



## **Installation Instructions for UnderDuct – General Information**

### **Overview:**

Joining duct with a catalyzed resin and cloth and/or mat may be effectively performed by placing cloth and/or mat on a sheet of waxed film or cellophane and saturating with a resin after adding catalyst. The wet lay-up may then be applied to the ends to be joined and air pockets worked out by squeezing or rolling on the firm surface.

Duct Fitting Ends and field cuts shall be completely brush coated with catalyzed resin prior to joint wrap so no raw glass fibers are exposed. Resins used shall be the same type used in the duct and fitting filament winding. Wet field joints (mat and resin) shall be a minimum 4" in width and at least the same thickness as the adjoining duct wall. Joints shall be minimum three wraps for duct up to 22"Ø, four wraps for 22"Ø to 36"Ø and six wraps for duct 38"Ø to 60"Ø. Joint material shall be thoroughly saturated with the same type of resin as used in duct and fittings. Minimum joint overlap shall be 4" for all sizes.

A hard roller (Paint Roller) can be used to spread the resin and to work out potential air bubbles. Additional layers of mat may be used in the same manner. Care should be taken to catalyze only the amount of resin that can be used during the pot life of the resin. A little experience can quickly determine the proper handling of the resin.

The catalyst should be carefully proportioned to the amount of resin to be used, and thoroughly mixed to a uniform blend. Duct joints or repaired parts should be allowed to cure at least 24 hours before being used.

If additional lamination is to be made over a cured area, surface should be broken by sanding before application.

### **Trench:**

The surface at the bottom of the trench should be continuous, smooth and free of rocks to avoid point loading on the duct. The trench should also be graded with a slight pitch to facilitate drainage with the bedding as uniform and continuous as possible.

Trench width should not be greater than necessary to provide adequate room for joining the duct in the trench and for compaction the backfill in the bedding zone and at the sides of the duct. The minimum distance between the duct and the trench is 4 inches; maximum recommended trench width is twice the diameter of the duct.

Where the risk of flooding the trench during installation is possible, care should be taken to keep water away from the duct and the field joint areas. Keeping the water from the duct system shall continue from the time the duct is first placed in the trench, until backfill or encasement is completed. Damage can occur when the duct is floated during a water uplift event.

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## **Backfilling:**

The approved backfill materials are pea gravel or dry sand. These materials will achieve 80% to 90% compaction without the use of mechanical compaction machines. Rodding and hand tamping are the only approved compaction methods over the top of the duct.

In poor soil conditions, permeable synthetic support fabric should be utilized as a trench liner to prevent migration of the gravel into native soil. The next two layers (6" cover over duct), in lifts of 6", may be the excavated material, provided there is no organic material, frozen lumps, debris, or particles larger than 1/2". Each layer is to be compacted to the required density. Where heavy floor loads are expected, the floor slab should be either structurally reinforced over the duct area or as an alternate method, a crown of concrete could be poured over the duct in lieu of the indicated select backfill. In either case, the selection of the proper method should be determined by the structural engineer.

## **Concrete Encasement:**

Concrete encasement is not required, but can be accommodated with provisions. If you are considering concrete encasement, it must be done in 2 to three 3 lifts depending on the diameter and trench conditions, with provisions to prevent floating. Please contact Monoxivent for specific instruction on how to do this without damaging the duct. Duct hold down systems for encasement should be designed by a Mechanical Engineer and confirmed with Monoxivent for potential pounds of floating lift per linear foot per diameter.

## **Tools and Supplies:**

Items you are going to need to make a Field Joint will be as follows. Lamination roller, rubber gloves, paint brushes, measuring containers, utility knife or scissors, grinding disc (36 grit abrasive), heat gun (if temperatures are below 60° F), wax paper or mylar, acetone (for cleanup) and protective wear.

## **Precautions:**

Although most polyester and vinylester resin are quite stable, extended storage at elevated temperatures above 80° F (26.7° C) can decrease the reactivity of the resin or cause it to gel even without the use of catalyst. Make sure you read the resin data sheets that come with every shipment. Temperature extremes must be avoided for proper curing of the resin. See Table 1 below for mixing ratios at varying temperatures. Work must be done in a dry, well-ventilated area. A wide flat surface should be available to wet-out the glass mat strips. The surface should be covered with a disposable covering. Anyone coming into contact with the resin and catalyst must wear rubber gloves and protective eyewear. Always review the supplied MSD Sheets, keep all joining materials away from an open flame and use an adequate amount of ventilation.

