

Belzona Know-How

FOR REPAIRING ERODED-CORRODED TUBE SHEETS

HEX-1

Common Problems

- Leakage of system fluids across tube sheet caused by wastage of the tube sheet ligaments due to electrolytic corrosion
- Cracking of ligaments due to weakening by electrolytic corrosion.

Set-up

All work should be carried out in strict accordance with the relevant Belzona® Instructions For Use.

In particular, coverage rates and overcoating times must be observed.

Product selection should be made based upon the extent of damage, the operating conditions and the time available to carry out the work. The affected tube sheet must be dry and all standing water blown out of tubes using a suitable airline. Where division bar seats are to be rebuilt, wooden or steel formers of correct size and shape should be sourced prior to commencement of application and coated with 2 coats of **Belzona® 9411** it will also be necessary to block off all tubes using tapered corks. These will need to be sourced before the application commences.

Preparation

Using suitable tools, remove all graphitized or dezincified tube sheet material until a sound metallic surface is exposed. Grit blast the surface of the tube sheet to give a surface profile of minimum of 3 mils (75 microns) using a suitable angular grit.

Where equipment is operating in aggressive corrosive solution, e.g. salt water, please refer to Section 1 of the Belzona® Instructions For Use.

On completion of blasting, wash the area with **Belzona® 9111** to remove all residual blasting debris. Block off all tubes taking care that the clean tube sheet is not contaminated. When all tubes are plugged, use a flat piece of wood to level the corks using the most protruding tube as a guide (fig. 1).

Conditioning

Where a **Belzona® 2000** Series product is being utilized, apply **Belzona® 2911** or **Belzona® 2921** in a thin film, using a stiff bristled brush, to the entire prepared area to which the

Belzona® 2000 Series product is to bond.

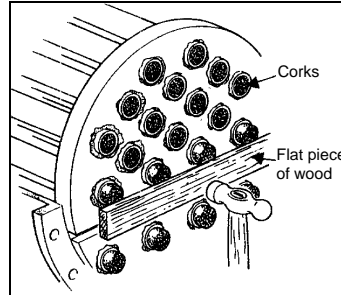


Fig. 1

Application

1. Rebuilding Tube Sheet

Mix the selected Belzona® material and using the applicators supplied, apply to all eroded areas of the tube sheet to restore the original profile. Press the Belzona® well into the blasted surface to avoid air entrapment. Application should commence at the center of the tube sheet and progress to the extremities. In areas of the tube sheet where there are no tubes, then the Belzona® may be feathered down to the tube sheet surface (fig. 2).

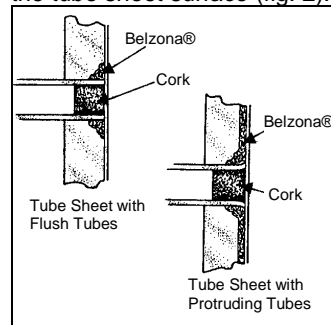


Fig. 2

2. Rebuilding Division Bar Seats

Apply a thin film of Belzona® into the seal area pushing well into the blasted profile. Apply a further thin film of Belzona® material to the underside of the previously released former. Bed the former into position in the seal groove, clamp and apply further Belzona® around the former to restore the original seal groove dimensions. Following a suitable cure time, remove the former (fig. 3).

3. Forming Technique

On small single pass tube sheets, rebuild the entire sheet by using a flat plate steel former coated with **Belzona® 9411**.

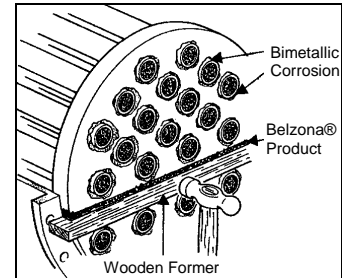


Fig. 3

Following preparation as outlined above, apply the selected Belzona® material to the tube sheet ensuring a peak of material at its centre. Apply a thin film of the chosen Belzona® material to the forming plate, which is then pushed against the tube sheet and pulled down to the correct position using existing flange studs or suitable clamps. Remove any exuded Belzona® and allow the System to fully cure before removal of the plate. Provided a minimum thickness of 1/8th of an inch (3 mm) of Belzona® has been applied using this method (fig. 4) there will be no necessity to apply a protective coating.

