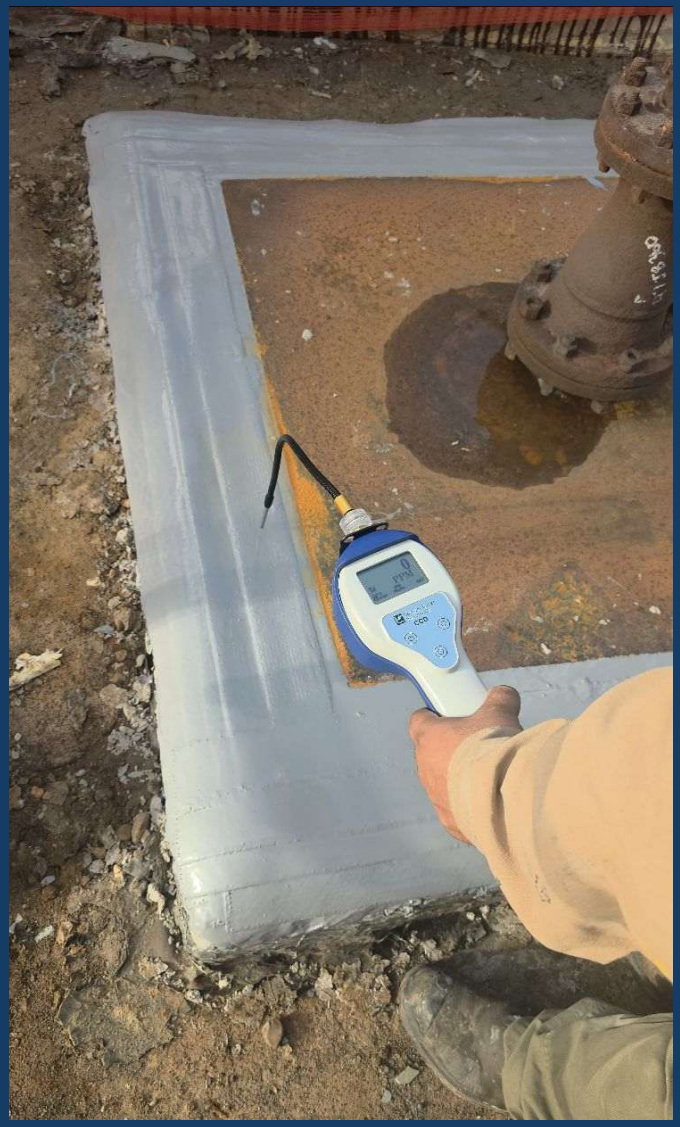
2026 A&WMA SWLA Spring Conference

Compliance-Driven VOC Emissions Sealing and Repair Using Advanced Polymer Systems

for EPA BWON and NSPS QQQ–Regulated Facilities

Bart Davis
Principle SME – Advanced Composite Repairs
BHI Coatings, LLC

We all have a common goal…



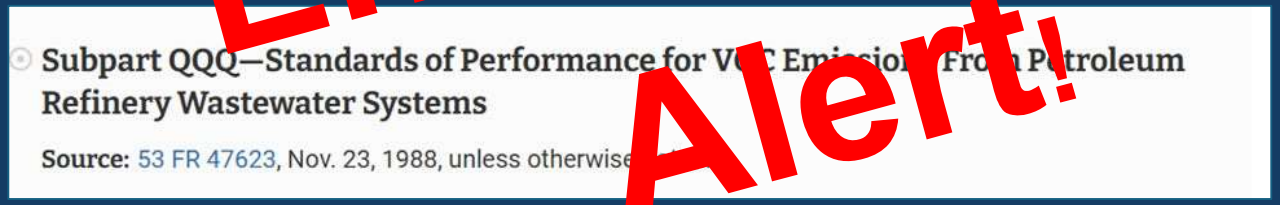

0
ppm
CCD

BWON Enforcement Alert!

Office of Civil Enforcement
Office of Enforcement and
Compliance Assurance

THIS was issued February 2024– we are enforcing - look for us at the gate.

CFR – Code of federal regulations Title 40 Chapter I Subchapter C Part 60 Subpart QQQ



Subpart QQQ—Standards of Performance for VOC Emissions From Petroleum Refinery Wastewater Systems

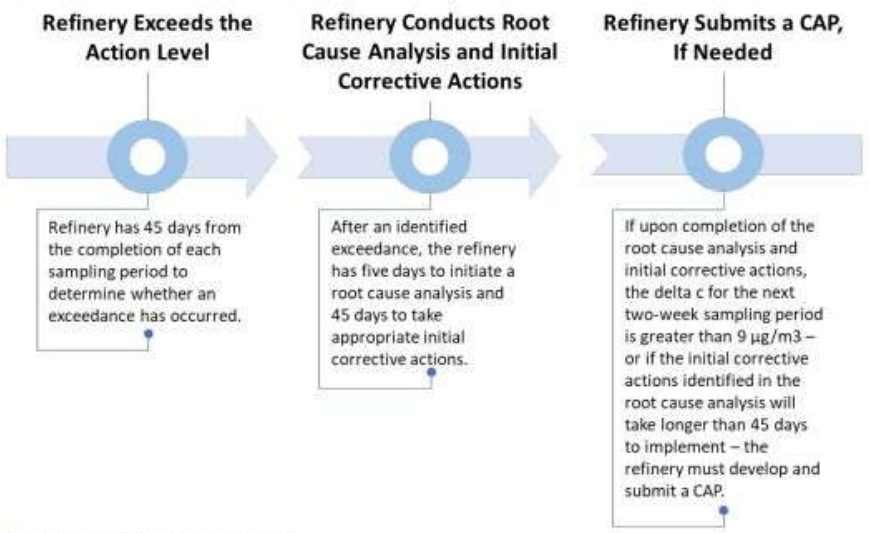
Source: 53 FR 47623, Nov. 23, 1988, unless otherwise

And while were at it. Remember we told you so……it's in the CFR

Violations at Petroleum Refineries and Ethylene Plants Cause Excess Benezene and Other VOC Emissions in Nearby Communities

Tick, tick, tick…..

Figure 4: Actions required by refineries after an exceedance of the benzene action level



Note: CAP = Corrective Action Plan.

Source: Benzene fenceline monitoring regulations in 40 C.F.R. § 63.658. (EPA OIG image)

45 days to add up your emissions, 5 Days to initiate a root cause analysis, 45 Days to take corrective actions

https://www.epa.gov/compliance/leak-detection-and-repair-best-practices-guide

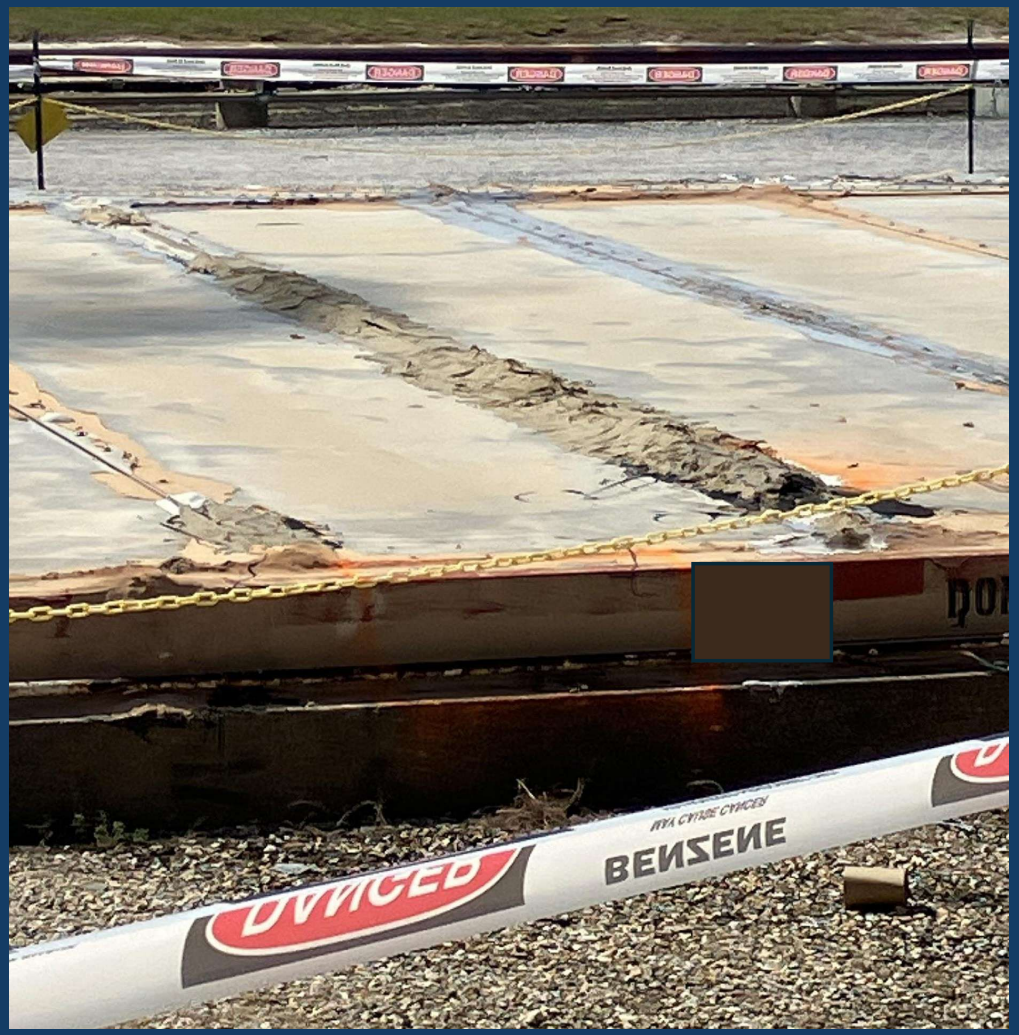
Ahhhh – everything is going to be okay;
we're implementing corrective actions…..

Corrective actions…

- Wrong product
- Wrong procedure
- Wrong people

Why do composite repairs fail?

- Wrong product
- Wrong procedure
- Wrong people



Why do composite repairs fail?

- Wrong product
- Wrong procedure
- Wrong people

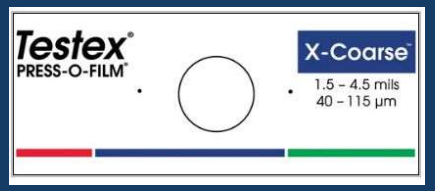
Why do sealants fail?

"It's estimated that 75% of coating failures are caused by poor surface preparation, according to a report by the Materials Analytical Group"

AMPP- Coatings Pro Magazine

- Right Prep Tools

Abrasive grit blasting remains the preferred preparation method where achievable



Vapor blasting is an eco-friendly process, as the water reduces the amount of dust and airborne contaminants, creating a safer environment for operators.

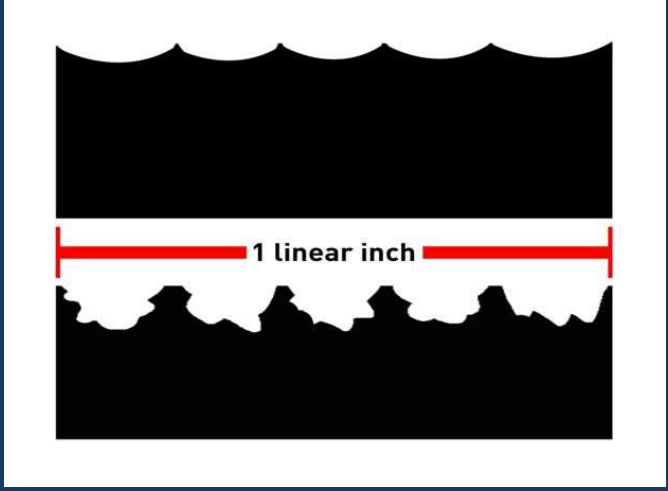
- Right Media

Emerald Blast is a magnesium silicate abrasive produced during the smelting process of ferronickel. It is characterized by its angular to sub-angular shape and a Moh's hardness of 7, making it suitable for various abrasive applications. The angular profile of the abrasive enhances coating adhesion by providing a rough surface with more surface area, which increases the connection points available for both chemical and mechanical bonding.

Abrasive grit blasting remains the preferred preparation method where achievable

Mechanical Adhesion

This is independent of the chemical nature of the material and depends on the penetration of the adhesive into the substrate.



Surface Roughness

Surface roughness leads to increased mechanical adhesion. However; if a product is not correctly formulated, i.e. too thick or sticky to apply, the increased mechanical adhesion can often be counteracted by an increase in in-built stresses due to the formation of air pockets and voids.

Belzona products are formulated such that they can easily and fully penetrate into the deepest void forcing out air and forming an intimate mechanical bond.

- Right Prep Tools


Grit Blasting Containment Area

Proper preparation of concrete is essential to successful repairs

Vapor blasting is an eco-friendly process, as the water reduces the amount of dust and airborne contaminants, creating a safer environment for operators.

