



**INSTALLATION
GUIDE AND CHECKLIST
CLOCK SPRING® CONTOUR™**

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REPAIR INFORMATION

General Data

Repair ID #: _____

Contour Design Report #: _____

Resin Lot #: _____

Expiry Date: _____

Hardener Lot #: _____

Type of Glass: Biax Quad (circle one)

Type of Resin: Std.(600) HT(700) (circle one)

Surface Preparation

Ambient Temperature: _____

Ambient Humidity: _____

Pipe Temperature: _____

Pipe and Defect Data

Line ID/Location: _____

Pipe Circumference: _____

Pressurized? Yes No
(circle one)

Installation Pressure: _____

Defect Type: _____

Defect Dimensions: _____
(Length, Width, Depth)

Date and Time: _____

Blast Type: Wet Dry Slurry
(circle one)

Surface Visually Clean? Yes No
(circle one)

REPAIR INFORMATION (CONT.)

Repair Details

Total Length/Area: _____

Repair Circumference: _____

Repair Thickness: _____

$$\text{Thickness} = \frac{\text{Repair Circumference} - \text{Pipe Circumference}}{6.28}$$

Installers

(Two installers are required. Four are preferred.)

Repair Dates

Installation Date	Layer Numbers	Chemical Batch Nos. (A/B)	Expiration Date



INSPECTION CHECKLIST

The following items should be verified by pipeline inspectors not participating in the Contour installation, to confirm that key aspects are being completed.

Pre-Installation Inspection

- Repair Information is recorded correctly on the form provided in the Installation Guide.
- Resin and hardener are within expiry dates.
- Surface preparation of the repair area meets NACE 3 or SA2.5 standards or equivalent.
- Ambient and pipe surface temperature are recorded correctly.
- Permits and toolbox talk are complete and PPE is being worn.



INSPECTION CHECKLIST (CONT.)

Installation Inspection

- Appropriate amount of time for mixing hardener into resin, approximately 3 minutes.
- Filler layer in defect area is adequate to provide smooth lamination surface.
- Fabric is wet through adequately, with no dry spots at the work bench.
- Fabric is fully consolidated, with no air bubbles or debris, before next layer is applied.
- Overlap between layers is between ½ and 1 inch (10 and 25 mm).
- Glass should be cut at least 1 inch (25 mm) greater than the circumference of the pipe to give an overlap, and these joints are staggered around the pipe circumference.
- Peel ply is wrapped smoothly after fabric application is complete, or if an overnight break is needed, with no gaps or bubbles to discourage bulges or unevenness in the hardened resin.



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CONTOUR KIT CONTENTS

1. Fiberglass Fabric
2. Resin and Hardener
3. Tyvek Suit
4. Leak-Stop Epoxy Paste Filler
5. Jiffy Mixer
6. Wooden Mixer
7. Brown Spatula
8. Short Pile Roller
9. Paint Brush
10. Fume Silica (crushed fibers)
11. Plastic polythene sheet
12. Trash bag
13. Measuring tape and cup



PERSONAL PROTECTIVE EQUIPMENT (PPE)

In addition to basic PPE required at the repair site, the following must be worn to perform these repairs:

- Rigger or thin nitrile gloves while handling glass fabric.
- Tyvek Protech 5/6 overalls or similar when working with resin or resin-impregnated laminate.
- Thick gloves when working with resin or resin-impregnated laminate. Change immediately if damaged.
- Leather or other impermeable footwear to prevent resin contact with skin.
- Suitable respirator (dust filter) when using more than 100 g of Cabosil at a time, or if extensive filler dust is visible in the atmosphere.
- Suitable respirator with organic solvent filter (e.g. 3M4251 or Kemira Silner 12 with A2 filter cartridge) when degreasing with isopropanol in a poorly ventilated area.

NOTE: Articles of PPE must be changed when you can (1) smell chemicals when wearing your mask, (2) when gloves or overalls are ripped, and (3) when overalls are soaked with resin. Remove PPE before entering areas used for cleaning, eating, or drinking.



