

# IN FOCUS: Cold Bonding

Issue 106

## Contents

### What is Cold Bonding? 1

Cold bonding can be described as the joining of...



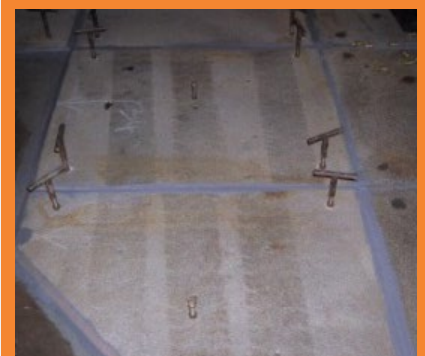
### Belzona Cold Bonding 2

Belzona bonding was first used in the late 1950s to attach equipment...



### Newbuild Solution 3

Belzona prevents abrasion in 111 riser bearings...



### Deck Maintenance 4

Epoxy injection ensures impact loading resistance...

## BELZONA COLD BONDING SOLUTIONS

### What is cold bonding?

Cold bonding can be described as the joining of two parts or materials without the use of heat. Traditional bonding techniques such as welding use high temperatures generated by an electric arc or the burning of gasses to 'melt' the materials so that they fuse into one. Cold bonding is achieved with the use of an adhesive that forms a bond between the two materials. Belzona cold curing composites allow for this bond to be created without the use of heat.

### A welcome alternative to welding

Welding is one of the most recognised bonding techniques; however, it also presents several challenges related to personal and environmental safety, downtime and defects that can lead to failures.

### Safety

The risk of sparks can limit the applications where welding is acceptable, especially in potentially explosive atmospheres. A random spark created while welding can cause a fire or even an explosion. Initiatives to minimise the risks of hot work have been implemented for many years, but accidents still happen.

In addition, toxic gases produced during the welding process can have a negative impact on the welder in confined spaces and also affect the environment, since they contain nitric oxide, nitrogen dioxide, carbon monoxide and ozone.

### Downtime

Welding can be a time consuming process due to the number of necessary steps required to carry out the application. Equipment needs to be degassed prior to application, the surface has to be machined back to the initial profile and once the application has been completed, the equipment needs to be stress relieved. The required post weld heat treatment and inspection further extends downtime.

### Defects and failures

Galvanic corrosion commonly occurs if the filler or parent metals are dissimilar. In addition, the heat generated by welding can lead to the creation of heat affected zones (HAZ) - which can also cause increased corrosion.

Residual stresses caused by uneven expansion-contraction change the structure and the properties of the metal and can lead to potential material degradation. ▶▶



Holed tank roof



Plates bonded with Belzona

## BELZONA COLD BONDING FEATURES

- » High adhesion - ensures long service life
- » Ambient cure - rapid achievement of full mechanical properties
- » Uniform and efficient load transfer
- » No shrinkage - materials are 100% solids
- » Durable - the system withstands industrial environments
- » No chance of water or bacterial ingress
- » Chemical, pressure and temperature resistance
- » Mechanical strength - capable of handling a wide range of loads



Cold applied  
No hot work



High adhesion  
to different  
substrates



Excellent chemical  
resistance



High  
compressive  
strength



Durable



Impact resistance



Tank base repair



Pipe wear pads bonding

## BELZONA COLD BONDING

### Newbuild applications



Process vessel internals bonding



Load bearing shim creation



Rudder bearing installation

### Repairs



Pump casing repair



Vessel through-wall defect repair



Platform leg repair

» Voids and porosity may also occur during the welding process. These can weaken the weld joint if not repaired, and can be difficult to detect if they are not visible on the surface of the weld.

100% contact which enhances load bearing capability.

- The system is solvent free, 100% solid and environmentally friendly.