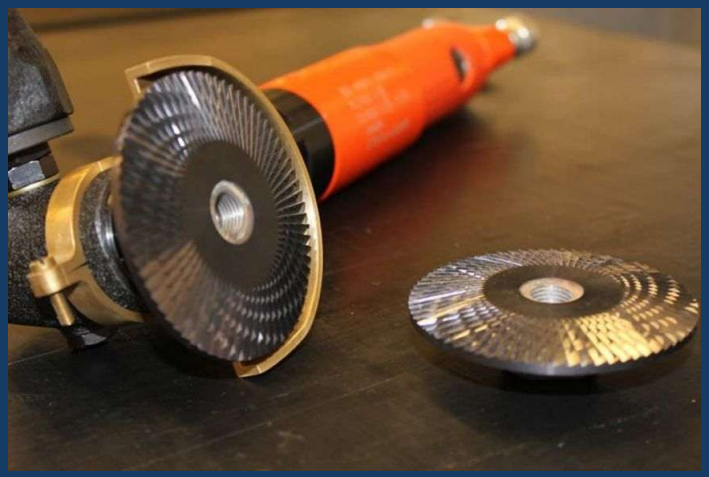
- Right Prep Tools

Diamond Grinding Concrete to remove surface laitance is a highly effective method for preparing concrete surfaces before applying Belzona. The process involves mechanically abrading the concrete to remove imperfections and create a textured finish

MontiPower's MBX Bristle Blaster power tools the alternative to 'sandblasting' for smaller areas or when regulations do not allow the use of loose abrasives.

SSPC SP-11 Power Tool Cleaning provides greater flexibility where abrasive blasting is impractical or restricted

- Right Prep Tools



Sparkless Grinder certified by DNV for use in potentially explosive and hazardous atmospheres. Classified as Cold work tools safe to use in Offshore Platforms, Refineries, Chemical Plants, and many other places where hydrocarbons are present.

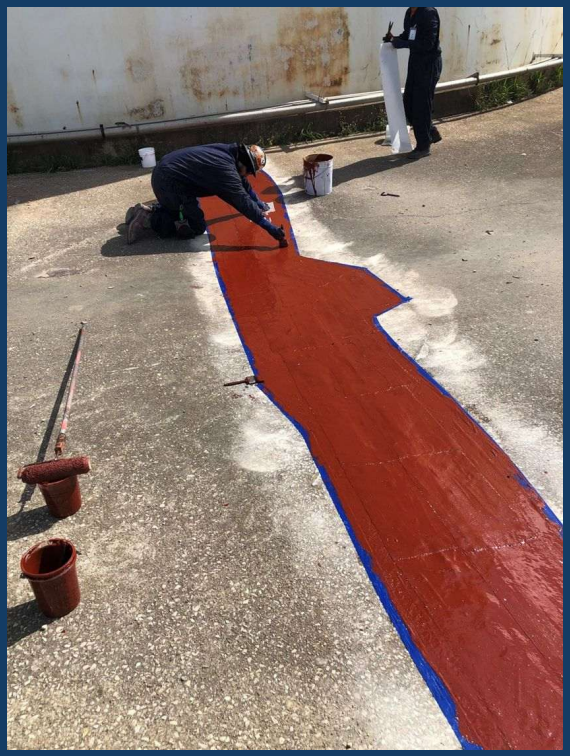
SSPC SP-11 Power Tool Cleaning

•No Hot Work

- Right Products

BELZONA®
Repair • Protect • Improve

- Right Products



Adsorption Theory

This states that the forces that hold two surfaces in contact are the same as those that cause the cohesion of all materials, i.e. Van der Waals forces, hydrogen bonding and covalent bonding.

- Right Products

- Bonding to Steel to Concrete Interface
- Steel: 5460 psi @ 212°F
- Concrete: 815 psi * @ 212°F
  *cohesive failure in concrete

(Belzona 4311 high-performance barrier coating)

- Right Products

Rebuilding Materials

For repairing, rebuilding, sealing, casting and bonding applications.

Belzona's rebuilding materials are specifically designed for repairing, rebuilding, sealing, casting and bonding applications. These products are designed to permanently repair critical machinery and equipment to provide excellent corrosion, erosion, impact and chemical resistance to maintain efficiency for the long term.

With specialist mechanical properties to best suit respective service environments, Belzona's rebuilding materials offer an effective alternative to replacing equipment or traditional repair methods which can be costly and require extensive periods of downtime.

Belzona 1111 (Super Metal) High-performance, durable epoxy composite for the repair and rebuilding of metal components. Approved for contact with drinking water (e.g. WRAS, NSF/WQA).

Belzona 1121 (Super XL-Metal) High-performance, extended working life, durable epoxy composite for the repair and rebuilding of metal components.

Belzona 1131 (Bearing Metal) High-performance, self-lubricating epoxy metal repair composite.

Belzona 1151 (Smoothing Metal) High-performance epoxy repair composite for resurfacing and smoothing shallow pitting.

Belzona 1161 (Super UW-Metal) High-performance, surface-tolerant epoxy repair composite suitable for wet and oily surfaces.

Belzona 1212 High-performance, rapid-curing, surface-tolerant epoxy repair composite suitable for wet and oily surfaces. Approved for contact with drinking water (e.g. WRAS).

Belzona 1221 (Super E-Metal) High-performance, fast-curing, multi-purpose composite for emergency repairs.

Belzona 1251 (HA-Metal) High-performance, heat-activated epoxy repair composite for applications directly onto hot metal surfaces.

Belzona 1311 (Ceramic R-Metal) Ceramic-filled erosion-corrosion-resistant epoxy metal repair composite.

Belzona 1511 (Super HT-Metal) High-temperature corrosion-resistant epoxy metal repair composite.

Belzona 1821 (Fluid Metal) Fluid epoxy resin suitable for the repair and protection of positive grip systems for equipment and walkways. Also suitable for casting applications.

Belzona 4301 (Magma CR1 Hi-Build) High chemical-resistant epoxy novolac metal repair and resurfacing composite.

Belzona 5711 High-performance, solvent-free rebuilding material for repairing damage to the leading edges of wind turbine blades.

Belzona 7111 Pourable chocking/grouting material designed to spread evenly across uneven surfaces to endure physical and thermal shock.

Belzona 7311 High-performance, fatigue-resistant structural adhesive specifically engineered for structural bonding.

Belzona 9611 Rapid-curing system for the emergency sealing of low pressure leaks, prior to a more permanent repair.

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silicon steel alloy blended with high molecular weight reactive polymers and oligomers.

Internal Stresses In Adhesive

Conventional solvented adhesive types often shrink during solidification and this can lead to micro-voids (due to evaporation of solvent) being formed in the cured product. The stresses within the adhesive often concentrate at these points with the result that the adhesive fails prematurely and at lower than predicted values.

Generally this cannot happen with Belzona products since they do not contain solvents

- Right Products

Enhanced Chemical-Resistant Systems

For protecting equipment and structures from chemical attack.

Belzona's enhanced chemical-resistant systems provide excellent resistance to a broad range of chemicals including acidic and alkaline substances.

These products adhere tenaciously to substrates such as concrete, most metals and composites, providing protection to these surfaces in aggressive conditions.

Suitable for rebuilding, coating and screeding, these high-performance systems protect structures against the consequences of chemical attack such as downtime, increased maintenance costs, and environmental and safety hazards.

Belzona 4181 (AHR Magma-Quartz)
Acid and heat-resistant epoxy concrete repair mortar.

Belzona 4301 (Magma CR1 Hi-Build)
Highly chemical-resistant epoxy novolac repair and resurfacing composite.

Belzona 4311 (Magma CR1)
Epoxy novolac barrier coating suitable for concrete and metal protection, offering high resistance to a broad range of chemicals.

Belzona 4331 (Magma CR3)
Epoxy novolac barrier coating for concrete and metal protection, offering high resistance to hot organic acids.

Belzona 4341 (Magma CR4)
Epoxy novolac barrier coating for concrete and metal protection, offering high resistance to hot inorganic acids.

Belzona 4351 (Magma CR5)
Epoxy novolac, static-dissipative barrier coating suitable for concrete and metal protection, offering high resistance to a broad range of chemicals.

Belzona 4361
Flexible chemical-resistant epoxy barrier coating suitable for concrete protection. Particularly suitable for areas subject to movement.

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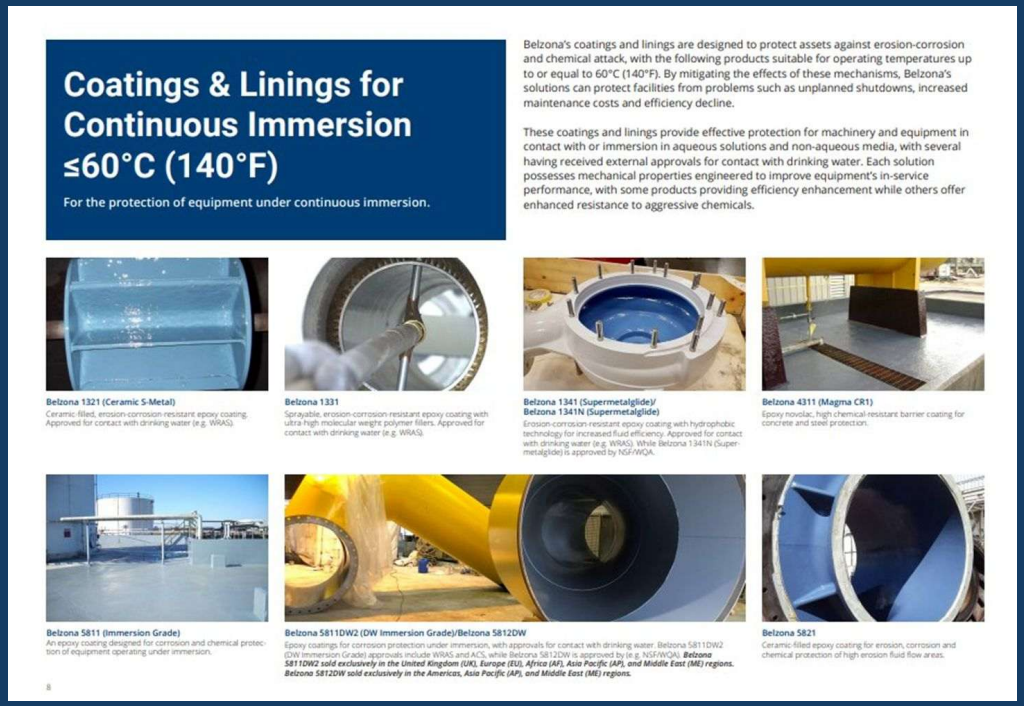
The resistance of a Belzona product to a chemical environment is dependent upon many factors, including:

- Type of Chemical
- Concentration
- Physical State
- Temperature
- Time of Immersion
- Fluid Dynamics

- Right Products



Coatings & Linings for Continuous Immersion ≤60°C (140°F)

For the protection of equipment under continuous immersion.

Belzona's coatings and linings are designed to protect assets against erosion-corrosion and chemical attack, with the following products suitable for operating temperatures up to or equal to 60°C (140°F). By mitigating the effects of these mechanisms, Belzona's solutions can protect facilities from problems such as unplanned shutdowns, increased maintenance costs and efficiency decline.

These coatings and linings provide effective protection for machinery and equipment in contact with or immersion in aqueous solutions and non-aqueous media, with several having received external approvals for contact with drinking water. Each solution possesses mechanical properties engineered to improve equipment's in-service performance, with some products providing efficiency enhancement while others offer enhanced resistance to aggressive chemicals.

Belzona 1321 (Ceramic S-Metal)
Ceramic-filled, erosion-corrosion-resistant epoxy coating. Approved for contact with drinking water (e.g. WRAS).

Belzona 1331
Sprayable, erosion-corrosion-resistant epoxy coating with ultra-high molecular weight polymer fillers. Approved for contact with drinking water (e.g. WRAS).

Belzona 1341 (Supermetalglide)/ Belzona 1341N (Supermetalglide)
Erosion-corrosion-resistant epoxy coating with hydrophobic technology for increased fluid efficiency. Approved for contact with drinking water (e.g. WRAS). While Belzona 1341N (Supermetalglide) is approved by NSF/WQA.

Belzona 4311 (Magma CR1)
Epoxy novolac, high chemical-resistant barrier coating for concrete and steel protection.

Belzona 5811 (Immersion Grade)
An epoxy coating designed for corrosion and chemical protection of equipment operating under immersion.

Belzona 5811DW2 (DW Immersion Grade)/Belzona 5812DW
Epoxy coatings for corrosion protection under immersion, with approvals for contact with drinking water. Belzona 5811DW2 (DW Immersion Grade) approvals include WRAS and ACS, while Belzona 5812DW is approved by (e.g. NSF/WQA). ***Belzona 5811DW2 sold exclusively in the United Kingdom (UK), Europe (EU), Africa (AF), Asia Pacific (AP), and Middle East (ME) regions. Belzona 5812DW sold exclusively in the Americas, Asia Pacific (AP), and Middle East (ME) regions.***

Belzona 5821
Ceramic-filled epoxy coating for erosion, corrosion and chemical protection of high erosion fluid flow areas.

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In terms of chemical attack, when considering the physical state of a material, we are primarily concerned with the mobility and concentration of molecules.

Liquids can be extremely aggressive because the molecules of concern are both mobile and highly concentrated; they are free to move yet still closely grouped.