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**Mixing:**

The rate of curing of the resin is dependent on the temperature. At low temperatures, most resins have a longer working life and require longer curing periods. Working time is decreased and curing takes place more rapidly as the temperature increases. Decreasing the amount of catalyst prolongs the working time. See Table 1.

The catalyst should be carefully proportioned to the amount of resin to be used, and thoroughly mixed to a uniform blend. Duct joints or repaired parts should be allowed to cure at least 24 hours before being used.

**Table 1**

Amount of Resin	Amount of Hardener	Temperature	Approximate Pot Life
1 qt	2 / 3 oz	50-60°F	20 min.
1 qt	1 / 2 oz	60-70°F	20 min.
1 qt	1 / 3 oz	70-80°F	20 min.
1 qt	1 / 3 oz	80-90°F	20 min.
1 qt	1 / 6 oz	Over 90°F	20 min. or less

**Joining:**

Coat all raw edges with resin mix, completely filling the joint and slightly squeezing the sections together. It is often preferable to add sufficient Cab-O Sil to resin for this step to produce a paste or light putty which will fill small voids and irregularities if there is not a good fit. It is often desirable to speed-up the hardening time for this step also by increasing the MEK catalyst required by 1 to 2 cc per pound. Insure that the interior surface is relatively smooth but a light “bead” on the interior is desirable and acceptable.

Butted sections may be “hot patched” with tabs to hold the alignment until the complete joint can be made. A tab consists of 2-3” square of glass mat saturated with resin mix. Place the prepared hot patch tab across the joint to be made to form a “tack weld.” Three are usually sufficient. For this step, it is often desirable to speed-up the hardening time of the resin by increasing the MEK catalyst by 1 to 2 cc per pound.

Two lay-ups may be required to prevent sag and overheating of the resin during hardening. Where accessible, the inside surface of the joint should be covered with 1-2 piles of fiberglass mat 4-6” wide and 1 ply of 6-8” wide surfacing veil or mat saturated with resin.

Cut the glass mat to length using Table 2 and Table 3 for the number of layers and width of glass required. Each piece of glass should be cut into manageable lengths allowing for a slight overlap. Lay the widest section of mat on a flat surface treated with release agent or covered with releasing film. Wet the entire surface with resin mix, using a paint brush and/or roller. Position the next ply of glass, staggering the pieces properly.

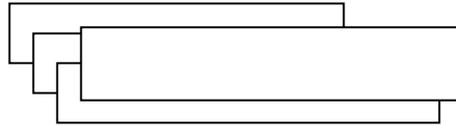
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FRP - Fiberglass Reinforced Plastic



Wet out the entire surface area of this layer with the resin mix. Remove as much air as possible with brush and/or roller toward the edges of the laminate section. Be careful to not remove excessive resin from an area.

Repeat with proper sequence of glass until all plies have been saturated with resin and formed into one integral unit.

### Wet Joint



If additional lamination is to be made over a cured area, surface should be broken by sanding before application.

### **Clean Up:**

Preferably, acetone is used as a cleaner for your hands and tools. Soap and hot water may be used, though not as effectively as acetone. Thorough cleanup must be made before the resin cures. Care should be exercised to keep catalyst and resin from contact with skin. We recommend wearing rubber gloves when working with resins and catalyst.

**Table 2**

Duct Wall Thickness	Minimum Total Width of Overlays
1 / 8"	4"
3 / 16"	4"
1 / 4"	4"
5 / 16"	5"
3 / 8"	6"
7 / 16"	7"
1 / 2"	8"
9 / 16"	9"
5 / 8"	10"

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**Table 3**

Inside Duct Diameter	# of Layers of 2" Wide Mat	# of Layers of 4" Wide Mat	# of Layers of 6" Wide Mat	Woven Roving	# of Layers of 8" Wide Mat	# of Layers of 10" Wide Mat	Inside # of Layers of 10" Wide Mat	Surface Veil
4" to 6"	1	2	0	0	0	0	0	0
8" to 12"	0	1	2	0	0	0	0	0
14" to 20"	0	1	1	0	1	0	0	0
22" to 36"	0	1	1	0	2	0	2	1
38" to 60"	0	1	2	1	2	0	2	1