### Belzona Cold Bonding

Belzona bonding was first used in the late 1950s to attach equipment ID tags. Over the years, materials were enhanced to resist higher pressures and temperatures as well as demonstrate comparably high adhesion and compressive strength. Cold bonding is now considered to be a viable alternative to welding due to several reasons:

- There is no risk of sparks or electrical hazards and no need for hot work permits.
- Cold bonding can be used when cutting and welding are restricted due to potentially explosive atmosphere.
- Fast and simple in-situ application without the need for special equipment makes cold bonding ideal for emergency repairs and challenging application areas, where access is restricted.
- There is no need for on-site machining, stress relieving and post weld heat treatment.
- Cold bonding adhesive can conform to irregular shapes and substrates, filling the void between the surfaces. This ensures

### Simple solution for complex situations

The cold bonding application is simple as it uses the Belzona material as an adhesive between two surfaces. This simple technique can solve highly complex issues in different and challenging situations.

An example is the deck renovation plate bonding technology, developed in the early 2000s, which involves the use of multiple plates bonded in place using the Belzona material to create a new deck. The video that demonstrates this system can be seen on the BelzonaTV, the dedicated Belzona YouTube channel. ([youtube.com/belzonatv](https://www.youtube.com/belzonatv))

Various other applications, including irregular shimming or chocking, restoring structural integrity and permanently bonding equipment and structures in harsh and challenging environments have been developed and proven through testing and case histories.

Belzona cold bonding has been accepted as a permanent installation and has been used on all Germanischer Lloyd classed vessels since 1984. ■

### COLD BONDING POINT OF ADHESION



### WELDING POINTS OF ADHESION



Cold bonding can offer repairs of equivalent or greater strength than welding, giving a larger contact surface. The bonding strength of Belzona 5811 has been measured by a tensile shear adhesion test. In the case of bonding a 1.0m<sup>2</sup> plate, the results demonstrate that the Belzona 5811 will be able to sustain up to 7000kN in pure shear. An equivalent 7mm weld along the edges of the plate will be able to support up to 2000kN. This demonstrates that the bonded solution gives 3.5 times the shear resistance compared to the same plate welded round the edges with a 7mm weld bead.



# ICHTYS PROJECT BONDING SOLUTION

## Belzona prevents abrasion in 111 riser bearings

Risers and riser housings needed protection on a new build central processing facility. The project was to be completed in South Korea, eventually bound for the Australian waters. When stationed, risers move inside the housings, creating abrasion and exacerbating corrosion. The decision was made to protect these areas with composite bearings.

The central processing facility required the highest performance product available as the bearings had a design life of 40 years. Belzona worked together with the customer from the conceptual phase to execution of the project. A complete technical package was delivered including design, product selection and work procedure, as well as on-site support and inspection. A total of 84 risers and housings

were completed on the hullside and 27 on the topside.

As the bearings reached 2.5m diameter and 3m length, they were split into up to 16 sections and had to be bonded in place. The bearings were aligned in place using jigs, straps and injection port bolts. The bearing had to be jacked to 4mm from the substrate and the seams were then dammed using [Belzona 1111 \(Super Metal\)](#). [Belzona 1321 \(Ceramic S-Metal\)](#) was injected through the injection ports. After curing the injection ports were cut off, filled with [Belzona 1111](#), and ground flush. The application is part of a substantial project, which represents the largest discovery of hydrocarbon liquids in Australia in 40 years. ■



Fitting bearing to housing



Fitting bearing to riser



Injecting Belzona 1321



Riser inserted into housing

## BELZONA 1212

Surface-tolerant epoxy composite for emergency in-situ metal repair of oil contaminated, wet and underwater substrates.



- Adheres to manually prepared surfaces
- Rapid cure even at low temperature
- Emergency in-situ repair



- Excellent mechanical properties
- Multi-purpose material
- Ideal for repair kits

## COLD BONDING SOLUTIONS

### Common repairs:

High adhesion epoxy composites such as [Belzona 1111 \(Super Metal\)](#) are used for general bonding applications.

### Large areas:

[Belzona 1121 \(Super XL-Metal\)](#) offers an extended working life and is ideal for large applications and hot climates.