Gases, although extremely mobile do not have a concentrated molecule arrangement. As such, gases are generally not aggressive unless under pressure or in a very wet atmosphere.

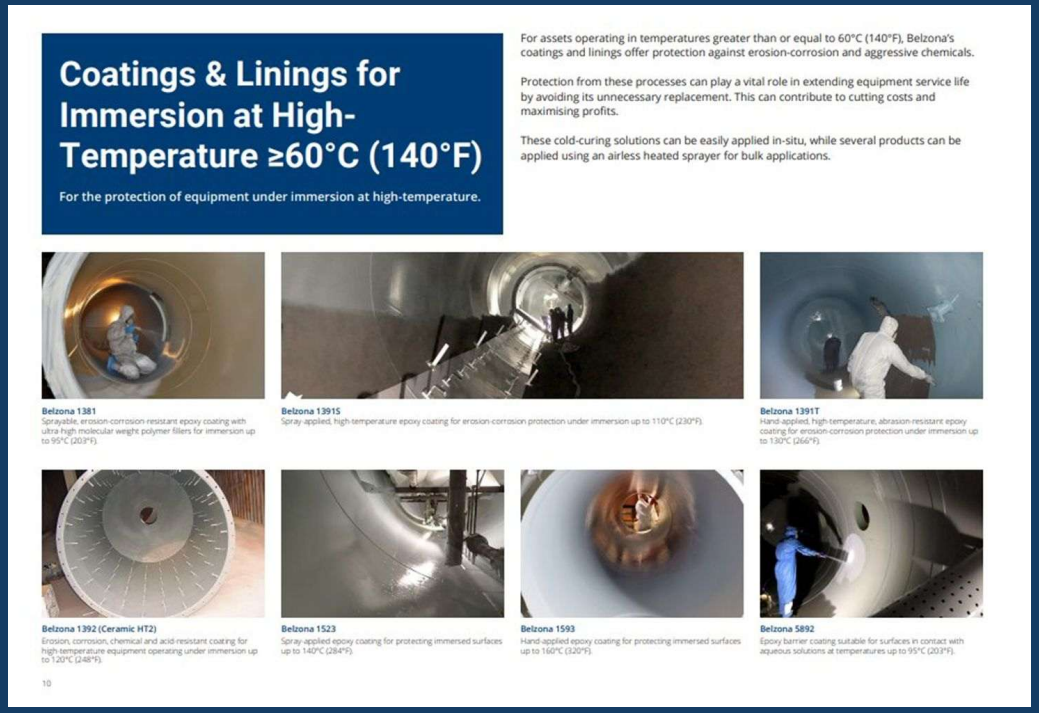
- Right Products

Crosslinking of epoxies is a crucial process that enhances their chemical resistance. It involves the chemical binding of polymers to each other, improving physical and chemical properties.

The crosslinking agent, such as epoxy crosslinkers, binds the epoxy group with the functional group of the target polymer, creating a strong bond.

The choice of crosslinker is vital, as it influences the properties of the final product, including hardness, flexibility, and chemical resistance.

- Right Products



Coatings & Linings for Immersion at High-Temperature ≥60°C (140°F)

For the protection of equipment under immersion at high-temperature.

For assets operating in temperatures greater than or equal to 60°C (140°F), Belzona's coatings and linings offer protection against erosion-corrosion and aggressive chemicals.

Protection from these processes can play a vital role in extending equipment service life by avoiding its unnecessary replacement. This can contribute to cutting costs and maximising profits.

These cold-curing solutions can be easily applied in-situ, while several products can be applied using an airless heated sprayer for bulk applications.

Belzona 1381
Sprayable, erosion-corrosion-resistant epoxy coating with ultra-high molecular weight polymer fillers for immersion up to 95°C (203°F).

Belzona 1391S
Spray-applied, high-temperature epoxy coating for erosion-corrosion protection under immersion up to 110°C (230°F).

Belzona 1391T
Hand-applied, high-temperature, abrasion-resistant epoxy coating for erosion-corrosion protection under immersion up to 130°C (266°F).

Belzona 1392 (Ceramic HT2)
Erosion, corrosion, chemical and acid-resistant coating for high-temperature equipment operating under immersion up to 120°C (248°F).

Belzona 1523
Spray-applied epoxy coating for protecting immersed surfaces up to 140°C (284°F).

Belzona 1593
Hand-applied epoxy coating for protecting immersed surfaces up to 160°C (320°F).

Belzona 5892
Epoxy barrier coating suitable for surfaces in contact with aqueous solutions at temperatures up to 95°C (203°F).

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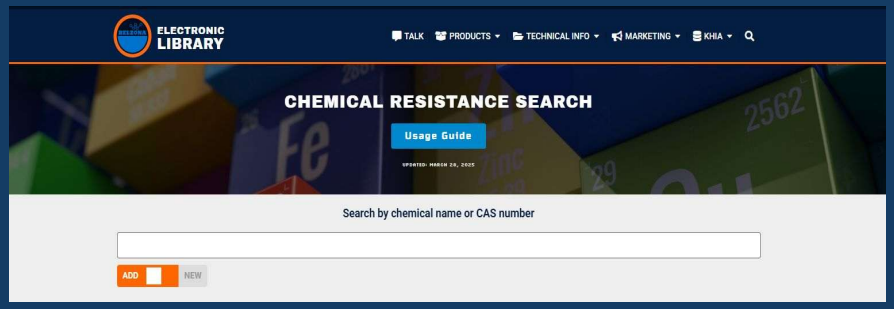
Temperature is a very important factor, as in general, the higher the temperature, the more aggressive the chemical.

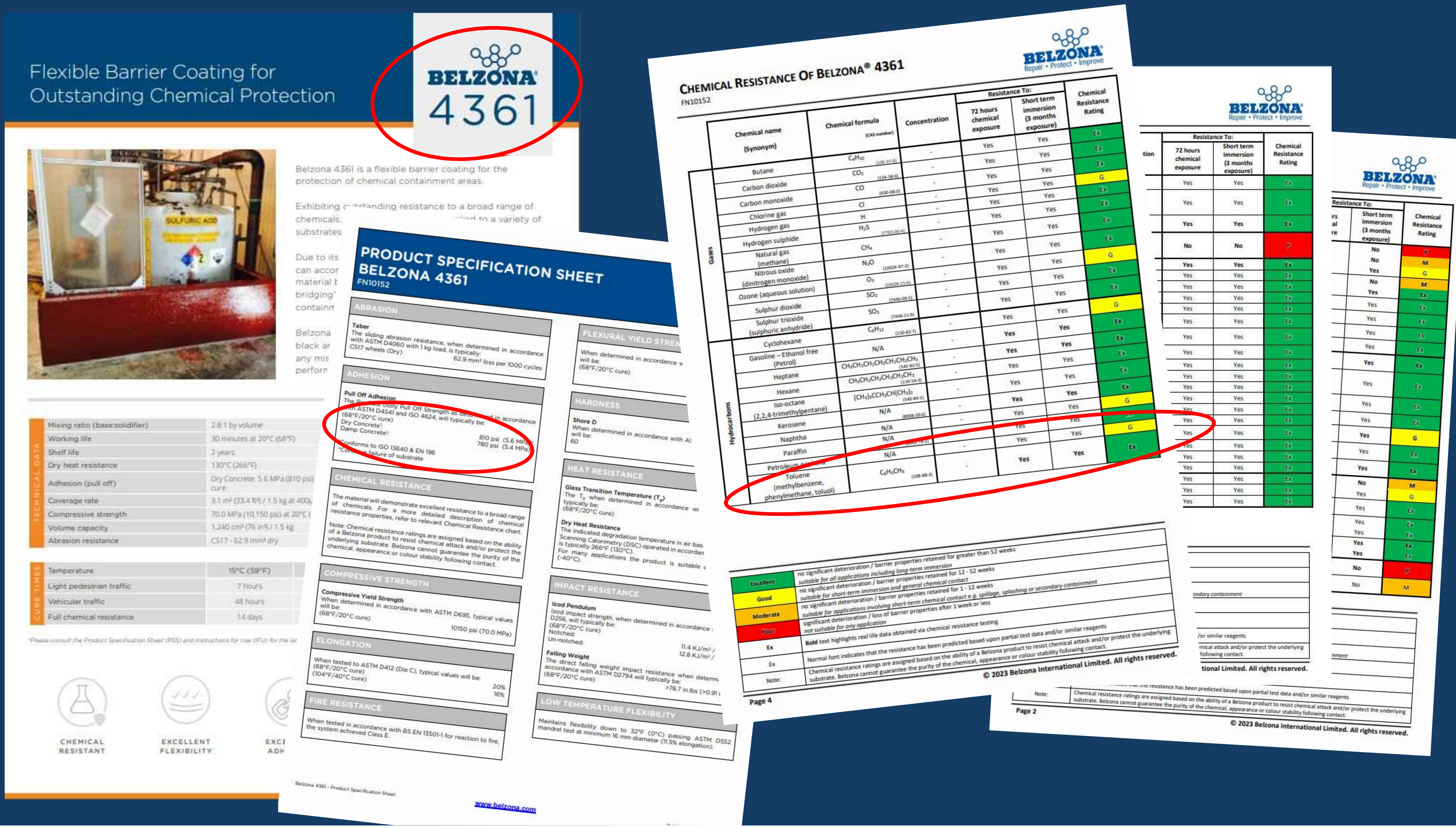
With increased temperature, the molecules/particles within the reagent become more mobile and hence, more aggressive.

To increase chemical resistance many Belzona products can be Post-Cured to enhance cross-linking.

BELZONA®
Repair • Protect • Improve



Excellent (Ex)	no significant deterioration / barrier properties retained for greater than 52 weeks suitable for all applications including long term immersion
Good (G)	no significant deterioration / barrier properties retained for 12 - 52 weeks suitable for short-term immersion and general chemical contact
Moderate (M)	no significant deterioration / barrier properties retained for 1 - 12 weeks suitable for applications involving short term chemical contact e.g. spillage, splashing or secondary containment
Poor (P)	significant deterioration / loss of barrier properties after 1 week or less not suitable for any application


