seal "The Heavyweight" or Gasoila Soft Set pipe sealant.
- Apply sealing compound to male and female threads.
- Hand tighten the joint, then use a wrench to get full make-up. Standard pipe wrenches can be used with care on fiberglass adapters: Do not overtighten.
- The parts should make up the number of threads shown in the table above. Otherwise, a proper seal may not be effected when tightened.

Nominal Pipe Size (in) (mm)	Threads to Dry Fit	Additional Threads to Seal	Approx. Torque Req. (Ft. Lbs)
1½ 40	4-5	3	100
2 50	4-5	3	110
3 80	5-6	3	130
4 100	6-7	2	160
6 150	7-8	2	200

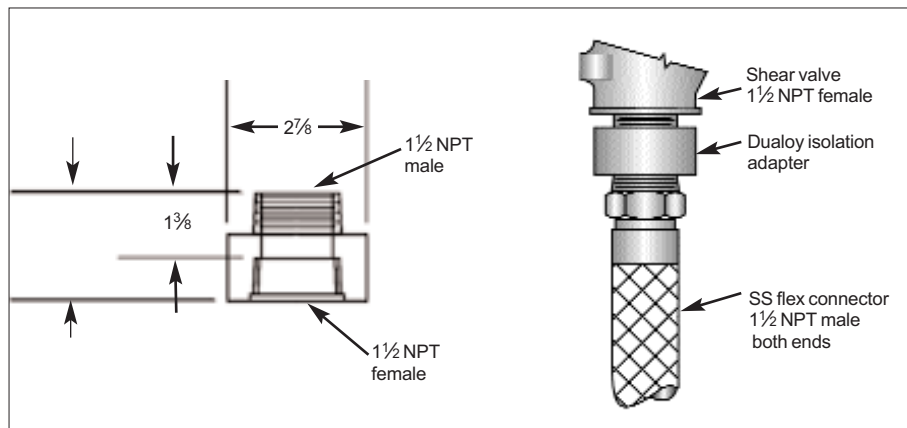
* 25 Ft. Lb. maximum torque for isolation bushings

Isolating flex connectors at the shear valve

When flex connectors are directly buried at the dispenser, regulations frequently require that they be cathodically protected and provisions be made to avoid stray current electrolysis and corrosion. In such cases the flex connector must be electrically isolated from the shear valve and from other metallic components in the system. Experience has shown that nylon isolation adapters do not perform well inasmuch as the poor mechanical strength of the material results in creep or thread deformation with subsequent leakage.

Ameron manufactures a 1½ NPT female x 1½ NPT male fiberglass-reinforced isolation adapter which may be mounted between the flex connector and the shear valve. Follow the same general installation procedures as with other NPT threaded fittings. After applying the sealing compound, hand tighten the adapter. Final make-up requires 1½ to 2 additional turns.

Fig. 8-1. The Ameron fiberglass-reinforced isolation adapter is mounted between the flex connector and the shear valve. Maximum torque on isolation bushing is 25 ft. lbs.



9 Repair procedures

Ameron produces repair couplings in 2 through 6-inch sizes. These couplings are listed by Underwriters Laboratories, Inc. for use in buried fuel systems and can be installed without in-trench tapering.

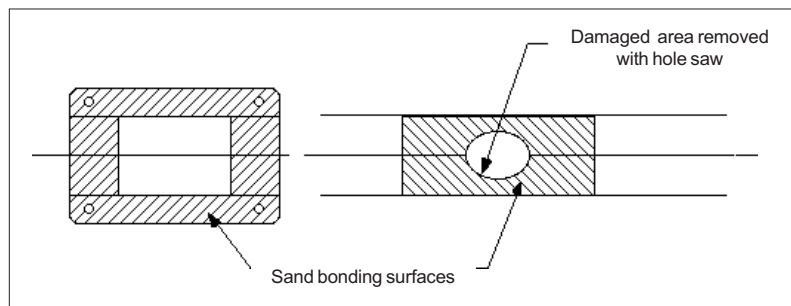
Minor damage (delaminated areas under 1 inch in diameter)

Minor damage is typically caused by impact and appears in the form of whitish discoloration or small circumferential cracks. Minor repairs can be made using half-couplings or full couplings. See Fig. 9-6 for proper cutting procedures.