4" to 6"	3m
8" to 12"	3m
14" to 20"	3m
22" to 36"	4m; v
38" to 60"	3m; 1wr; 2m; v

m= 1 1/2 oz / ft<sup>2</sup>

wr = 24 1/2 oz / ft<sup>2</sup>

v = Surfacing Veil

\*Joint thickness should be at least as thick as the pipe to be joined\*

\* ASTM C 582 Table 2 Type 2

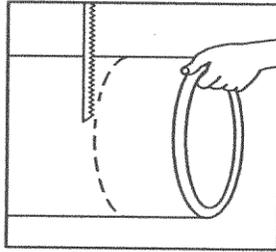
\* ASTM D 3982 Table 2

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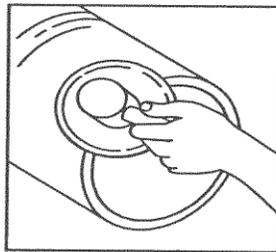
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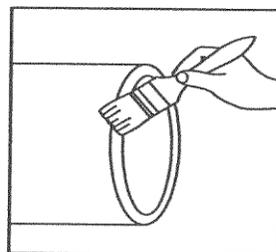
## Joining Procedures for Wet Lay-Up



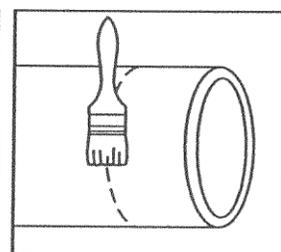
1. Firmly support duct sections. Square the ends to be welded using a saw.



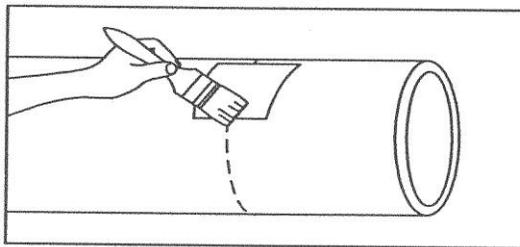
2. Rough the outer surface with sander approximately 1" farther from the ends than the finished weld surface. Where inside welds are possible, interior surfaces should be sanded prior to assembly. See Table 2 on previous page.



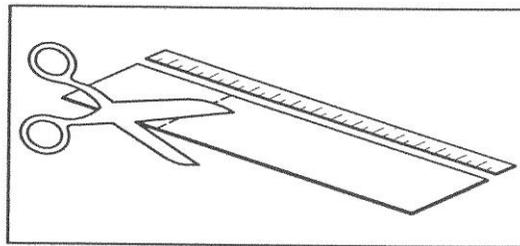
3. Coat roughened ends of duct with a small amount of catalyzed reins. Any large voids may be filled with silica-filled resin putty.



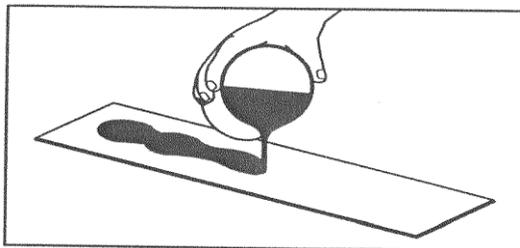
4. Support components in joint position so that no movement occurs while making the joint. Fill joint with resin.



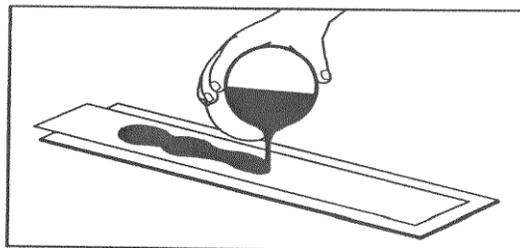
5. A "Hot Patch" technique may help prevent movement of duct during the weld-cure period. Wet 2" squares of mat with a small amount of resin using three times normal amount of catalyst. Apply "Hot patches" at intervals around joint. Curing or hardening in a matter of minutes, they secure duct sections in proper alignment. Mix resin and catalyst for "Hot Patches" in a small paper cup and discard immediately after use to avoid contaminating welding resin.



6. Lay out fiberglass mat strips on the work table. Length of each strip should be 2" longer than circumference of duct. Strips longer than 36" may be cut in half to simplify application. Mix prescribed amount of catalyst with required amount of resin in a separate clean container. Prepare only the amount of resin which can be used immediately (about 1 qt. per 6 sq. ft. of mat) the resin will harden in roughly 20-30 minutes.