Flexible Barrier Coating for Outstanding Chemical Protection
BELZONA 4361
Belzona 4361 is a flexible barrier coating for the protection of chemical containment areas.
SULFURIC ACID
Mixing ratio (base:solidifier) | 2.8:1 by volume
Working life | 30 minutes at 20°C (68°F)
Shelf life | 2 years
Dry heat resistance | 130°C (266°F)
Adhesion (pull off) | Dry Concrete: 5.6 MPa (810 psi)
Coverage rate | 3.1 m² (33.4 ft²) / 1.5 kg
Compressive strength | 70.0 MPa (10,150 psi) at 20°C
Volume capacity | 1,240 cm³ (76 in³) / 1.5 kg
Abrasion resistance | CS17 - 62.9 mm³ dry
Temperature | 15°C (59°F)
Light pedestrian traffic | 7 hours
Vehicular traffic | 48 hours
Full chemical resistance | 14 days
CHEMICAL RESISTANT
EXCELLENT FLEXIBILITY
PRODUCT SPECIFICATION SHEET
BELZONA 4361
FN10152
ABRASION
Taber
The sliding abrasion resistance, when determined in accordance with ASTM D4060 with 1 kg load, is typically: CS17 wheels (Dry) 62.9 mm³ loss per 1000 cycles
ADHESION
Pull Off Adhesion
(68°F/20°C cure)
Dry Concrete: 810 psi (5.6 MPa)
Damp Concrete: 780 psi (5.4 MPa)
Conforms to ISO 13640 & EN 196
CHEMICAL RESISTANCE
The material will demonstrate excellent resistance to a broad range of chemicals. For a more detailed description of chemical resistance properties, refer to relevant Chemical Resistance chart.
Note: Chemical resistance ratings are assigned based on the ability of a Belzona product to resist chemical attack and/or protect the underlying substrate. Belzona cannot guarantee the purity of the chemical, appearance or colour stability following contact.
COMPRESSIVE STRENGTH
Compressive Yield Strength
When determined in accordance with ASTM D695, typical values will be: (68°F/20°C cure) 10150 psi (70.0 MPa)
ELONGATION
When tested to ASTM D412 (Die C), typical values will be: (68°F/20°C cure) 20% (104°F/40°C cure) 16%
FIRE RESISTANCE
When tested in accordance with BS EN 13501-1 for reaction to fire, the system achieved Class E.
HARDNESS
Shore D 60
HEAT RESISTANCE
Dry Heat Resistance: typically 266°F (130°C)
IMPACT RESISTANCE
Izod Pendulum Notched: 11.4 KJ/m² Un-notched: 12.8 KJ/m²
Falling Weight >78.7 in.lbs
LOW TEMPERATURE FLEXIBILITY
Maintains flexibility down to 32°F (0°C) passing ASTM D552 mandrel test at minimum 16 mm diameter (11.5% elongation).
Belzona 4361 - Product Specification Sheet
www.belzona.com
CHEMICAL RESISTANCE OF BELZONA® 4361
FN10152
BELZONA Repair • Protect • Improve
Gases: Butane, Carbon dioxide, Carbon monoxide, Chlorine gas, Hydrogen gas, Hydrogen sulphide, Natural gas (methane), Nitrous oxide (dinitrogen monoxide), Ozone (aqueous solution), Sulphur dioxide, Sulphur trioxide (sulphuric anhydride)
Hydrocarbons: Cyclohexane, Gasoline – Ethanol free (Petrol), Heptane, Hexane, Iso-octane (2,2,4-trimethylpentane), Kerosene, Naphtha, Paraffin, Petroleum naphtha, Toluene (methylbenzene, phenylmethane, toluol)
Excellent: no significant deterioration / barrier properties retained for greater than 52 weeks; suitable for all applications including long-term immersion
Good: no significant deterioration / barrier properties retained for 12 - 52 weeks; suitable for short-term immersion and general chemical contact
Moderate: no significant deterioration / barrier properties retained for 1 - 12 weeks; suitable for applications involving short-term chemical contact e.g. spillage, splashing or secondary containment
Poor: significant deterioration / loss of barrier properties after 1 week or less; not suitable for any application
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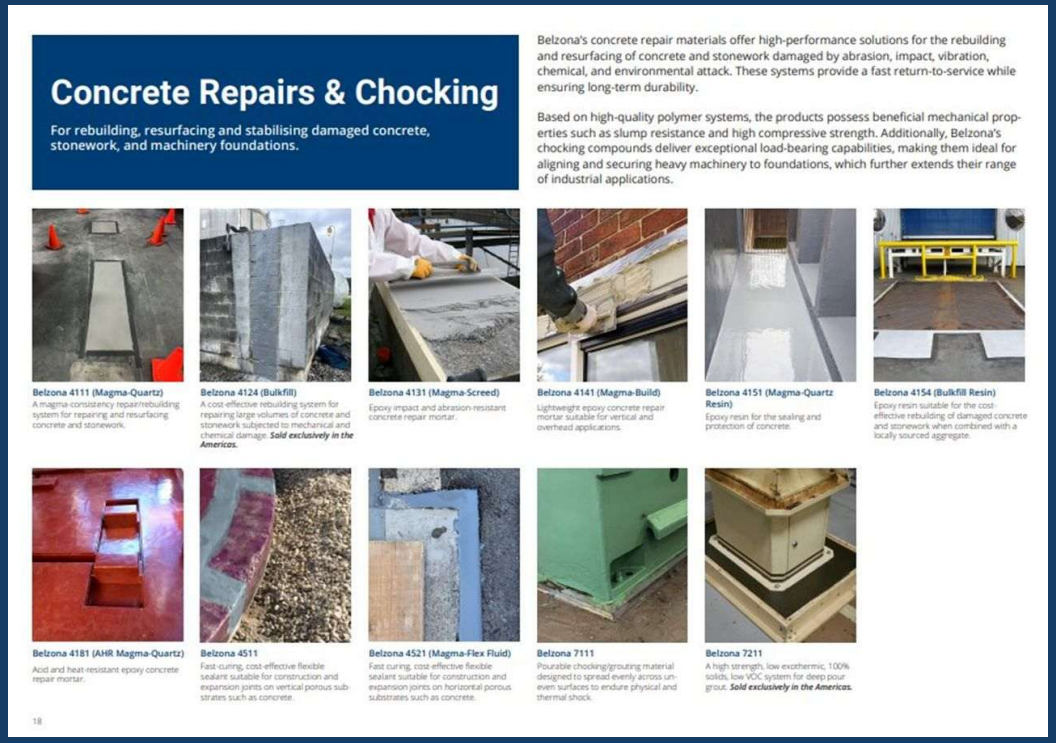
- Right Products



Concrete Repairs & Chocking

For rebuilding, resurfacing and stabilising damaged concrete, stonework, and machinery foundations.

Belzona's concrete repair materials offer high-performance solutions for the rebuilding and resurfacing of concrete and stonework damaged by abrasion, impact, vibration, chemical, and environmental attack. These systems provide a fast return-to-service while ensuring long-term durability.

Based on high-quality polymer systems, the products possess beneficial mechanical properties such as slump resistance and high compressive strength. Additionally, Belzona's chocking compounds deliver exceptional load-bearing capabilities, making them ideal for aligning and securing heavy machinery to foundations, which further extends their range of industrial applications.

Belzona 4111 (Magma-Quartz)
A magma-consistency repair/rebuilding system for repairing and resurfacing concrete and stonework.

Belzona 4124 (Bulkfill)
A cost-effective rebuilding system for repairing large volumes of concrete and stonework subjected to mechanical and chemical damage. ***Sold exclusively in the Americas.***

Belzona 4131 (Magma-Screed)
Epoxy impact and abrasion-resistant concrete repair mortar.

Belzona 4141 (Magma-Build)
Lightweight epoxy concrete repair mortar suitable for vertical and overhead applications.

Belzona 4151 (Magma-Quartz Resin)
Epoxy resin for the sealing and protection of concrete.

Belzona 4154 (Bulkfill Resin)
Epoxy resin suitable for the cost-effective rebuilding of damaged concrete and stonework when combined with a locally sourced aggregate.

Belzona 4181 (AHR Magma-Quartz)
Acid and heat-resistant epoxy concrete repair mortar.

Belzona 4511
Fast-curing, cost-effective flexible sealant suitable for construction and expansion joints on vertical porous substrates such as concrete.

Belzona 4521 (Magma-Flex Fluid)
Fast curing, cost-effective flexible sealant suitable for construction and expansion joints on horizontal porous substrates such as concrete.

Belzona 7111
Pourable chocking/grouting material designed to spread evenly across uneven surfaces to endure physical and thermal shock.

Belzona 7211
A high strength, low exothermic, 100% solids, low VOC system for deep pour grout. ***Sold exclusively in the Americas.***

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Concrete Rebuilding with Belzona epoxy mortar systems prior to sealing the asset with Belzona reinforced flexible sealants and coatings.

- Right Products

Elastomeric Materials

For rebuilding, coating and sealing applications requiring a degree of flexibility.

Belzona's 2000 Series elastomeric polymers provide excellent resistance to wear, abrasion and atmospheric degradation where elasticity, extensibility, mechanical strength and tear resistance are required. These properties are vital to the repair of assets such as expansion joints, conveyor belts, floating hoses and numerous applications where flexibility is paramount.

This versatile series of polyurethane products provides options for rebuilding, coating and casting applications. Unlike most rubber maintenance processes such as vulcanisation, these solutions can be applied without hot work, which is vital for application onto rubber surfaces. Meanwhile they can also adhere to almost any substrate including metals and cementitious materials.

Belzona 2111 (D&A Hi-Build Elastomer)
Flexible rebuilding-grade abrasion-resistant polyurethane elastomer, suitable for repairing damaged rubber and metal surfaces.

Belzona 2131 (D&A Fluid Elastomer)
Flexible, pourable abrasion-resistant polyurethane elastomer suitable for casting applications.

Belzona 2141 (ACR-Fluid Elastomer for Immersed Service)
Flexible abrasion and cavitation-resistant polyurethane elastomer suitable for coating applications on rubber and metal components.

Belzona 2211 (MP Hi-Build)
Flexible, multi-purpose rebuilding-grade polyurethane elastomer suitable for repair applications on rubber and metal components.

Belzona 2221 (MP Fluid Elastomer)
Flexible, pourable, multi-purpose casting-grade polyurethane elastomer suitable for casting applications.

Belzona 2311 (SR Elastomer)
Rapid-curing, flexible, multi-purpose rebuilding-grade polyurethane elastomer, suitable for repair and coating applications on rubber and metal components.

Flexible Elastomeric products from Belzona are used to protect repairs from movement and can bond to PE, PP, steel and concrete.

ASME PCC2 Compliant Repairs to process equipment accepted by API 570, 653, 510 with documentation to satisfy M.O.C. in PSM programs.

Belzona SuperWrap II

ISO/ASME compliant composite repair solution for restoring strength to pipes and tank walls.

Belzona SuperWrap II is a superior maintenance solution for restoring the strength of pipes and tank walls. The system consists of a bespoke hybrid reinforcement sheet, a release film to compact and consolidate the application, and a fluid-grade resin system available in four grades for different service temperatures (listed below).

The system can be designed and applied in accordance with ISO 24817 and ASME PCC-2 standards and applied by trained and validated personnel. Specifically developed for service in safety-critical and high-pressure environments, and suitable for bonding to complex pipe geometries, repairs can ensure maintenance-free service for up to 20 years.

Belzona 1981
Low-temperature resin for application temperatures of 5°C (41°F) - 20°C (68°F) and operating temperatures up to 60°C (140°F).

Belzona 1982
Extended working life resin for application temperatures of 20°C (68°F) - 40°C (104°F) and operating temperatures up to 80°C (176°F).

Belzona 1983
High-temperature resin for application temperatures of 5°C (41°F) - 40°C (104°F) and operating temperatures up to 150°C (302°F).

Belzona 1984
Surface tolerant resin for service temperatures up to 50 °C (122 °F) and suitable for minimum application temperature of 5 °C (41 °F).

SuperWrap II Selection Guide	Belzona 1981	Belzona 1982	Belzona 1983	Belzona 1984
ASME PCC2/ISO 24817 compliant repair	•	•	•	•
Compliant on grit blasted surface	•	•	•	
Compliant on SSPC-SP11 prepared surfaces	•	•		•
Compliant on mild steel	•	•	•	•
Compliant on stainless steel	•	•		
Applicable for patch repairs	•	•	•	•
Designed for applications in colder climates	•			•
Extended working life for applications in higher ambient temperatures		•		•
For assets operating in high-temperature service			•	
Designed to be applied directly to damp, wet and underwater surfaces				•
Maximum temperature service for compliance	60°C (140°F)	80°C (176°F)	150°C (302°F)	50°C (122°F)

*All properties are to be used as a guide only. Please check the IFU and PSS for specific information.

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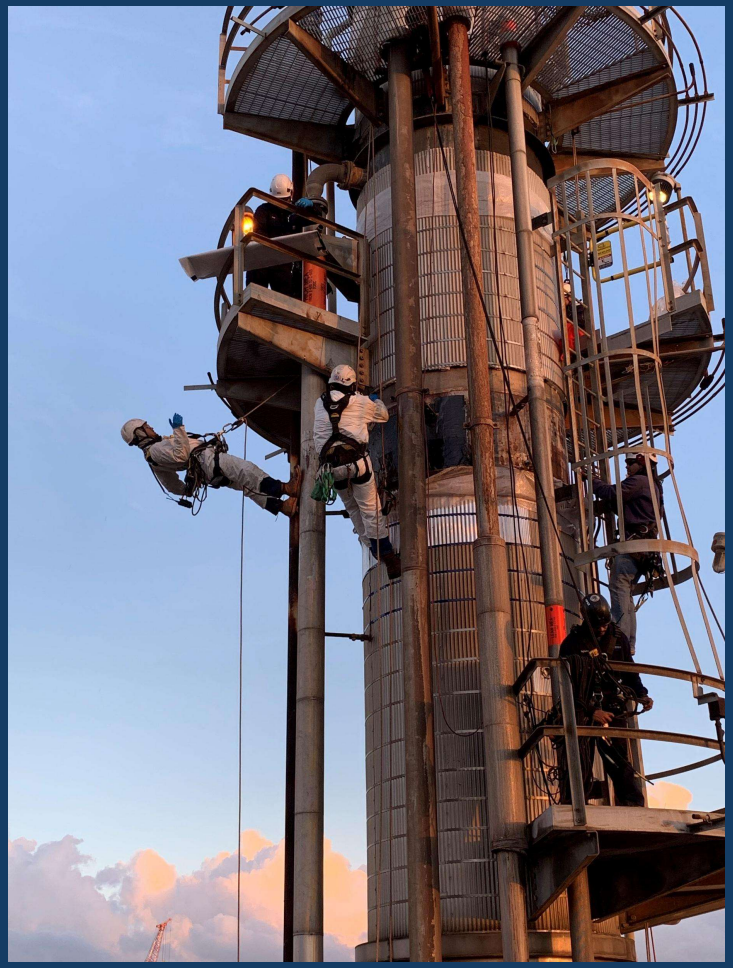


Procedures

- Surface preparation
- Composite approach - multiple products and reinforcements
- Step by step graphic instructions with hold points
- Quality Assurance / Quality Control documentation
- Inspection & Test Plan

Failed Sump Seal

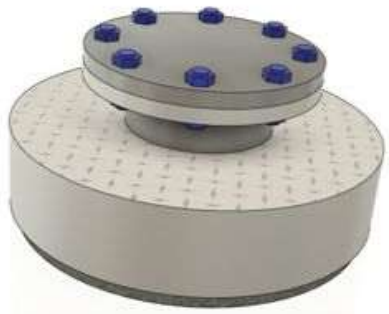
JOB SCOPE

Job Scope
Belzona Houston is recommending a reinforced epoxy composite wrap to strengthen the defective areas.