### Emergency repairs:

Belzona materials such as [Belzona 1212](#) and [Belzona 1221 \(Super E-Metal\)](#) are fast curing and can be mixed and applied in small quantities. They are ideal for emergency repair situations like rapid pipe leak repair.

### Contaminated wet and oily surfaces:

Belzona surface-tolerant epoxies are formulated for active leaks and underwater repairs, since they bond well to wet and oily surfaces. [Belzona 1161 \(Super UW-Metal\)](#) are paste grade and [Belzona 5831 \(ST-Barrier\)](#) is a coating grade material.

### High temperature environment:

Heat activated Belzona materials with corrosion protection up to 150°C (302°F) can be applied directly onto hot surfaces. The heat activated range includes a paste grade, [Belzona 1251 \(HA-Metal\)](#), and [Belzona 5841](#) and [Belzona 5851 \(HA-Barrier\)](#) coatings.



Corroded nozzle



Cold bonded plate reinforcement

DEMONSTRATION OF OUTSTANDING PERFORMANCE

During a Conference at the Belzona Technology Centre, the adhesive properties of [Belzona 1251](#) were put to the test, when a Mercedes SL500 was suspended above a Mercedes S320 LCDI. The [Belzona 1251](#) heat activated material was applied to a connecting joint only 75mm in diameter and cured immediately prior to the lift. With the Mercedes SL 500 AMG weighing over 2.2 tonnes and a minimal amount of adhesive, it demonstrated that [Belzona 1251](#) was able to carry over 1.8 million times its own weight! Further testing carried out by Belzona's USA and UK laboratories demonstrated the product could actually lift over 20 tonnes in this configuration.



Adhesive properties of the [Belzona 1212](#) were also recently tested by the England's strongman, who pulled a full minibus. The rope was connected by a [Belzona 1212](#) bonded joint. Material was applied onto a wet and oily surface.



# SUCCESSFUL DECK MAINTENANCE ON A NORTH SEA PLATFORM

## Fluid grade epoxy injection ensures impact loading resistance

Belzona's cold bonding technology was applied to a badly deteriorated deck on a North Sea platform in 2004. The deck had become weakened through daily operation and weather. The original 8mm steel deck was corroded through in many locations and welding was not an option due to the installed under-deck passive fire protection.

The following application procedure was developed, specified and applied by a competent team, who received comprehensive Belzona training. Steel plates, drilled to accept jacking bolts and injection ports, were prepared and positioned onto the grit blasted deck. The jacking bolts were used to obtain accurate levels. The sides of the plates were dammed using an epoxy

paste. A fluid grade epoxy was then injected into the void using an airless pump to seal and bond the reinforcement plate to the deck achieving full contact.

Independent testing showed that the Belzona bonding method in this case was equivalent in strength to a welded plate. Very good resistance to impact loading was achieved and considered by the independent engineering designers to be "robust enough to withstand the rigours of the laydown area operations". Daily operations were not interrupted and the passive fire protection in the machinery space below was not affected. This work has been inspected annually and now, almost 12 years on, is still in perfect condition. ■



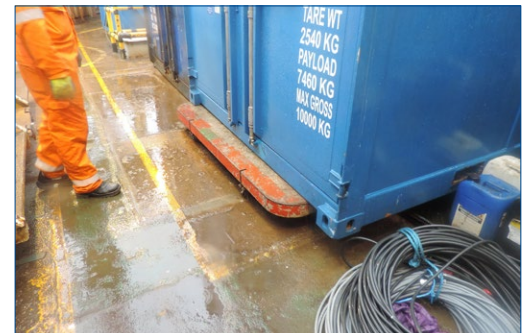
Corroded platform deck



Close up: corroded platform deck



Plates bonded onto the deck



Deck inspected in 2015, 11 years later after application: Belzona plate bonding solution in excellent condition



Click here to find your local Belzona Representative