CLEANLINESS

The materials used for this repair must be kept free of contaminants. It is important to keep the area clean while repairs are underway.

- ▶ Protect surfaces and equipment around laminating areas with polythene sheeting.
- ▶ Clean up drips, runs, and spills immediately.
- ▶ Clean up waste resin before it cures.
- ▶ Dispose of waste fabric, peel ply, and resin tins as you go (see Resin Disposal).
- ▶ Keep tools clean or dispose of promptly.



MATERIAL STORAGE AND HANDLING

Store materials in a clean, dry area.

- ▶ Store resins in their original containers at a temperature of 50°F to 77°F (10°C to 25°C).
- ▶ If resin crystallizes during storage, stand the tin in warm water, about 100°F (40°C), and stir, taking care to keep water out of the tin. Let the resin cool before use.
- ▶ Keep materials from getting wet or dirty throughout the job.
- ▶ Always keep materials away from temperatures below 32°F (0°C) and above 104°F (40°C).
- ▶ In extreme climates (below 50°F [10°C] or above 86°F [30°C]), keep resin and hardener tins indoors or in the shade as needed to bring them to a good working temperature range before use.



PREPARING REPAIR AREA FOR VARIOUS METALS

1. Prime the repair area as follows, based on material of pipe under repair.

Steel Pipes (Leaking Defect)

- a. Grit-blast to white metal finish (SA21/2).

Aluminum and Alloyed Steel Pipes

- a. Apply a layer of resin and abrade with 60-grit silicon carbide paper.
- b. Treat with primer before bonding.

Copper-Nickel Pipes

- a. Pressure wash thoroughly with low-pressure water.
- b. Degrease the area and apply primer.

2. If surface needs further cleaning, use MEK or acetone from now on. Isopropanol will take too long to dry, and could inhibit the repair bond.
3. Apply repair as soon as possible after preparation, before surface corrosion or condensation forms.



CUTTING FABRIC

1. Thoroughly clean off a work area or lay down a clean sheet of polythene to protect fabric from contamination.
2. Plan and complete all cutting at the start of each section relevant to pipe geometry and the number of layers to be applied.
3. For large pipes, use a rotary cutter and straight edge (or scissors) to cut fabric into plies $\frac{1}{2}$ to 1 inch (10 to 20 mm) longer than the pipe circumference.



TRAINER TIP:

Do not apply fabric yet.



TRAINER TIP:

For smaller diameter pipes (24 inches [61 cm] or less), you may wrap a longer length of fabric in a spiral around the pipe instead of cutting individual plies. See Spiral Wrap Method section (pg. 14).

4. If not using fabric immediately, cover fabric and peel ply sections (or place them in plastic bags) to prevent contamination. Fabric and peel ply are best left lying flat, but can be rolled, for storage.



FILLING AND FAIRING

Use either Leak-Stop epoxy putty or thickened resin as filler. Instructions for thickening resin can be found below. Filler consistency is critical for a good finish and to prevent sagging.

1. Spread filler over roughened and cleaned defect area, rebuilding the pipe's original circumference.
2. Apply filler to transitions so that fabric can conform to any curvature.
3. Smooth filler surface with spatula or paint brush.
4. Let filler cure and fully harden.
5. Sand filler to desired shape as needed.



MIXING RESIN

1. Pour the entire contents of the smaller tin of hardener (CS 600-B or 700-B) into the larger tin of resin (CS 600-A or 700-A).
2. Scrape hardener tin with the brown scraper provided to ensure all hardener is used.
3. Mix resin and hardener for at least 3 minutes with the wooden stick or Jiffy mixer, scraping the bottom and sides of the tin, until mixture looks homogenous. Avoid trapping air in the resin.
4. Use material promptly after mixing, and stop using it when it gets too thick.