Application Information	
Gap Fill Material 100% Solids Epoxy Putty	**Materials Used** Belzona 1121
Leak Seal Composite 100% Solids Epoxy Cross Woven Polyester Cloth	**Materials Used** Belzona 7311 Belzona 9341
UV Top Coat Membrane Epoxy-Urethane Hybrid	**Materials Used** Belzona 3121

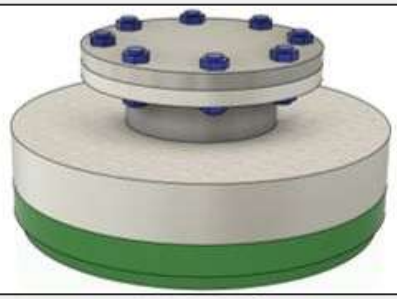
Specifications		
Repair Component	**Value**	**Purpose**
GAP FILL MATERIAL	Belzona 1121	Rebuilding Metal Loss
MATRIX PASTE	Belzona 7311	Structural Adhesive Paste for Composite
REINFORCING CLOTH	Belzona 9341	Increased Tensile Strength
NUMBER OF LAYERS	1	Strength
TOP COAT	Belzona 3121	UV Resistance
APPROVED SURFACE CLEANLINESS FOR STEEL	SSPC-SP 10 Abrasive Blasting SSPC-SP 11 – Power Tool Cleaning	Quality and Control
APPROVED ANCHOR PROFILE FOR STEEL	3 mil – SP 10 1 mil – SP 11	Quality and Control

WORK PROCEDURE



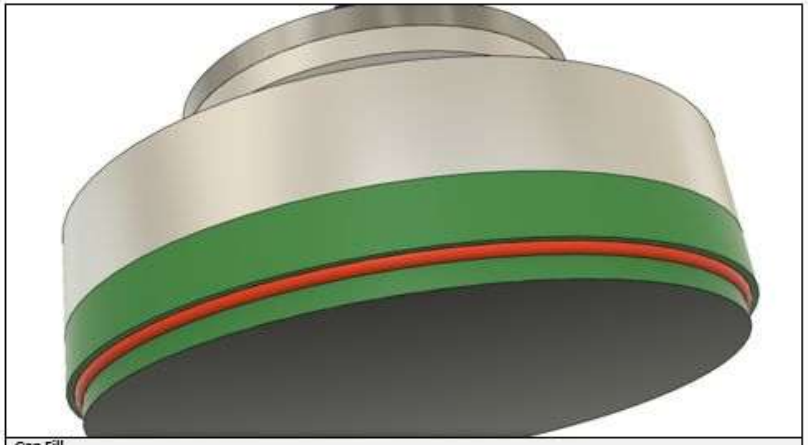
Defective Asset

- Locate critical defect
- Mark off defective corroded area
- Mask off repair area



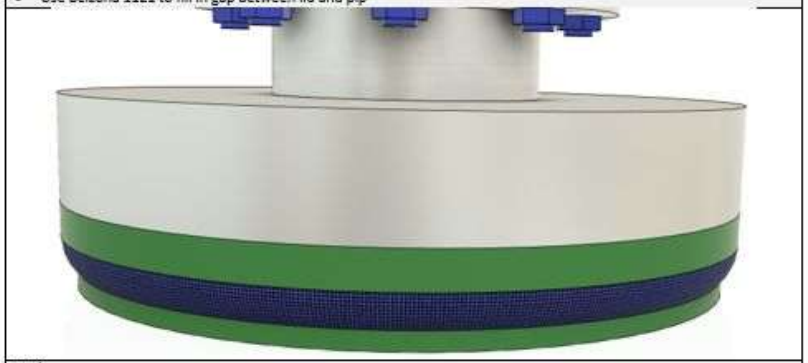
Surface Preparation

- Degrease and clean repair area
- Remove existing failed repair
- Achieve specified surface cleanliness level and anchor profile as per approved methods seen on page 3



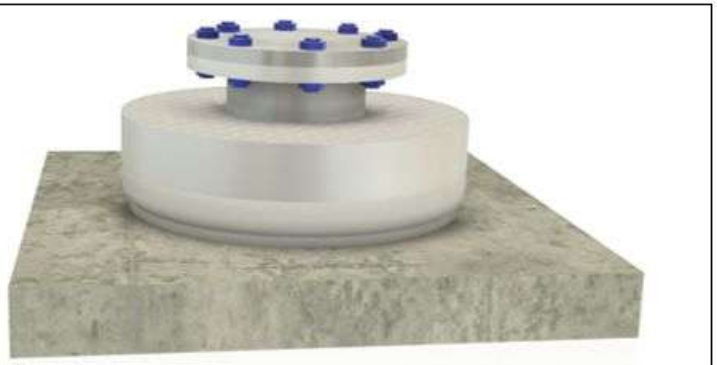
Gap Fill

- Use Belzona 1121 to fill in gap between lid and pip



Seal

- Use Belzona 7311 combined with Belzona 9341 to cove and seal lid/pipe interface.
- Extend 3 inches above and below seal.



UV Top Coat

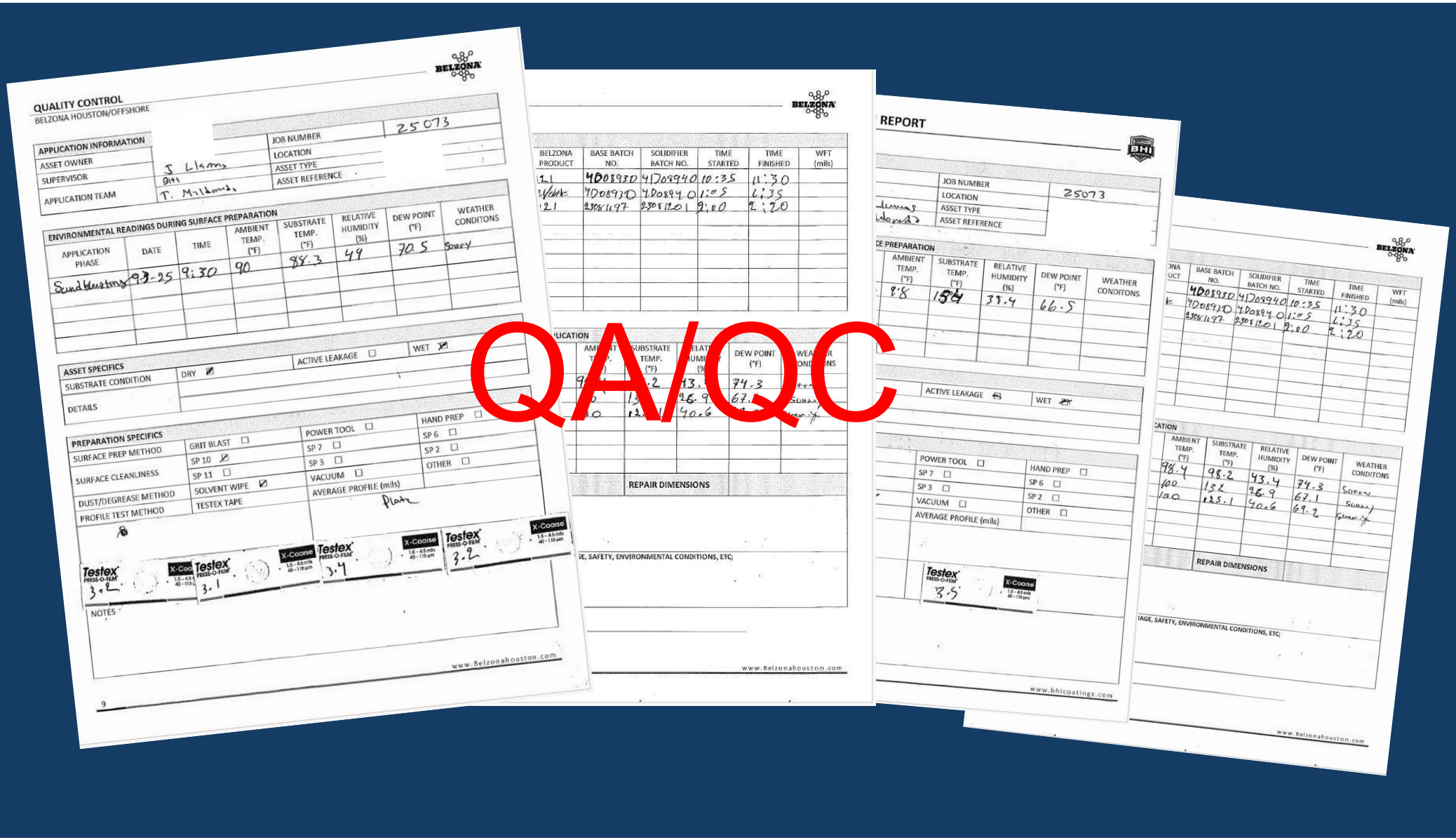
- Use Belzona 3121 to cover repair area with a UV stable membrane

Oringal Sump

Chamfer with Belzona 1121

Belzona 7311/9341 Compsite

Belzona 3121 Top Coat


QUALITY CONTROL
BELZONA HOUSTON/OFFSHORE
APPLICATION INFORMATION
ASSET OWNER
SUPERVISOR
APPLICATION TEAM
JOB NUMBER
LOCATION
ASSET TYPE
ASSET REFERENCE
25073
ENVIRONMENTAL READINGS DURING SURFACE PREPARATION
APPLICATION PHASE
DATE
TIME
AMBIENT TEMP. (°F)
SUBSTRATE TEMP. (°F)
RELATIVE HUMIDITY (%)
DEW POINT (°F)
WEATHER CONDITIONS
ASSET SPECIFICS
SUBSTRATE CONDITION
DRY
ACTIVE LEAKAGE
WET
DETAILS
PREPARATION SPECIFICS
SURFACE PREP METHOD
GRIT BLAST
SURFACE CLEANLINESS
SP 10
SP 11
DUST/DEGREASE METHOD
SOLVENT WIPE
PROFILE TEST METHOD
TESTEX TAPE
POWER TOOL
SP 7
SP 3
VACUUM
AVERAGE PROFILE (mils)
HAND PREP
SP 6
SP 2
OTHER
Testex
X-Coarse
NOTES
www.Belzonahouston.com
BELZONA PRODUCT
BASE BATCH NO.
SOLIDIFIER BATCH NO.
TIME STARTED
TIME FINISHED
WFT (mils)
REPAIR DIMENSIONS
www.Belzonahouston.com
REPORT
JOB NUMBER
LOCATION
ASSET TYPE
ASSET REFERENCE
25073
www.bhicoatings.com
BELZONA
AMBIENT TEMP. (°F)
SUBSTRATE TEMP. (°F)
RELATIVE HUMIDITY (%)
DEW POINT (°F)
WEATHER CONDITIONS
REPAIR DIMENSIONS
www.Belzonahouston.com

QA/QC

Floating Roof Leaks

Specification

Application Information	
Leak Sealing Material	**Materials Used**
Rapid Cure Epoxy Stick	Belzona 9611
Rapid Cure Surface Tolerant Epoxy	Belzona 1212
Fatigue Resistant Adhesive	**Materials Used**
100% Solids Epoxy Hybrid Resin	Belzona 7311
Structural Composite	**Materials Used**
100% Solids Epoxy Resin	Belzona 1982
Fiberglass Reinforcing Mesh	Belzona 9381
Flexible Barrier	**Materials Used**
100% Solids Fluid Grade High Elongation Epoxy	Belzona 5815
UV Top Coat	**Materials Used**
2 part Modified Aliphatic Urethane	Belzona 5111

Specifications		
Repair Component	**Value**	**Purpose**
LEAK SEAL STICK	Belzona 9611	• Leak Sealing • Though Wall Bridging
LEAK REBUILD COMPOUND	Belzona 1212	• Additional Leak Seal • Rebuild of Metal in Defective Area
PASTE REINFORCING MESH	Belzona 9341	• Tensile Strength • Pressure Retention
FATIGUE RESISTANCE COMPOUND	Belzona 7311	• Long Term Adhesion • Load Transfer to Composite
RESIN	Belzona 1982	• Wetting out Reinforcement • Composite Mechanics
FLUID REINFORCING CLOTH	Belzona 9371	• Tensile Strength • Pressure Retention
FLEXIBLE BARRIER	Belzona 5815	• Enhanced Flexibility
UV TOPCOAT	Belzona 5111	• UV Resistance
SURFACE CLEANLINESS	SSPC-SP 10	Quality and Control
ANCHOR PROFILE	3 mil	Quality and Control

Belzona Fatigue Resistant Adhesive Written Procedures

JOB SCOPE COMPOSITE REPAIR

Job Scope

Belzona Houston is recommending a composite patch in conjunction with a fatigue resistant bond layer and flexible top coat to provide pressure retention, strength and long-term bonding over the weakened defective areas.