4. Applying Belzona® Protective Coatings

Following rebuilding of the tube sheet, mix a selected Belzona® fluid grade product and using short bristle brushes, apply 2 even coats to the entire tube sheet. For more complete information, refer to Belzona® Know-How System Leaflet HEX-3 "Applying erosion-corrosion resistant coatings".

5. Removal of Corks

Following completed application of all Belzona® materials and, after the designated cure time, remove the corks. Using a ball peen hammer gently tap the corks into the tubes. Chamfer all tube ends using a conical grinding stone. The corks can either be blown out using compressed air or removed with a corkscrew.

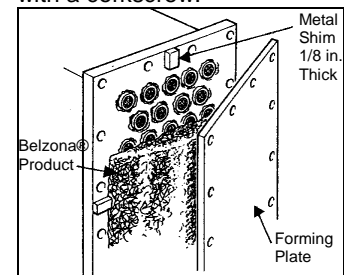


Fig. 4

Belzona® Technical Comparison:

Product	Consistency	Erosion Resistance	Working Life at 60°F (15°C)	Full Chemical Cure at 60°F (15°C)
Belzona® 1111	Paste	Very Good	25 minutes	3 days
Belzona® 1121	Paste	Good	60 minutes	7 days
Belzona® 1311	Paste	Very Good	25 minutes	3 days
Belzona® 1511	Paste	Good	40 minutes*	-----**
Belzona® 2111	Paste	Excellent	20 minutes	3 days
Belzona® 4301	Paste	Fair	35 minutes	14 days

* Minimum application and cure temperature is 65°F (18°C)

**Designed to cure in service. See IFU for specific details.

Belzona® System Selector:

Main System Requirement	Belzona® 1111	Belzona® 1121	Belzona® 1311	Belzona® 1511	Belzona® 2111	Belzona® 4301
Large areas requiring long overcoating times		•				
Areas subject to high erosion/corrosion conditions			•			
Floating end tube sheets					•	
Application requiring maximum chemical resistance						•
Maximum heat resistance				•		
General repairs	•					

Recommended Equipment:

<p>Mixing and application tools are included in each pack of Belzona®. Prior to carrying out the repair, however, it is important that all other necessary tools and equipment are available on site. Every situation will be somewhat different, but the basic requirements could include those shown to the right.</p>	<ul style="list-style-type: none"> • Grit Blasting Equipment • Suitable Mechanical Tools for Removal of Graphitized or Dezincified Metal • Conical Grinding Stone • Belzona® 9111 • Belzona® 9411 • Tapered Corks • Suitable Formers • A Dry Air Supply • Corkscrew 	<ul style="list-style-type: none"> • Suitable Protective Clothing/ Equipment • Masking Tape • Stiff Bristled Brushes • Surface Profile Gauges • Vacuum Equipment • Wet Film Thickness Gauges • Space Heating or Dehumidification Equipment for In-situ Application
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For more complete technical information, please refer to the appropriate Belzona Product Specification Sheet.

For detailed instructions on surface preparation, mixing and curing, please refer to the appropriate Belzona Instructions For Use.

Comprehensive Health and Safety information is provided with the product. For more information, please contact your local Belzona representative.

The technical data contained herein is based on the results of long term tests carried out in our laboratories and to the best of our knowledge is true and accurate on the date of publication. It is however subject to change without prior notice and the user should contact Belzona to verify the technical data is correct before specifying or ordering. No guarantee of accuracy is given or implied. We assume no responsibility for rates of coverage, performance or injury resulting from use. Liability, if any, is limited to the replacement of products. No other warranty or guarantee of any kind is made by Belzona, express or implied, whether statutory, by operation of law or otherwise, including merchantability or fitness for a particular purpose.

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