TRAINER TIP:

Resin can be used for about 40 minutes after mixing at 77°F (25°C). Working time decreases at higher temperatures, and increases at lower temperatures.



MIXING RESIN (CONT.)

Thickening Resin

To thicken resin for use as filler or on vertical or overhead surfaces, follow the steps below (note: resin should already be mixed before adding fume silica).

1. Add fumed silica thixotrope slowly to resin.
2. Mix until mixture is even, without lumps.
3. Add fumed silica until filler is the consistency needed. For use on vertical/overhead surfaces, the resin should still wet out fabric, but not drain. Approximate values are shown below.

Resin Type	Fumed Silica to Add per 2 kg Tin	
	For Filler	For Vertical/ Overhead Surfaces
Standard	1-2 scoops (200-400 ml)	1-2 scoops (200-400 ml)
High Temperature	2-3 scoops (400-600 ml)	2-4 scoops (400-800 ml)



TRAINER TIP:

More fumed silica will be needed as the application temperature rises.



TRAINER TIP:

Thickened resin heats up quickly as it cures. Use within 10 to 15 minutes of mixing, and take care when picking up the tin, as it may get very hot.

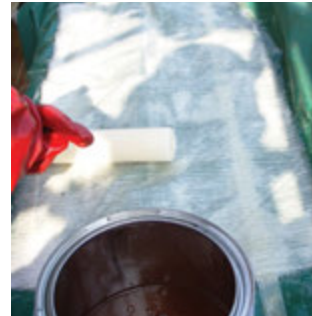


WETTING OUT FABRIC

Before Application

Where possible, wet out fabric with resin before applying to pipe following the directions below. The weight of resin needed for this is roughly the same as the weight of fabric used.

1. Cover a work bench with a polyethylene sheet.
2. Apply a generous layer of mixed resin to the sheeted surface with the roller provided.
3. Lay the first fabric ply onto the resin layer and roll more resin onto its surface.
4. Work the resin into the fabric with firm pressure on the roller. The fabric will turn translucent as the resin penetrates its fibers.
5. Turn the fabric over to check for dry areas, and



WETTING OUT FABRIC (CONT.)

On the Pipe

1. Apply a layer of resin to the surface the fabric will be placed on.
2. Place the first layer of fabric on the pipe and apply more resin over it.
3. Work the resin into the fabric with the roller until fabric turns translucent.



Step 1



Step 2

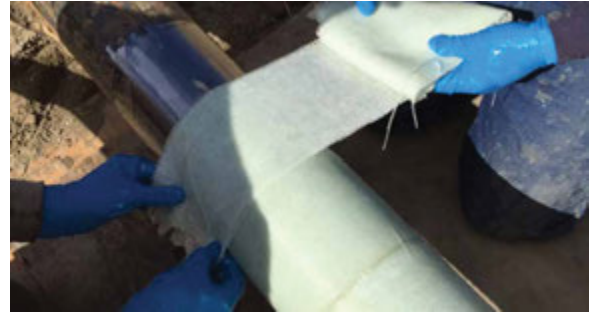


Step 3



APPLYING FABRIC TO PIPE

1. Roll a layer of resin over the repair surface.
2. Apply the first layer of fabric to the repair surface, the appropriate ply width away from the repair area. If using separate plies rather than a continuous wrap, ensure the overlap is not over the defect.
3. Smooth the fabric onto the surface gently with your hands or roller, pushing all air pockets and bubbles to the joints or edges to remove them. This is called consolidation.
4. Wet out, apply, and consolidate each following ply or wrapped layer in the same manner. Each layer should be wound in the same direction around the pipe.
5. Move leading edge point so that overlapped ply staggers around the pipe circumference at different points. Overlap edge should be more than 1



APPLYING FABRIC TO PIPE (CONT.)

6. Confirm with each layer that no debris is trapped in the wrap, and that fabric is completely wet out, applying more resin as needed.
7. Ensure that each layer is in full contact with the ply below it, and that each one lies flat (make cuts around odd geometries if needed).
8. Overlap as required at either end of the repair to achieve desired taper.



TRAINER TIP:

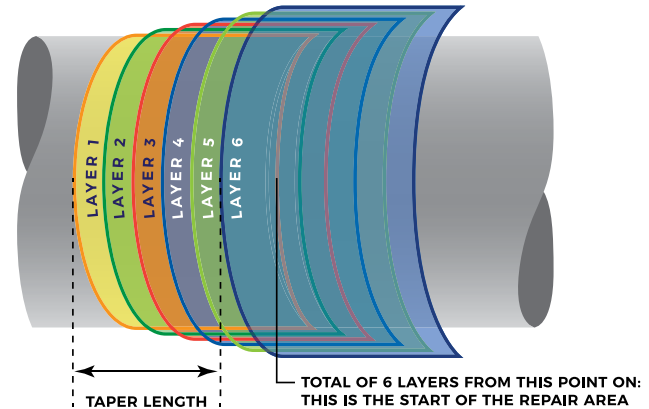
Do not lean on or press too hard on the surface. This wet repair will be like a dough, and this could cause dents in the fabric that cannot be removed.



SPIRAL WRAP METHOD

This alternative method is easiest to apply to pipes smaller than 24 inches (61 cm).

1. Measure the width of the fabric, and determine the number of layers needed. For this example, we use **4¾ inch (120 mm) wide fabric** for a repair requiring **6 layers**.
2. Mark a starting point ⅓ of the fabric width (in this case, 4 inches [100 mm]) away from the defect under repair (see illustration).
3. Mark the steps where each wrap should fall, ⅓ of the fabric width (¾ inch [20 mm]) from the previous mark. For elbows, make these marks on the outside of the pipe bend, with the first one in line with the starting point.
4. Wind wetted out fabric around the circumference of the pipe, starting as marked and moving along the repair length, in line with reference marks. For elbows, stay as nearly perpendicular to the pipe axis as possible.



PEEL PLY FINISHING LAYER

Once final fabric layer has been applied, or if an over-night break is needed, apply peel ply as follows.

1. Start peel ply wrap on the pipe, beyond the edge of the fabric. For straight pipe or elbow it is best to apply it in a spiral with each wrap overlapping the previous by about 1 inch (25 mm).
2. Wrap in the same direction as the fabric, applying only light pressure.
3. Confirm no debris is trapped beneath the peel ply. If something is trapped, remove the ply and the contaminant and reapply the peel ply.
4. The peel ply will soak up excess resin on the surface. Brush more resin onto any areas that look dry.



PEEL PLY FINISHING LAYER (CONT.)

5. Don't allow peel ply to tent over any high points. Press it onto the fabric surface with the brush, allowing no air gaps.
6. Wrap peel ply until the entire area is completely covered. Make sure there are no air voids, indentations, wrinkles, or dry patches.
7. Leave an outer corner of the peel ply dry so the ply can be removed once the resin has cured.



FINISHING LAMINATES

1. Carefully remove the peel ply. All traces must be removed.
2. Inspect the laminate for foreign matter, pits/scores, de-lamination, unconsolidated areas, remaining peel ply, exposed edges or cuts, dry areas, and blisters.
3. Remove any protruding fibers from the edges with a file, grinder, or scissors.
4. Seal exposed or cut edges with more resin.
5. File off any ridges that have formed under the peel ply.
6. Coat dry edges with resin.



RESIN DISPOSAL

1. Mix unused resin and hardener together.
2. Add a small amount of mixture to empty hardener tins, mixing it around to neutralize residue in tin.
3. Use empty tins to divide resin into 500 g or smaller amounts before it begins to heat up (within 30 minutes of mixing).

CAUTION: Larger quantities will smoke and fume if left to stand.

4. Leave to cure in a well-ventilated area.
5. Dispose of cured resin and neutralized tins as general waste. Dispose of uncured material and tins in accordance with local hazardous waste regulations.



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