Application Details	
Job Reference	Floating Roof Top Repair
Date	7/21/2024
Company	

Asset Details	
Location	Baytown
Asset Reference / Identification	Tank 905
Substrate Material	Carbon Steel
Asset Contents	Oil Slop
Surface Cleanliness	SSPC-SP 10 (Abrasive Bla

Asset Data	Value
External Diameter	120
Original Wall Thickness	0.375
Minimum Remaining Wall Thickness	0
Max Operating Temperature	140

Defective Area Details	
Type of Defect	Through Wall
Hole Dimensions	1" Diameter Circular D
Total Defective Area	TBD
Damage Source	Corrosion
Damage Origin	External

Conditions During Repair	Value
Substrate Temperature	120
Ambient Temperature	90

3

JOB SCOPE

Specification

Application Information

Leak Sealing Material
Rapid Cure Epoxy Stick
Rapid Cure Surface Tolerant Epoxy

Fatigue Resistant Adhesive
100% Solids Epoxy Hybrid
Resin

Structural Composite
100% Solids Epoxy Resin
Fiberglass Reinforcing Mesh

Flexible Barrier
100% Solids Fluid Grade High Elongation Epoxy

UV Top Coat
2 part Modified Aliphatic Urethane

Specifications

Repair Component	Value
LEAK SEAL STICK	Belzona 9611
LEAK REBUILD COMPOUND	Belzona 1212
PASTE REINFORCING MESH	Belzona 9341
FATIGUE RESISTANCE COMPOUND	Belzona 7311
RESIN	Belzona 1982
FLUID REINFORCING CLOTH	Belzona 9371
FLEXIBLE BARRIER	Belzona 5815
UV TOPCOAT	Belzona 5111
SURFACE CLEANLINESS	SSPC-SP 10
ANCHOR PROFILE	3 mil

4

WORK PROCEDURE

Material Properties

LEAK SEAL MATERIAL

Mechanical/Chemical Property	Testing Standard
Tensile Shear Adhesion onto SP-11 Prepared Surface (Clean and Dry)	ASTM D1002
Tensile Shear Adhesion onto SP-11 Prepared Surface (Oil Contaminated)	ASTM D1002
Pull Off Adhesion onto SP-11 Prepared Surface (Clean and Dry)	ASTM D4541
Flexural Strength onto SP-11 Prepared Surface (Oil Contaminated)	ASTM D4541
Tensile Strength (Yield)	ASTM D638
Flexural Strength (Yield)	ASTM D790
Chemical Resistance	Testing via ISO 2812 demonstrates excellent versus a v... excellent rating versus asset contents due to chemical ...
Property Distinctiveness	Due to rapid cure and surface preparation tolerance, B... active leakage repairs on less-than-ideal repair substrat...

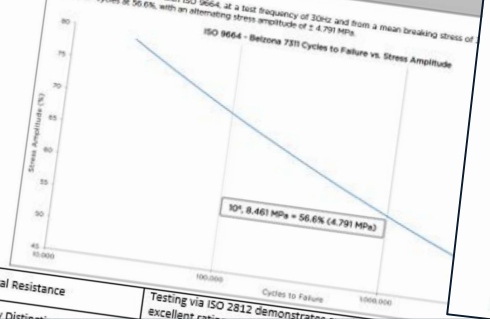
FATIGUE RESISTANT MATERIAL

Mechanical/Chemical Property	Testing Standard
Tensile Shear Adhesion onto SP-10 Prepared Surface (140 °F Cure and Test)	ASTM D1002
Pull Off Adhesion onto SP-10 Prepared Surface (140 °F Cure and Test)	ASTM D4541
Tensile Strength (140 °F Cure and Test)	ASTM D638
Elongation (140 °F Cure and Test)	ASTM D638
Shear Strength (140 °F Cure and Test)	ASTM D5379
Shear Modulus (140 °F Cure and Test)	ASTM D5379
Flexural Strength (140 °F Cure and Test)	ASTM D790

FATIGUE RESISTANCE

Tensile Shear
When tested in accordance with ISO 9664, at a test frequency of 30Hz and from a mean breaking stress of ... survive 10^6 cycles at 56.6%, with an alternating stress amplitude of ± 4.791 MPa.

ISO 9664 - Belzona 7311 Cycles to Failure vs. Stress Amplitude



Chemical Resistance	Testing via ISO 2812 demonstrates...
Property Distinctiveness	excellent rating...

WORK PROCEDURE COMPOSITE REPAIR

STRUCTURAL LOADING COMPOSITE

Mechanical/Chemical Property	Testing Standard	Belzona 1982/9381
Tensile Shear Adhesion onto SP-10 Prepared Surface (176 °F Cure and Test)	ASTM D1002	2180 psi
Pull Off Adhesion onto SP-10 Prepared Surface	ASTM D4541	5120 psi
Tensile Strength (Hoop Axis)	ASTM D3039	73,230 psi
Tensile Strength (Axial Axis)		17,550 psi
Strain to Failure (Hoop Axis)		1.34%
Strain to Failure (Axial Axis)		1.24%
Shear Modulus (140 °F Cure and Test)	ASTM D5379	11.06 x 10^3 psi
Flexural Strength (Hoop Axis)	ASTM D790	83,820 psi
Flexural Strength (Axial Axis)	ASTM D790	29,300 psi
Chemical Resistance	Testing via ISO 2812 demonstrates excellent versus a variety of hydrocarbons. Expected excellent rating versus asset contents due to chemical nature, molecular size and viscosity.	
Property Distinctiveness	An ASME PCC-2 Article 401 engineered composite. This system has been prequalified for high-risk composite repair application.	

FLEXIBLE BARRIER

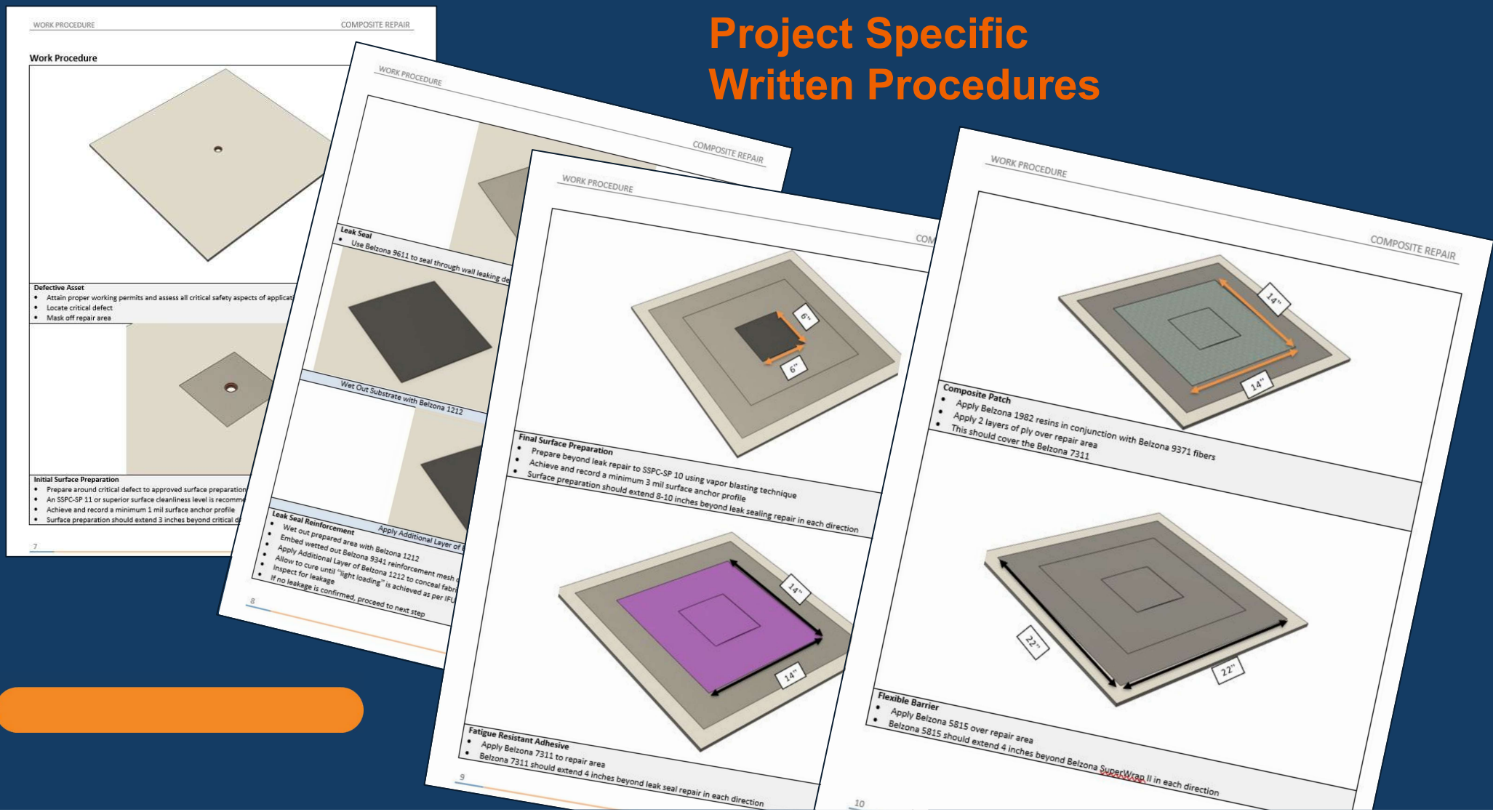
Mechanical/Chemical Property	Testing Standard	Belzona 5815
Pull Off Adhesion onto SP-10 Prepared Surface	ASTM D4541	2420 psi
Tensile Strength	ASTM D412	2430 psi
Elongation	ASTM D412	12%
Flexural Strength	ASTM D790	312 psi
Mandrel Bend Elongation	ASTM D522	10%
Chemical Resistance	Testing via ISO 2812 demonstrates excellent versus a variety of hydrocarbons. Expected excellent rating versus asset contents due to chemical nature, molecular size and viscosity.	
Property Distinctiveness	A flexible epoxy coating used to coat surfaced subject to frequent movement.	

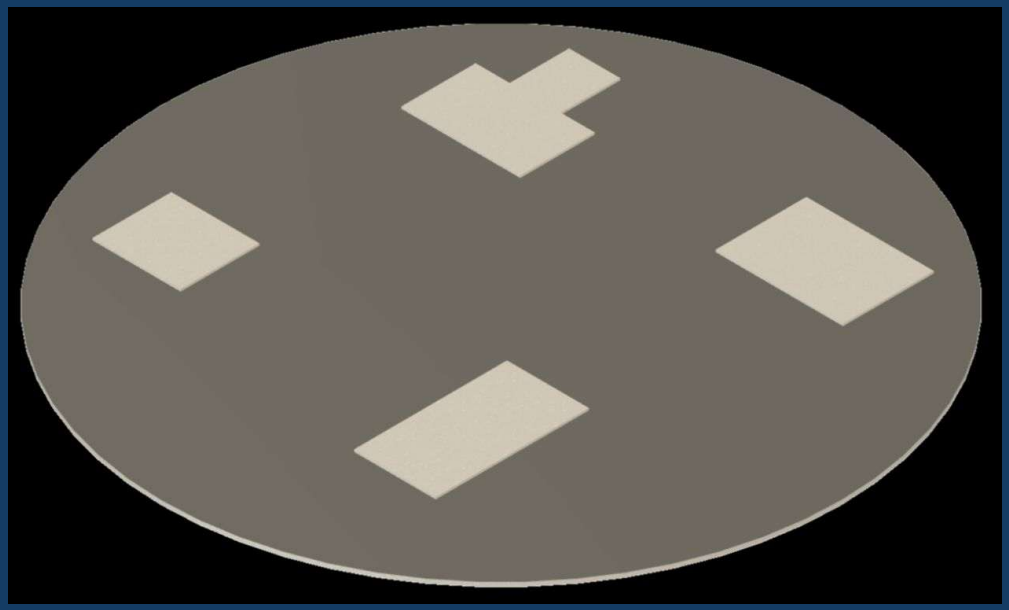
UV TOPCOAT

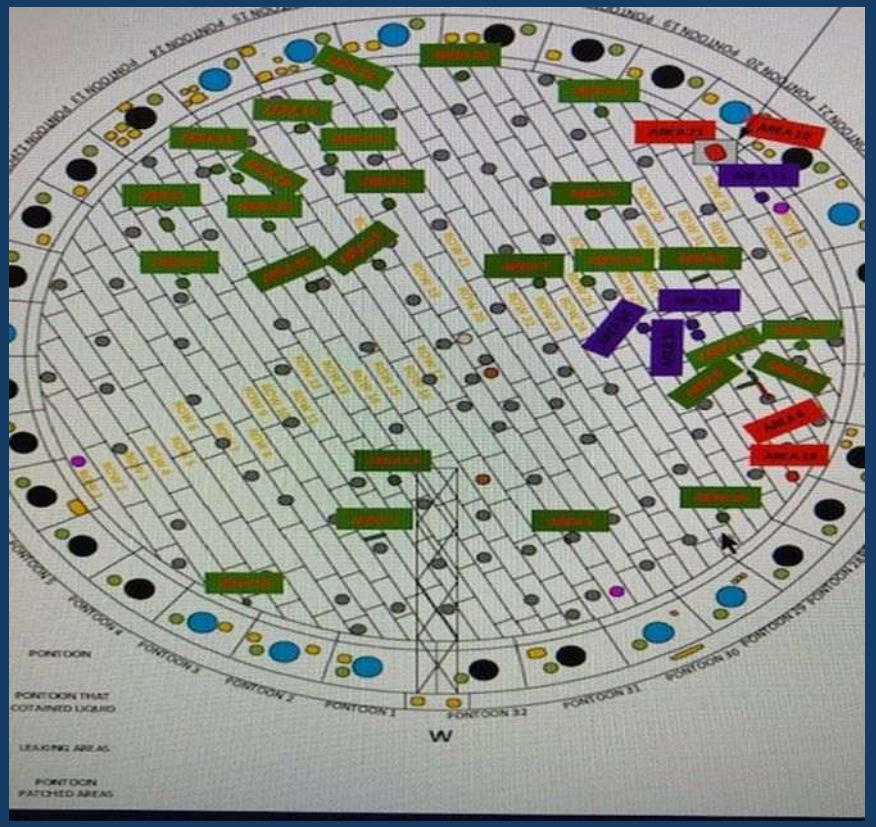
Mechanical/Chemical Property	Testing Standard	Belzona 5111
Accelerated Weathering Resistance	BS 3900	No discoloration, loss of gloss, blistering, flaking, rusting or other breakdowns after 3000 hours exposure
Corrosion Resistance	BS 3900	Demonstrates no rusting, blistering or flaking when exposed to 2000 hours salt spray cabinet
Property Distinctiveness	A modified aliphatic urethane with enhanced UV and corrosion resistance. Its extreme hardness adds to durability of the system to environmental wear.	

6

Project Specific Written Procedures





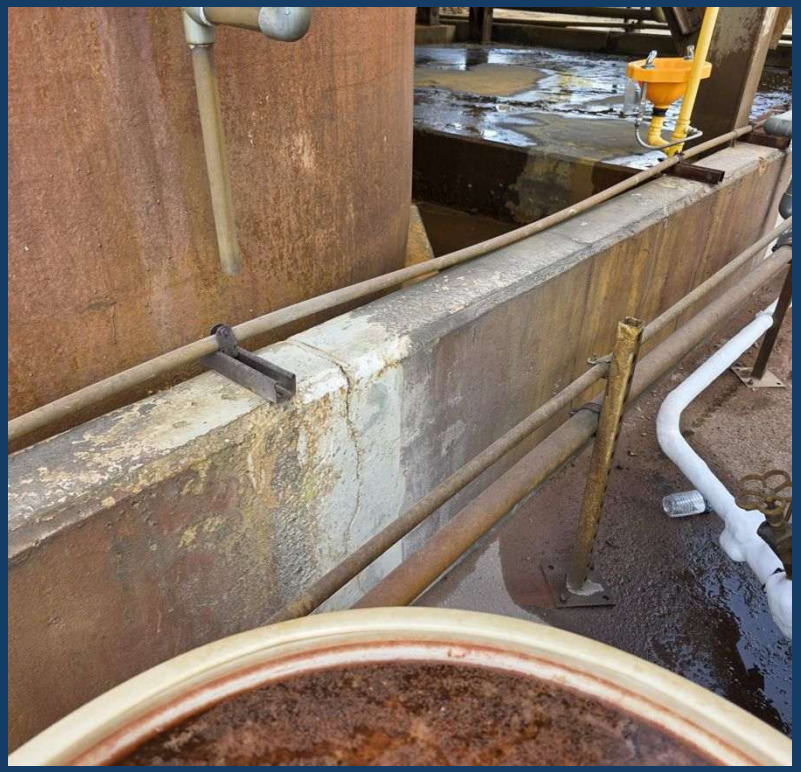

PONTOON
PONTOON THAT CONTAINED LIQUID
LEAKING AREAS
PONTOON PATCHED AREAS
W

Leak at Plate to Concrete Interface

High Performance Concrete Repair and Rebuild Composite

BELZONA 4111

Leaking Containment Area



High Performance Chemical Resistant Coating

BELZONA 4311

Belzona 4311 (Magma CR1) is a hand and sprayed applied, two-component barrier coating for the protection of surfaces against chemical attack.

This solvent-free coating isolates concrete and metal surfaces from aggressive chemicals, such as sulphuric acid.

In addition, Belzona 4311 demonstrates excellent adhesion to a variety of rigid substrates, including concrete, stone, brick, stainless steel, mild steel, carbon steel and copper.

Available in two colours (red and grey) the outstanding chemical resistance of Belzona 4311 offers long term protection to primary and secondary containment areas.

TECHNICAL DATA			
Mixing ratio (base:solidifier)	3:1 by volume	6:1 by weight	
Working life	20 minutes at 20°C (68°F)		
Shelf life	5 years		
Heat resistance	217°C (423°F) dry	60°C (140°F) wet	
Adhesion (tensile shear)	Steel: 20.6 MPa (2990 psi)		
Compressive strength	59.1 MPa (8,570 psi)		
Heat distortion temperature	48°C (118°F) at 20°C (68°F) cure	78°C (172°F) at 100°C (212°F) cure	
Coverage rate	4m² (43ft²) / 1L at 250 microns (10 mils)		

CURE TIMES				
Temperature	15°C (59°F)	20°C (68°F)	30°C (86°F)	40°C (104°F)
Light pedestrian traffic	8 hours	6 hours	4 hours	3 hours
Vehicular traffic	1 day	18 hours	12 hours	10 hours
Full chemical resistance	14 days	7 days	3 days	2 days

Please consult the Product Specification Sheet (PSS) and Instructions for Use (IFU) for the latest technical data.

CHEMICAL RESISTANT

EXCELLENT ADHESION

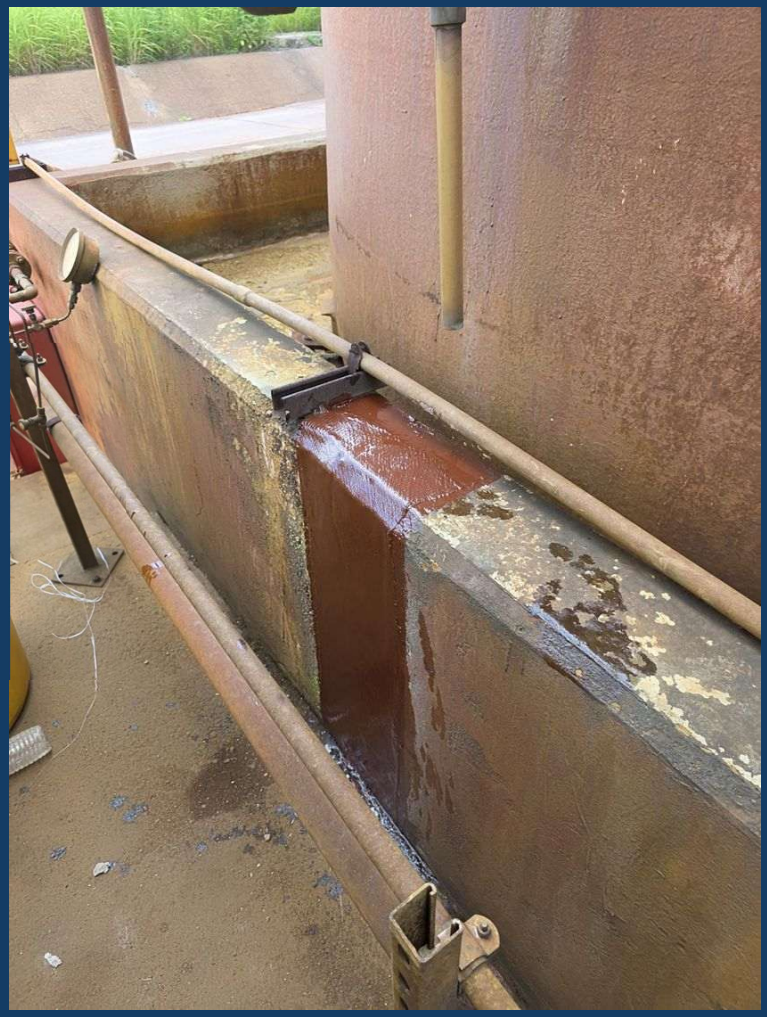
VERSATILE

SPRAYABLE

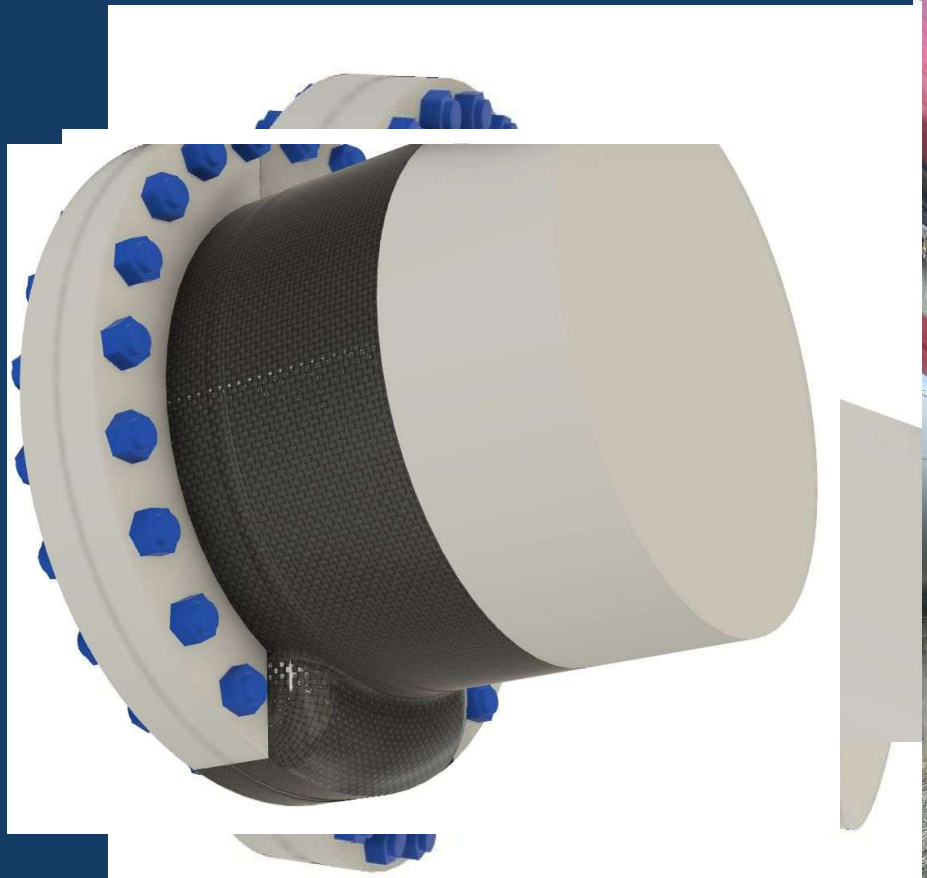
SOLVENT FREE

www.belzona.com/4311

- Right product
- Right procedure
- Right people



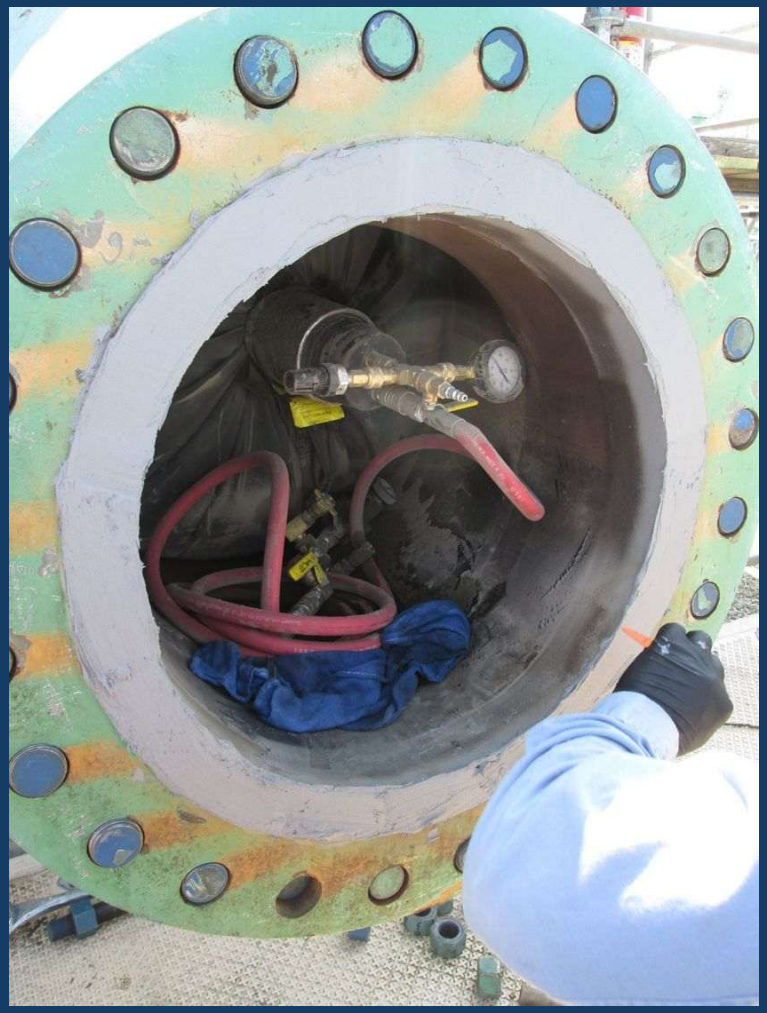
- Midstream asset
- API compliant leak repair using ASME qualified engineered composite
- Crude oil line with defect near flange



SuperWrap II Engineered Wrap

Flange Rebuild

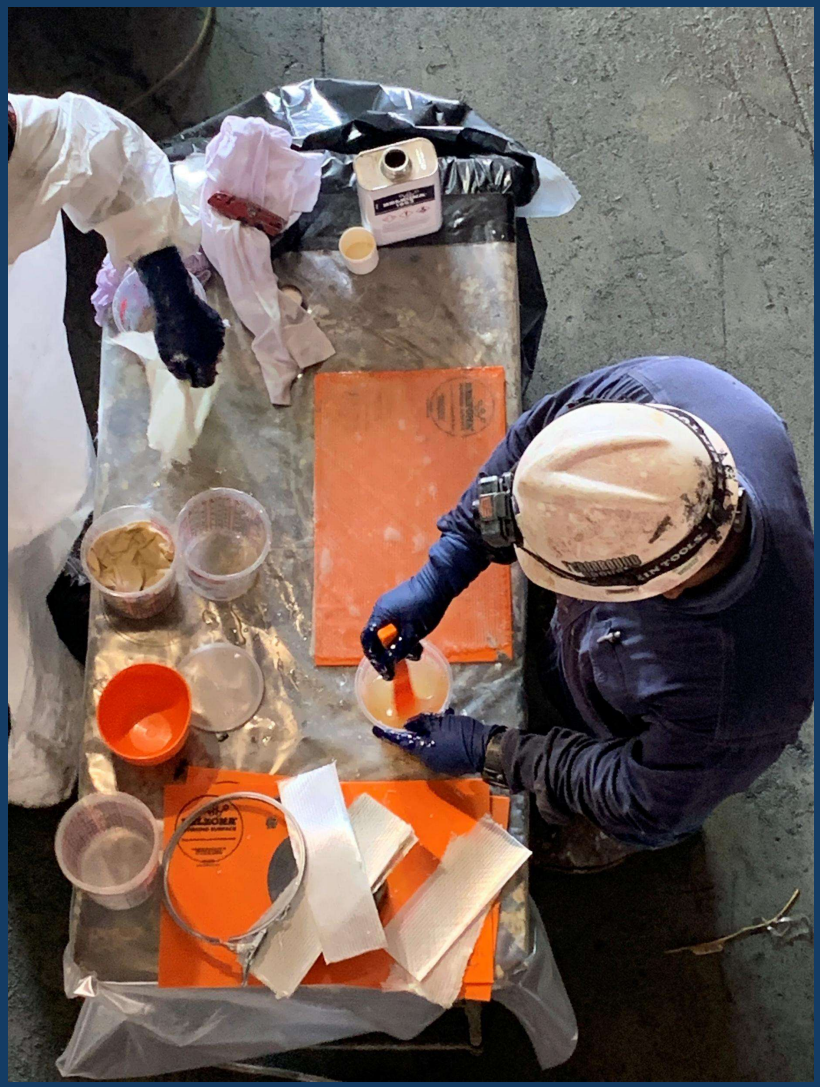
Belzona Flange Face Forming



BHI COATINGS

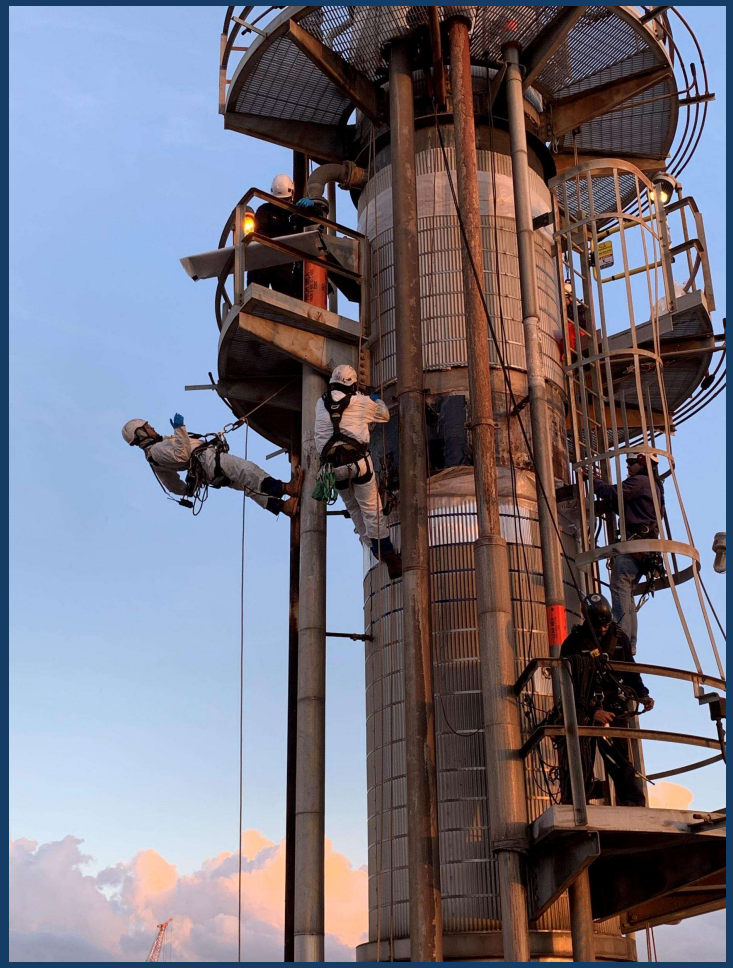
People

BHI COATINGS



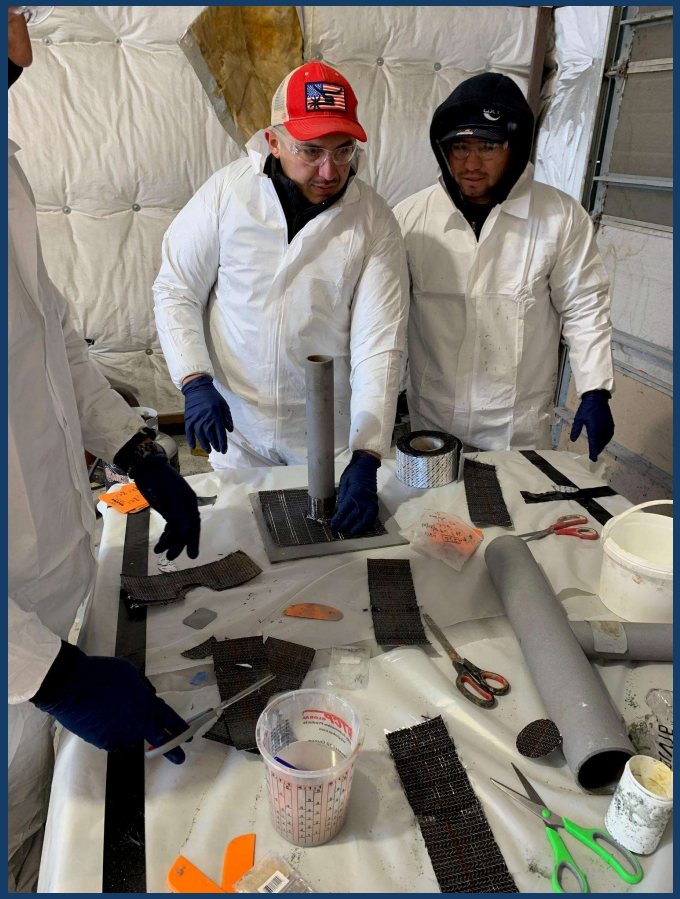

CAUTION
FALL PROTECTION REQUIRED
BHI
COATINGS

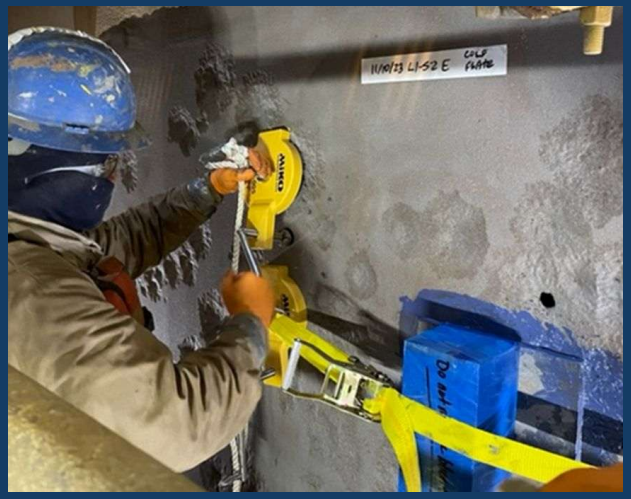

6555



Contractor Training

OQ and Project Specific

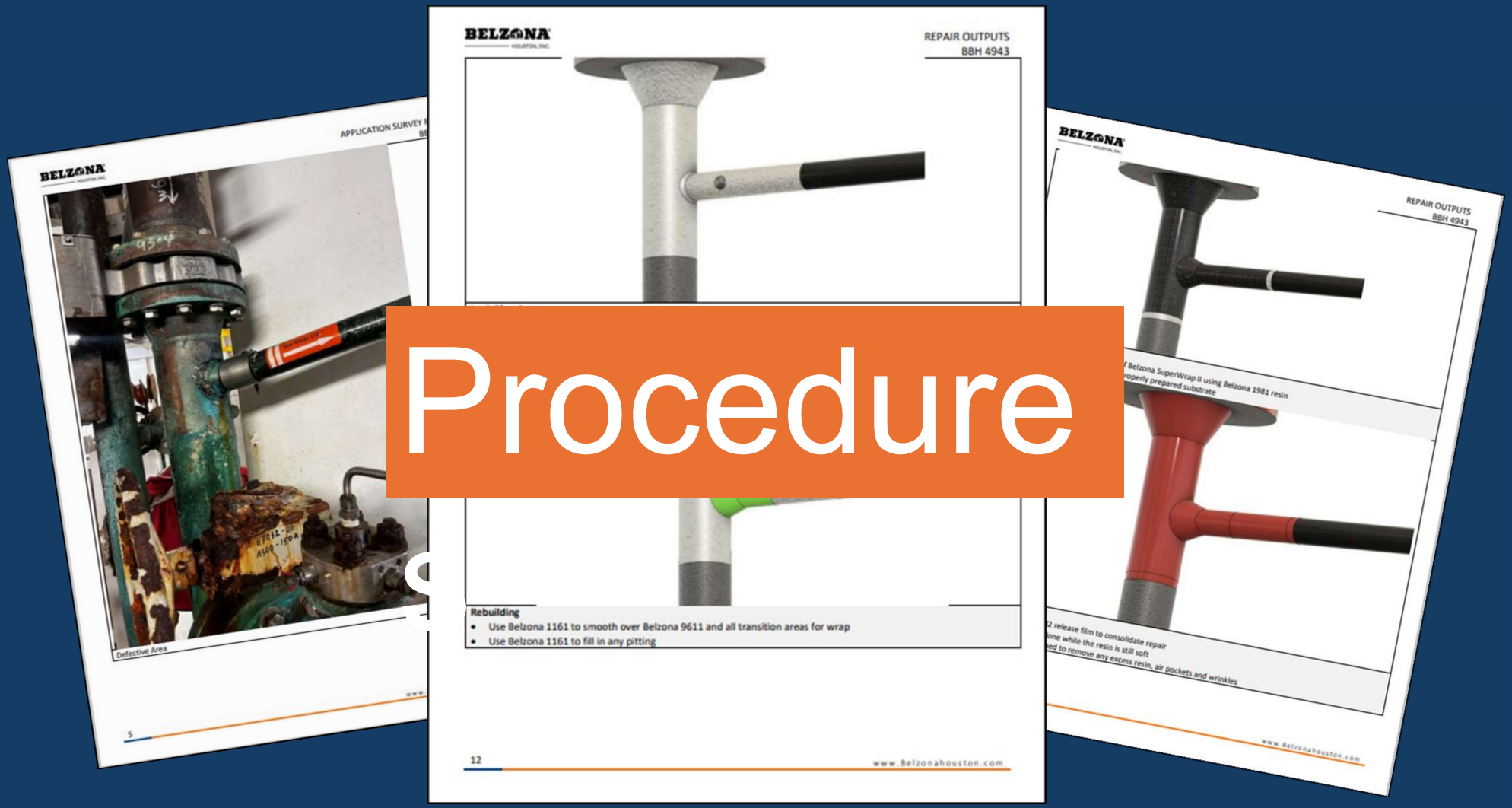



11/8/13 LI-52 E
COLD FLAME


S1 FLP


Products

Procedure


BELZONA
APPLICATION SURVEY
Defective Area
5
BELZONA
REPAIR OUTPUTS
BBH 4943
Rebuilding
• Use Belzona 1161 to smooth over Belzona 9611 and all transition areas for wrap
• Use Belzona 1161 to fill in any pitting
12
www.Belzonahouston.com
BELZONA
REPAIR OUTPUTS
BBH 4943
Belzona SuperWrap II using Belzona 1981 resin
properly prepared substrate
release film to consolidate repair
one while the resin is still soft
ed to remove any excess resin, air pockets and wrinkles
www.Belzonahouston.com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BHI COATINGS

Coat It

Wrap It

Seal It

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