When repairing lines which have already been in service and which may contain flammable fumes, do not use electric drills or other tools which may constitute a spark hazard near the pipe. Use only air-driven or manual tools for

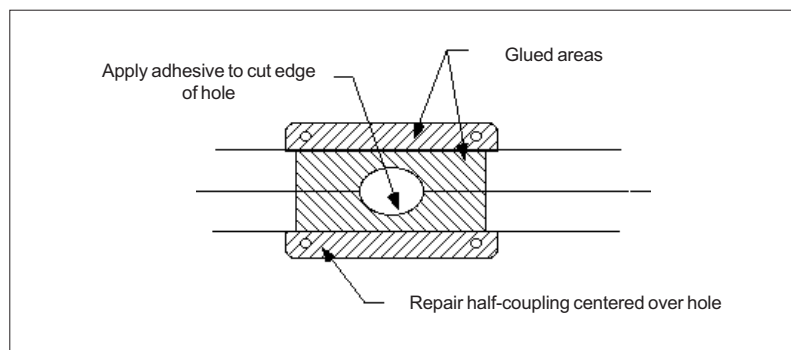
- Remove the affected area with a 1½-inch hole saw.
- Clean all burrs from edge of hole.

Fig. 9-1. Minor damage to pipe can be repaired by removing the



- Using a flapper sander or emery cloth, abrade the pipe where it will contact the repair coupling halves and the entire inner surface of the coupling.
- **Apply adhesive to the cut edge of the hole and to the sanded areas.**
- Position the coupling halves so that the hole is centered and 90° away from the flanges.
- After bolting the halves together, an adhesive bead should be visible around the edges of the coupling halves.
- Allow the adhesive to cure before pressurizing the system.

Fig. 9-2. Minor damage is repaired by removing the affected area with a hole saw. A repair coupling is positioned so that the hole is centered and 90° away from the coupling flanges.



Moderate damage (under 3 inches in length)

If cracks and delaminated areas are too extensive to be encompassed by a hole saw, removal of a short section of pipe is necessary. For damage three inches or less in length, a coupling can be used to make the repair.

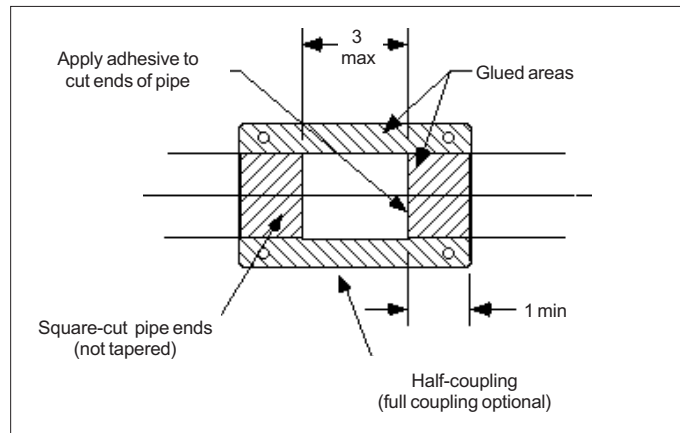
- If using a half-coupling, align it precisely to maintain spacing requirements. The use of a full coupling is recommended.

The ends of the pipe must be within 3 inches of each other for this repair procedure to maintain the UL listing. Similarly, pipe insertion of at least 1 inch in the repair couplings must be maintained.

9 Repair procedures (cont.)

- Center the coupling around the gap in the pipe.
- Abrade all bonding surfaces before applying adhesive.
- Coat the cut ends of the pipe and bonding surfaces with adhesive, then bolt the coupling halves together.

Fig. 9-3. Moderate damage can be repaired by cutting out a short length of pipe and joining the ends with a complete coupling or a half-coupling.



Major damage (over 3 inches in length)

Damage in which more than three inches of pipe must be removed is considered major. Major damage is typically caused by excavation equipment or large objects striking the pipe. Repair major damage with a replacement nipple and one or more repair couplings.

