

IN FOCUS: Belzona vs. Welding

Issue 116

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

High-flying low-maintenance cell phone antenna bonding



Tank Maintenance 4

Through-wall tank defects repaired on-line

COLD BONDING WHEN HOT WORK IS UNSUITABLE

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 gases to 'melt' the materials so that they fuse into one. Cold bonding is achieved with the use of an adhesive.

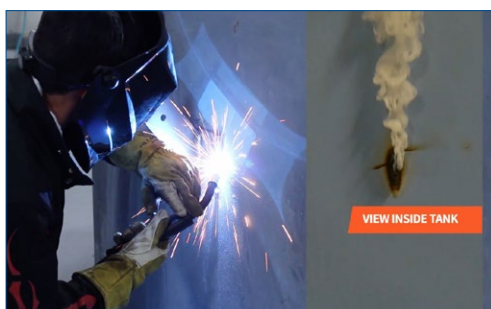
A welcome alternative to welding

Welding is one of the most recognised bonding techniques; however, it also presents several challenges related to 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 single 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.

Toxic gases produced during the welding process can have a negative impact on the welder in confined spaces and also affect the environment.



Welding

Downtime

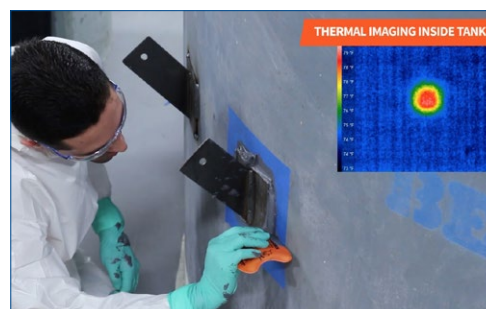
Welding can be a time consuming process due to the number of necessary steps required to carry out the application. Equipment needs to be degassed prior to application, the surface has to be machined back to the initial profile and once the application has been completed, the equipment needs to be stress 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.

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.



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



Through-wall repair



Pipe wear pads bonding

BELZONA COLD BONDING

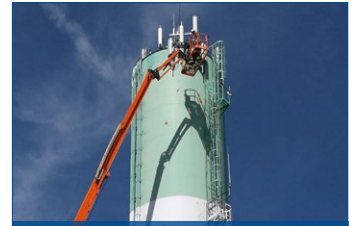
Newbuild applications



1. Bonding of supports



2. Load bearing shim creation



3. Bracket/support installation

Repairs



4. Metal reinforcement



5. Leak sealing



6. Returning strength to metal

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 atmospheres.
- 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 100% contact which enhances load bearing capability.
- The system is solvent free, 100% solids and environmentally friendly.

Bonding methods: “composite sandwich”

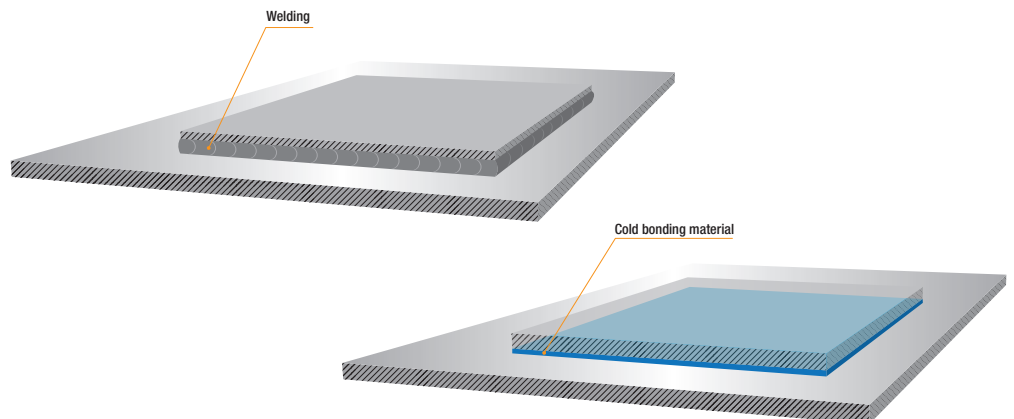
In most cases cold bonding can be simply achieved with a Belzona 1000 series paste grade adhesive. The product is pushed well into both roughened surfaces, which are then joined together, allowing any excess material to exude eliminating air entrapment.

Bonding methods: injection

Bonding large areas, for e.g. 1m² doubler plates, may require the addition of a fluid grade Belzona 1000 or 5000 series material to be injected through the ports, ensuring full contact between two surfaces. In this case, a paste grade is used to seal the edges, and the fluid grade material is injected, flowing from the corner(s) inwards, until it starts exuding from the vent port(s).

