

IN FOCUS: Cold Bonding



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

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...



Deck Maintenance 3

Fluid grade epoxy injection ensures impact loading resistance...



Pipeline stabilised with irregular shim 4

Pipe bridges supporting gas...

BELZONA COLD BONDING

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

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 1.0m² 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.

PIPELINE STABILISED WITH IRREGULAR SHIM

Pipe bridges supporting gas pipeline over waterways

Back in 1998, our Slovakian Distributor SLOVCEM spol. s r.o. received an enquiry from a gas transmission company wanting to upgrade the support construction for their pipe bridge over the Morava River at the Czech-Slovak border. The arched steel structures made of materials and technology available at that time had become deteriorated and required reconstruction and remedial actions. To achieve this, 16 sliding supports between the bridge and pipe had to be installed. As the gas line needed to remain active, welding was not a viable option.

The client decided that a Belzona plate bonding application using [Belzona 1111 \(Super Metal\)](#) was the best solution as it would provide a high strength bond and, at the same time, eliminate the need for hot work allowing the application to progress without disrupting the gas supply.



General view of pipe bridge

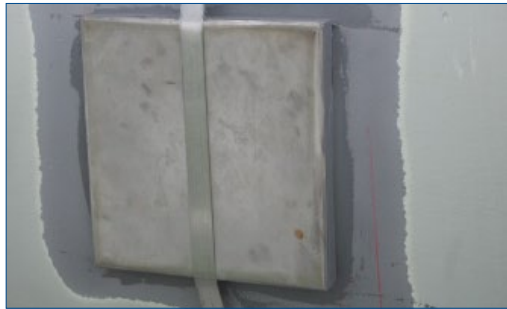
First, all surfaces were prepared by degreasing with Belzona 9111 (Cleaner/Degreaser), followed by grit blasting to SA2½ and a 75 micron profile and subsequent rewashing with Belzona 9111 (Cleaner/Degreaser).

Next, [Belzona 1111 \(Super Metal\)](#) was applied to both the pipeline and the prefabricated wear plate, forming a central peak. The wear plate was then positioned into place and any excess material removed. After cure, during which the wear plate was held in place using a metal strap, the application was finally over-painted to ensure a more uniform appearance.

Until today, the application is in perfect condition and, thanks to this success, four additional bridges have had supports bonded with Belzona so far. ■



Preparing/measuring location for supports



[Belzona 1111](#) used to bond wear pad



Completed sliding support in place

BELZONA LAUNCHES NEW POURABLE CHOCKING COMPOUND - [BELZONA 711](#)

Designed to endure the physical and thermal shock common to industrial environments, Belzona 711 is specifically formulated to spread out evenly across irregular surfaces. The system is 100% solid and it will not shrink during cure. It also possesses self-levelling properties, facilitating quick and simple application. Excellent load bearing capability is demonstrated by a comparably high compressive strength. Tested in accordance with ASTM D695 compressive yield strength measures at 14930 psi (102.9 MPa) and compressive modulus at 5.75x105 psi (3964 MPa). Belzona 711 features high creep, corrosion and vibration resistance, ensuring lasting performance under varying service conditions.



[WATCH VIDEO](#)

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 1211 \(E-Metal\)](#) 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 1831 \(Super UW-Metal\)](#) is a 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 the Belzona Conference held at the Harrogate Technology Centre in 2010, Belzona demonstrated the adhesive properties of [Belzona 1251](#) by suspending a Mercedes SL500 AMG 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.



- Belzona newbuild applications that require excellent adhesion and high compressive strength:
- » Creation of load bearing shims
 - » Retention of bearing rings
 - » Modification of vessel internals
 - » Equipment assembly



Issue No.

106

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 10 years on, is still in perfect condition. ■



Corroded platform deck



Close up: corroded platform deck



Plates bonded onto the deck



Deck inspected in 2012, 8 years later after application: Belzona plate bonding solution in excellent condition



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