- For damage less than 12 inches in length, a single full-size, 14-inch long coupling will provide the required 1-inch pipe insertion at each end.
- To make repairs greater than 12 inches in length, use two full-size or half-couplings to join the replacement nipple with the existing line as shown in Fig. 9-5.
- Follow the guidelines given for minor damage: abrade all bonding surfaces, coat all cut pipe ends with adhesive and observe spacing and insertion depth requirements.

Failure to restrict the maximum gap between pipe ends to 3 inches and to provide a minimum 2-inch insertion depth of pipe in the repair couplings nullifies the UL listing mark.

Fig. 9-4. Major damage is repaired by removing the damaged pipe. Affected areas under 10 inches in length are repaired using a full-length coupling to hold a pipe nipple.

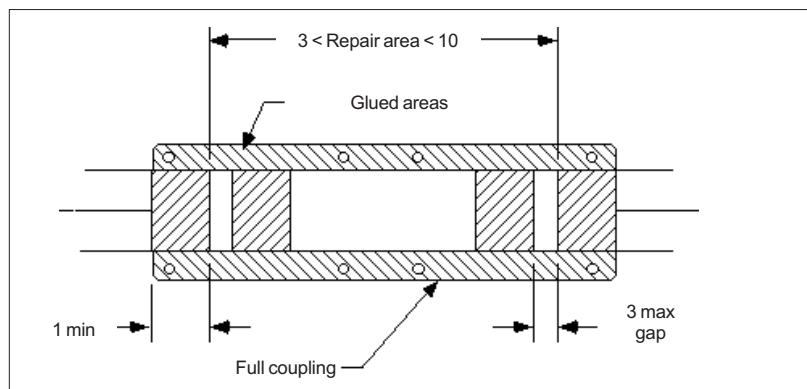
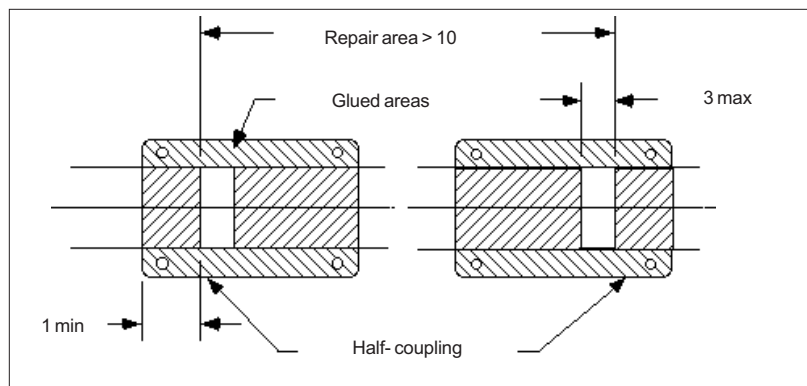


Fig. 9-5. Repairs over 10 inches in length are made by joining a replacement nipple to sound pipe with whole or half-couplings at each end.

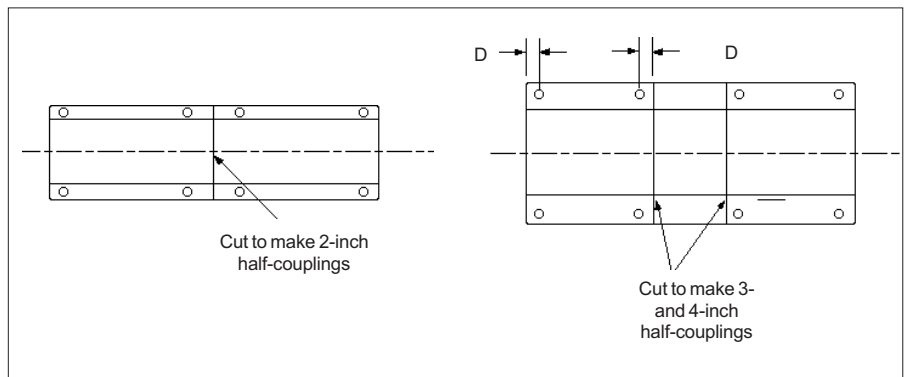


9 Repair procedures (cont.)

Cutting repair couplings

On 2-inch couplings the center holes have been located near the middle of the coupling. Cut exactly between these two holes. The resulting half-couplings are 7 inches long. Two cuts are necessary when making 3- and 4-inch half-couplings. The resulting half-couplings are 5½ inches long.