Put it to the test!

The bonding strength of Belzona 5811 has been measured by a tensile shear adhesion test. In the case of bonding a 1m² plate, the results demonstrate that 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 around the edges with a 7mm weld bead. ■



HIGH-FLYING LOW-MAINTENANCE JOB

Mounting cell phone antennas to a 220' water tower

A local water authority needed to install cell phone radio dishes at the top of the water tower.

Welding them on wasn't an option due to potential damage to the tower's steel walls and protective paint. Belzona's solution on the other hand, does not require any heat to apply or cure.

Belzona 1111 (Super Metal) was used as an adhesive to bond antenna brackets onto the tower.



View of the tank

Some of the mounts were forced to be on uneven surfaces and over weld lines.

Special care was taken to ensure the existing paint was removed from the rough surface of the weld without compromising the integrity of the weld itself. Belzona 1111 was chosen due to its outstanding bond strength, which was very important due to the value of equipment being mounted on it.

Completed in 2013, this application will remain maintenance-free for decades to come. ■



Surface ready for Belzona application



Bracket bonded with Belzona 1111



Application completed

COLD BONDING SOLUTION EXAMPLES

Various examples of Belzona cold bonding in action can be found on khia.belzona.com

1. Bonding of supports:
Belzona stabilizes gas pipeline on bridges by installing sliding supports.

[Vol XXVI No 66](#)

2. Load bearing shim creation:
Crash barrier bonded to floor at a food manufacturing facility instead of mechanical fixings to prevent bacterial growth.

[Vol XXVII No 67](#)

3. Bracket/support installation:
Bonding cell phone antennas to a water tank, preventing heat damage to the tank lining.

[Vol XXVIII No 157](#)

4. Metal reinforcement:
Bonding reinforcing plates to steel box girder bridge where welding was not an option.

[Vol XXX No 80](#)

5. Leak sealing:
Corroded sludge buffer tank repaired with bonded plates on-line.

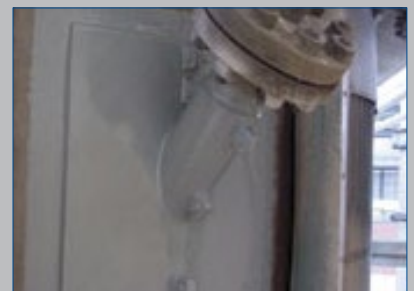
[Vol XXVII No 69](#)

6. Returning strength to metal:
Thinned nozzle necks were restored with custom doubler plates.

[Vol XVIII No 42](#)



Corroded nozzle



Reinforced nozzle

STOP IT. SEAL IT. BELZONA IT.

- Stop the leak with Belzona 9611
- Complete repair with Belzona 1161



OUTSTANDING PERFORMANCE DEMONSTRATION

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 [Belzona 1212](#) were also recently tested by 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.



KEEPING THE TANK ON-LINE
Corroded tank wall repair with doubler plates

A 6m diameter x 6m high circular steel tank supplying water for the fire sprinkler system in a large foam manufacturing plant was suffering from corrosion at the water line. Over several years the tank had become badly corroded around approx. 50% of the circumference at the water line causing it to split open in some areas allowing water to flow out.

For fire safety reasons the tank needed to be constantly on-line, 24 hours a day, 7 days a week.

Replacing it with a new tank was not an option due to time and budget. Belzona 1161 (Super UW-Metal) was chosen to bond 400mm x 300mm doubler plates to seal the corroded area. The repair was then overcoated with Belzona 5831 (ST-Barrier) for overall corrosion protection.

The Belzona repair was completed with the tank on-line in 2013. To date, the application is performing well eliminating corrosion and preventing the problem from reoccurring. ■



Corroded tank



Close up of corroded areas



Surface preparation



Tank repair completed

PRODUCT SELECTOR	Belzona 1111	Paste grade adhesive for general applications
	Belzona 1121	As above with extended working life for larger areas
	Belzona 1161	Surface-tolerant adhesive for oil contaminated, wet and underwater substrates
	Belzona 1212	As above and fast-curing for emergency repairs
	Belzona 1251	As above and heat-activated, cures in high temperature service
	Belzona 1511	Cold applied paste grade adhesive for high-temperature service
	Belzona 1321 Belzona 5811 Belzona 5831	Fluid grade material for injection bonding

For more information, please contact your local Belzona representative: