PRODUCT SPECIFICATION SHEET
BELZONA 7311
FN10213

GENERAL INFORMATION

Product Description:
A two component fatigue resistant adhesive, optimised for structural bonding applications requiring high mechanical strength, cleavage and shear resistance. Suitable for typical wet and dry service applications up to 60°C (140°F). For use in Original Equipment Manufacture or repair situations.

Application Areas:
When mixed and applied as detailed in the Belzona Instructions for Use (IFU), the system is ideally suited for application to the following:

- Plate bonding
- Bonding of brackets
- Support installation
- Returning strength to structures
- Rudder bearing installation
- Housing bonding
- Load bearing clips
- Bonding vessel furniture
- Bonding of composite plates

BOND DESIGN & TECHNICAL SUPPORT

Belzona 7311 is a structural adhesive specifically engineered for use in designed joints. In the event this technical data sheet does not provide the required test data for your modelling and simulation, or you require support for a specific bonding application, please contact the Belzona Technical Team. Belzona have additional resource and may be able to carry out bespoke testing to categorise the exact material properties for your specific application.

APPLICATION INFORMATION

Application Methods
Brush
Applicator
Cartridge

Application Temperature
For best results, application should occur in the following ambient temperature range: 5°C/41°F to 60°C/140°F. Consult the Belzona IFU for specific details.

Cure Time
Cure times will vary depending on the substrate temperature, ambient conditions and will be reduced for thicker sections and extended for thinner applications. Consult the Belzona IFU for specific details.

Coverage Rate
The theoretical coverage rate at 2mm thick adhesive joint/bond line is 0.4 m^2 (4.3 ft^2) / 0.8 litre unit

Base Component

Appearance	Soft paste
Colour	Blue
Gel strength at 20°C (68°F)	200 - 260 g/cm HF
Density	1.15 – 1.19 g/cm^3

Solidifier Component

Appearance	Soft paste
Colour	Cream
Gel strength at 20°C (68°F)	230 - 300 g/cm HF
Density	1.15 – 1.19 g/cm^3

Mixed Properties

Colour:	Blue
Slump Resistance	nil at 0.64 cm (0.25 inch)
Mixed Density	1.15 – 1.19 g/cm^3
VOC content (ASTM D2369 / EPA ref. 24):	0.15% / 1.76 g/L

Mix Ratio

Mix ratio by weight (Base : Solidifier)	3 : 1
Mix ratio by volume (Base: Solidifier)	3 : 1

Working Life
The working life will vary according to the temperature.
At 20°C (68°F), the usable life of mixed material will typically be 40 minutes. Consult the Belzona IFU for specific details.

The above application information serves as introductory guide only. For full application details including the recommended application procedure/technique, refer to the Belzona IFU which is enclosed with each packaged product.

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ADHESION

Cleavage Adhesion
The cleavage adhesion on mild steel, as determined in accordance with ASTM D1062, will typically be:

Grit Blasted (ISO 8501-1 Sa 2.5)	Cleavage Adhesion
20°C/68°F applied, cure & test	360 N/mm / 2060 pli
20°C/68°F applied, 60°C/140°F cure & test	300 N/mm / 1700 pli
60°C/140°F applied, cure & test	330 N/mm / 1860 pli

Power-Tool Clean (SSPC-SP11)	Cleavage Adhesion
20°C/68°F applied, cure & test	210 N/mm / 1200 pli

Cleavage Adhesion
The cleavage adhesion on brass, as determined in accordance with ASTM D1062, will typically be:

Grit Blasted (ISO 8501-1 Sa 2.5)	Cleavage Adhesion
20°C/68°F applied, cure & test	320 N/mm / 1830 pli
60°C/140°F applied, cure & test	310 N/mm / 1770 pli

Pull Off Adhesion
The PosiTest dolly pull off strength on 10mm thick mild steel, as determined in accordance with ASTM D4541 and ISO 4624, will typically be:

Grit Blasted (ISO 8501-1 Sa 2.5)	Pull Off Adhesion
20°C/68°F applied, cure & test	37.9 MPa / 5500 psi*
60°C/140°F applied, cure & test	33.7 MPa / 4890 psi*
20°C/68°F applied & cure, -30°C/-22°F test	38.6 MPa / 5590 psi*

Power-Tool Clean (SSPC-SP11)	Pull Off Adhesion
20°C/68°F applied, cure & test	37.8 MPa / 5480 psi*

*Aluminium dollies applied wet on wet onto **Belzona 7311** surface. Mode of failure = dolly failure.

ADHESION

Tensile Shear Adhesion
The tensile shear adhesion on mild steel, as determined in accordance with ASTM D1002, will typically be:

Grit Blasted (ISO 8501-1 Sa 2.5)	Tensile Shear Adhesion
5°C/41°F applied & cure, 20°C/68°F test	27.0 MPa / 3910 psi
10°C/50°F applied & cure, 20°C/68°F test	32.7 MPa / 4740 psi
20°C/68°F applied, cure & test	33.4 MPa / 4840 psi
40°C/104°F applied & cure, 20°C/68°F test	33.9 MPa / 4910 psi
60°C/140°F applied & cure, 20°C/68°F test	31.2 MPa / 4520 psi
60°C/140°F applied, cure & test	24.8 MPa / 3600 psi
20°C/68°F applied, 60°C/140°F cure & test	20.9 MPa / 3030 psi
20°C/68°F applied & cure, -10°C/14°F test	34.2 MPa / 4960 psi

Power-Tool Clean (SSPC-SP11)	Tensile Shear Adhesion
20°C/68°F applied, cure & test	23.2 MPa / 3360 psi

Tensile Shear Adhesion
The tensile shear adhesion on mild steel, as determined in accordance with ISO 4587, will typically be:

Grit Blasted (ISO 8501-1 Sa 2.5)	Tensile Shear Adhesion
20°C/68°F applied, cure & test	24.2 MPa / 3510 psi

Power-Tool Clean (SSPC-SP11)	Tensile Shear Adhesion
20°C/68°F applied, cure & test	11.4 MPa / 1653 psi

ADHESION

Tensile Shear Adhesion (Heat aging)
The tensile shear adhesion on mild steel, as determined in accordance with ASTM D1002, after 8500 hours heat exposure at 60°C/140°F, will typically be:

Grit Blasted (ISO 8501-1 Sa 2.5)	Tensile Shear Adhesion After Heat Exposure At 60°C/140°F
20°C/68°F test	28.1 MPa / 4080 psi

Power-Tool Clean (SSPC-SP11)	Tensile Shear Adhesion After Heat Exposure At 60°C/140°F
20°C/68°F test	22.9 MPa / 3320 psi

Tensile Shear Adhesion (Immersion)
The tensile shear adhesion on mild steel, as determined in accordance with ASTM D1002, after 8500 hours immersion in water at 40°C/104°F, will typically be:

Grit Blasted (ISO 8501-1 Sa 2.5)	Tensile Shear Adhesion After Immersion In Water At 40°C/104°F
20°C/68°F test	22.4 MPa / 3250 psi

Power-Tool Clean (SSPC-SP11)	Tensile Shear Adhesion After Immersion In Water At 40°C/104°F
20°C/68°F test	20.9 MPa / 3030 psi

Tensile Shear Adhesion (Thermal cycling)
The tensile shear adhesion on mild steel, as determined in accordance with ASTM D1002, after 120 cycles between 60°C/140°F and -30°C/-22°F, will typically be:

Grit Blasted (ISO 8501-1 Sa 2.5)	Tensile Shear Adhesion After Thermal Cycling Between 60°C/140°F and -30°C/-22°F
20°C/68°F cure & test	29.5 MPa / 4280 psi

ADHESION

Tensile Shear Adhesion (Other metallic substrates)
The tensile shear adhesion, as determined in accordance with ASTM D1002, will typically be:

Substrate	Grit Blasted (ISO 8501-1 Sa 2.5)	Tensile Shear Adhesion
Aluminium	20°C/68°F applied, cure & test	17.2 MPa / 2490 psi
Aluminium	60°C/140°F applied, cure & test	15.3 MPa / 2220 psi
Brass	20°C/68°F applied, cure & test	21.2 MPa / 3070 psi
Brass	60°C/140°F applied, cure & test	29.6 MPa / 4290 psi
Copper	20°C/68°F applied, cure & test	19.1 MPa / 2770 psi
Copper	60°C/140°F applied, cure & test	18.6 MPa / 2700 psi
Stainless steel	20°C/68°F applied, cure & test	31.0 MPa / 4490 psi
Stainless steel	60°C/140°F applied, cure & test	27.9 MPa / 4040 psi

Tensile Shear Adhesion (Non-metallic substrates)
The tensile shear adhesion, as determined in accordance with ASTM D1002, will typically be:

Substrate	Flash Blasted / Roughened Surface	Tensile Shear Adhesion
Carbon fibre	20°C/68°F applied, cure & test	12.4 MPa / 1800 psi*
GRP (Epoxy G10 FR4)	20°C/68°F applied, cure & test	16.5 MPa / 2390 psi*
Polyamide	20°C/68°F applied, cure & test	4.6 MPa / 670 psi
Polyethylene	20°C/68°F applied, cure & test	2.6 MPa / 380 psi
Polypropylene	20°C/68°F applied, cure & test	2.3 MPa / 330 psi

*Cohesive failure of substrate

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BELZONA®
Repair • Protect • Improve

CHEMICAL ANALYSIS

Total Concentration
The mixed **Belzona 7311** has been independently analysed for halogens, heavy metals, and other corrosion-causing impurities in accordance with ASTM E165, ASTM D4327 and ASTM E1479. Typical results are displayed as follows:

Analyte	Total Concentration (ppm)
Fluoride	20
Chloride	3,134
Bromide	<48
Sulphur	51
Nitrite	<7
Nitrate	<7
Antimony, Arsenic, Bismuth, Cadmium, Lead, Tin, Silver, Mercury, Gallium, Indium and Zinc	ND (<5)

ND : Not Detected

COMPRESSIVE PROPERTIES

When determined in accordance with ASTM D695, typical values will be:

	Compressive Strength	Proportional Limit	Compressive Modulus
20°C/68°F cure & test	53.0 MPa 7680 psi	44.0 MPa 6380 psi	880 MPa 1.30 x 10^5 psi
60°C/140°F cure & test	40.9 MPa 5930 psi	32.0 MPa 4640 psi	760 MPa 1.10 x 10^5 psi

ELECTRICAL PROPERTIES

Dielectric Constant
Tested to ASTM D150 is typically 3.92 when tested at 1V & 50 Hz.

Dielectric Strength
Tested to ASTM D149 is typically 32.3 kV/mm when tested at 2000V/s.

Surface Resistivity
Tested to ASTM D257 is typically 4.12 x 10^{15} Ohms when tested at 500V for 1 minute.

Volume Resistivity
Tested to ASTM D257 is typically 1.66 x 10^{12} Ohms.m when tested at 500V for 1 minute.

ELONGATION & TENSILE PROPERTIES

When determined in accordance with ASTM D638, typical values will be:

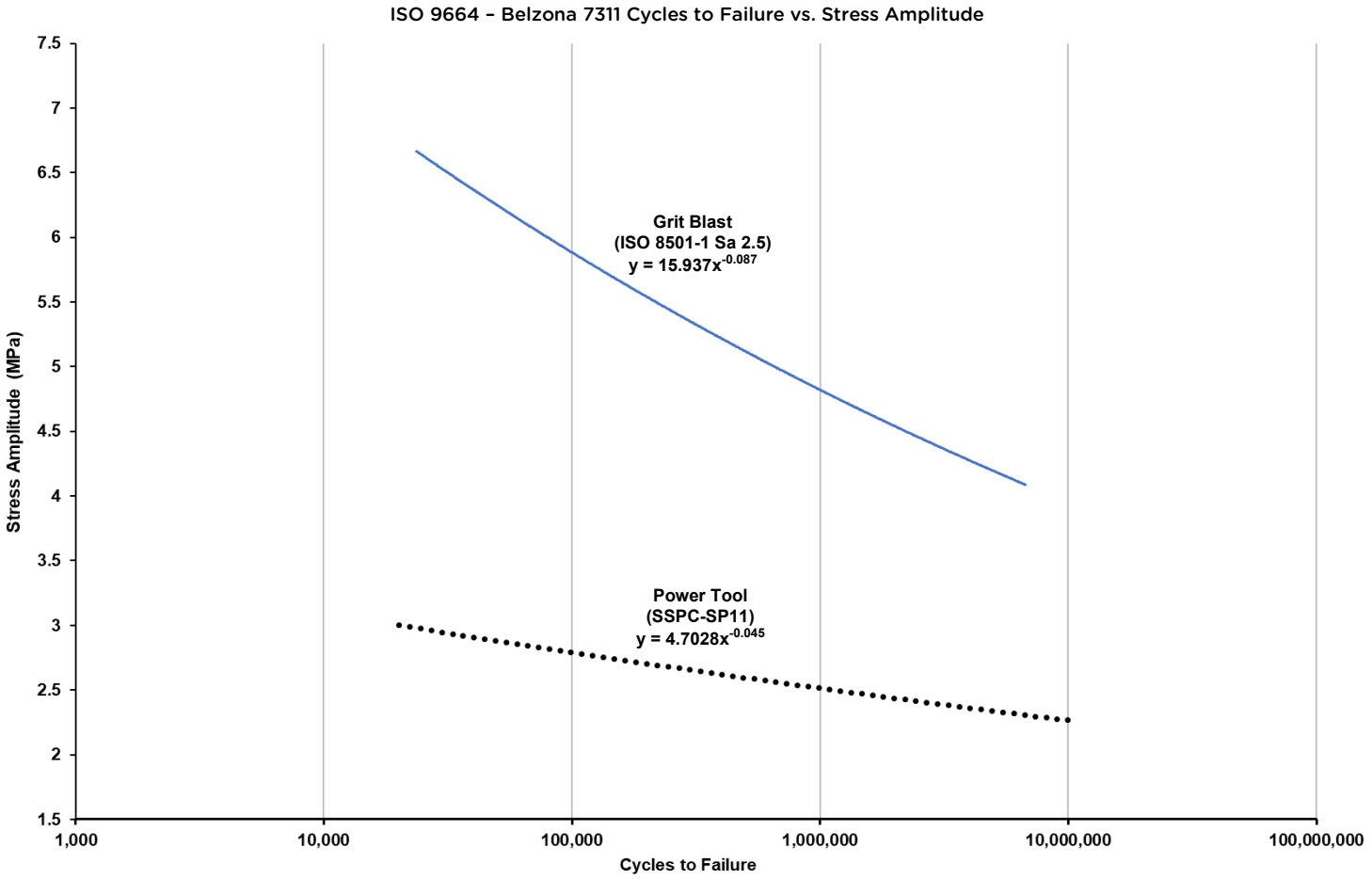
	Elongation	Tensile Strength	Young's Modulus	Poisson's Ratio
20°C/68°F cure & test	3.9%	37.0 MPa 5360 psi	2550 MPa 3.7 x10^5 psi	0.40
60°C/140°F cure & test	4.5%	30.7 MPa 4450 psi	2100 MPa 3.0 x10^5 psi	0.43

FATIGUE RESISTANCE

Tensile shear
When tested in accordance with ISO 9664, at a test frequency of 30Hz, **Belzona 7311** will perform as follows:

Grit Blasted Preparation (ISO 8501-1 Sa 2.5)
From a mean breaking stress of 35% (8.461 MPa), **Belzona 7311** will survive 10^6 cycles at 56.6%, with an alternating stress amplitude of ± 4.791 MPa.

Power Tool Preparation (SSPC-SP11)
From a mean breaking stress of 35% (4.003 MPa), **Belzona 7311** will survive 10^6 cycles at 63.1%, with an alternating stress amplitude of ± 2.526 MPa.



FLEXURAL PROPERTIES

When determined in accordance with ASTM D790, typical values will be:

	Flexural Strength	Flexural Modulus
20°C/68°F cure & test	59.2 MPa 8580 psi	2240 MPa 3.2 x10^5 psi
60°C/140°F cure & test	52.0 MPa 7540 psi	8000 MPa 1.2 x10^6 psi

HARDNESS

Barcol and Shore D Hardness
The Barcol and Shore D hardness when determined in accordance with ASTM D2583 and ASTM D2240 respectively, will typically be:

	Barcol 935	Shore D
20°C/68°F cure & test	65	76
60°C/140°F cure & test	70	78

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HEAT RESISTANCE

Dry Heat Resistance
The indicated degradation temperature in air based on Differential Scanning Calorimetry (DSC) operated in accordance with ISO 11357 is typically 202°C (396°F).

Heat Distortion & Glass Transition Temperature (HDT & T_g)
The HDT and Tg when determined in accordance with ASTM D648 and ISO 11357 respectively, will typically be

	HDT	T_g
20°C/68°F cure	47°C (117°F)	53°C (127°F)
60°C/140°F cure	87°C (189°F)	94°C (201°F)

Service Temperature
For typical wet and dry service applications the product is suitable for service between -30°C (-22°F) up to 60°C (140°F).

IMPACT RESISTANCE

Izod Pendulum
Izod impact strength, when determined in accordance with ASTM D256, will typically be:

	Reversed notched Izod Impact Strength
20°C/68°F cure & test	15.9 KJ/m^2 165.2 J/m
60°C/140°F cure, 20°C/68°F test	16.2 KJ/m^2 171.4 J/m
60°C/140°F cure & test	9.7 KJ/m^2 100.5 J/m

SHEAR PROPERTIES

When determined in accordance with ASTM D5379, typical values will be:

	Shear Strength	Shear Modulus
20°C/68°F cure & test	25.8 MPa 3740 psi	1890 MPa 2.7 x10^5 psi
60°C/140°F cure & test	18.4 MPa 2670 psi	1280 MPa 1.9 x10^5 psi

THERMAL PROPERTIES

Thermal Conductivity
When tested in accordance with EN 12667 and ASTM C177, the thermal conductivity will typically be:

Test Temperature	Thermal Conductivity (λ/ W/m.k)
5°C/41°F	0.164
20°C/68°F	0.166
60°C/140°F	0.183

Thermal Expansion
When tested in accordance with ISO 11359 and ASTM E831, the coefficient of thermal expansion determined from -25°C/-13°F to 30°C/86°F will typically be:

Orientation	Thermal Expansion CTE or $\alpha_{-25/30}$ [K^{-1}]
Length	76.43 x 10^{-6}
Width	80.44 x 10^{-6}
Depth	75.85 x 10^{-6}

SHELF LIFE

Separate Base and Solidifier components shall have a shelf life of 3 years from date of manufacture when stored in their original unopened containers between 5°C (41°F) and 30°C (86°F).

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WARRANTY

This product will meet the performance claims stated herein when material is stored and used as instructed in the Belzona Information For Use leaflet. Belzona ensures that all its products are carefully manufactured to ensure the highest quality possible and are tested strictly in accordance with universally recognized standards (ASTM, ANSI, BS, DIN, ISO, etc.). Since Belzona has no control over the use of the product described herein, no warranty for any application can be given.

AVAILABILITY AND COST

Belzona 7311 is available from a network of Belzona Distributors throughout the world for prompt delivery to the application site. For information, consult the Belzona Distributor in your area.

HEALTH AND SAFETY

Prior to using this material, please consult the relevant Safety Data Sheets.

MANUFACTURER / SUPPLIER

Belzona Limited,
Claro Road, Harrogate,
HG1 4DS, UK

Belzona Inc.
14300 NW 60th Ave,
Miami Lakes, FL, 33014, USA

TECHNICAL SERVICE

Complete technical assistance is available and includes fully trained Technical Consultants, technical service personnel and fully staffed research, development and quality control laboratories.

Belzona products are manufactured under an ISO 9001 Registered Quality Management System