Fig. 9-6. Cut full-length couplings so that all bolt holes on half-couplings are equidistant from the ends.



10 Primary system testing

Recommended practices

Plan tests carefully and carry them out with all due precautions. Pressurizing equipment should be suited to the size of the system and the pressure required and should be operated by qualified and experienced personnel only.

The following recommendations are offered only as a guide. Ameron assumes no responsibility or liability for the consequences of any testing practices.

- Pressure sources should be capable of approaching test pressure gradually.
- Use gauges with a full-scale reading of no more than twice the test pressure: Do not use a 100 psi gauge for a 10 psi test. Use reliable gauges calibrated against a dead weight tester and zeroed for atmospheric pressure.
- Isolate tanks from the piping when pressure testing.
- The recommended hydrostatic pressure is 150% of expected operating pressure and should be maintained at least 10 minutes.
- Do not exceed 150% of system rating. Check the pressure rating of all the components of the system—not just the pipe—because hoses and flexible connectors are almost always rated lower than the pipe.
- Do not adjust fittings while system is under pressure. If threaded adapters or bushings leak, release the pressure before attempting to tighten.
- Temperature changes can affect the pressure in the test line. Substantial pressure increases may occur in closed systems exposed to the sun. Conversely, overnight decreases in pressure due to cooling from afternoon to early morning are normal and do not necessarily indicate a leak.
- After testing, maintain 5 to 10 psi (35 to 70 kPa) in the system during subsequent construction so that damage caused by stakes, excavation equipment, etc. can be detected and corrected before pavement is installed or product is pumped.

Ameron recommends hydrostatic testing of primary systems as the effects of sudden pressure loss when testing with liquids are far less severe than with gases. If pneumatic testing is necessary, restrain the system adequately to prevent damage or injury in case of rapid pressure loss. Pneumatic testing can be extremely dangerous.

11 Health and safety information

FOR CHEMICAL EMERGENCY
SPILL, LEAK, FIRE, EXPOSURE
OR ACCIDENT

CALL CHEMTREC - DAY
OR NIGHT

1-800-424-9300

Toll-free in the continental U.S.

483-7616 in District of
Columbia

For calls originating outside the
continental U.S.

202-483-7616 -Washington D.C.
collect

ALL CALLS ARE RECORDED

Toxicity of adhesive

Hardener: Irritating to the skin, eyes and respiratory tract: toxic orally; may cause sensitization.

Resin: May be mildly irritating to skin and eyes; may cause sensitization.

Handling precautions for adhesive

Hardener: Do not get in eyes, on skin or clothing. Avoid breathing vapor. Wash thoroughly after handling. When handling in the field, wear gloves and eye protection. When handling in bulk quantities, wear rubber gloves, rubber apron and NIOSH approved respirator.

Resin: Avoid contact with eyes, skin or clothing. When handling in the field, wear gloves and eye protection. Wash thoroughly after handling.

First aid for adhesive users

In case of contact

Eyes: Immediately flush with plenty of water for at least 15 minutes. Call a physician.

Skin: Wash with water and soap if available.

Clothing: Remove contaminated clothing and wash before reuse.

Inhalation: Remove to fresh air. Give oxygen or artificial respiration if necessary.

Ingestion: If hardener is swallowed and person is conscious, give plenty of water or milk to drink. **Do not induce vomiting.** Call a physician. If resin is swallowed, give 100 grams (about 1/4 lb) of activated charcoal slurry in water. **Do not induce vomiting.** Call a physician.

Important notice

This literature and the information and recommendations it contains are based on data reasonably believed to be reliable. However, such factors as variations in environment, application or installation, changes in operating procedures, or extrapolation of data may cause different results. Ameron makes no representation or warranty, express or implied, including warranties of merchantability or fitness for purpose, as to the accuracy, adequacy or completeness of the recommendations or information contained herein. Ameron assumes no liability whatsoever in connection with this literature or the information or recommendations it contains.



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