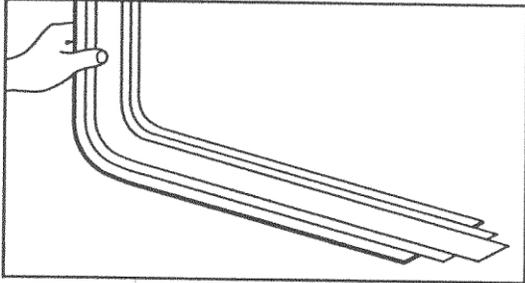
7. After mixing in the catalyst thoroughly, pour the resin onto the widest mat first. Spread it over the entire mat strip, working it into the mat fibers manually. (Neoprene gloves are recommended).



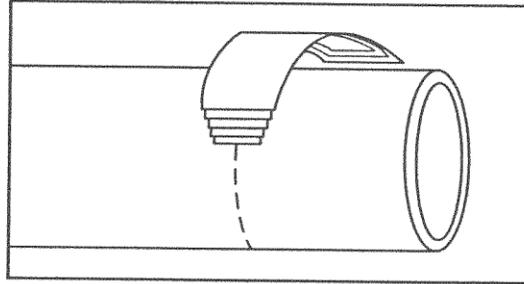
8. Place the next widest strip onto the first strip by staggering away from the first to produce a smooth weld strip joint. Add more resin and work onto the second strip.

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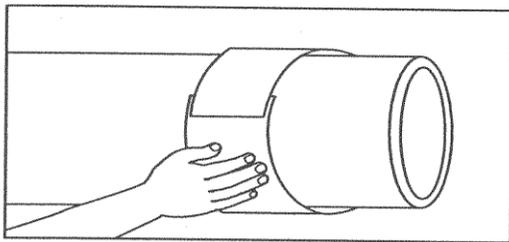
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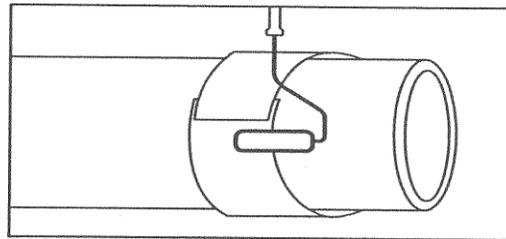
9. Add other strips in the same manner. In wetting each strip, it is best to be a little "lean" on resin at this stage rather than over-wetting. More resin may be added later if necessary. After



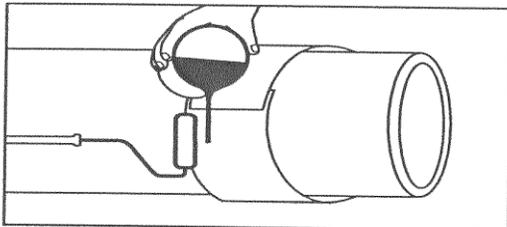
10. Pick up the completed weld strip by one end and center it carefully on the duct joint. Apply the tapered end first with the



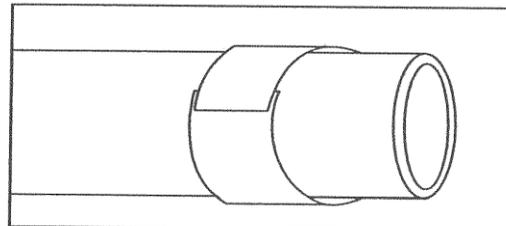
11. Be sure the weld is centered, with care taken to avoid wrinkles on the under and back side of the weld. Continue applying the strip around the joint until the free end overlaps



12. Finish the application of the weld with the roller. Any remaining air bubbles will appear as light spots. These should be rolled to the edge of the weld where they will be released and disappear. If weld is not a slight butt joint, a little extra rolling and hand work to shape mat strips to structure configuration will eliminate bumps and ridges.



13. At this stage, resin may be added where necessary if any mat appears to be not thoroughly wetted. It is better to have too little resin on the weld strip, when initially applied, than too much. Over-wetting makes it difficult to keep the weld strips in place. Also coat the remaining sanded surface with resin.



14. Allow the completed weld to cure thoroughly tack free. Do not move or disturb weld until it is thoroughly cured. If temperature is below 55°F, keep weld area warm with heat lamps. For exterior installation, protect the weld from the weather.

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