Orms

Project

St Giles Circus

Title

Planning Condition Discharge - Materials Data Sheets

Client

Consolidated Developments

Date

19th June 2019

Project name	Orms project number	Project team code	File
ST GILES CIRCUS	1793	SGC	1793 SGC Planning Condition Discharge

Revision	Date	Description	Status	Created	Checked
PL01	19.16.19	Planning Conditions Discharge - Materials Data Sheets	PL - PLANNING	RV	RV

Consent 2012 / 6858 / P
Condition No 15

Property: Whole Site

/ Note: The information about the facing materials of the mansard on 23-25 Denmark street and the external envelope of 26 Denmark Street & 22-23 Denmark Place is omitted from this section and included in the sections for Consent 2012/6858/P, Condition 16 & Consent 2015/6937 / L, Condition 15 /

Stone

Consent 2012 / 6858 / P
Condition No 15

Stone

Stone Type C - Portland Roach, Honed Finish

ALBION STONE

portland stone – naturally

BOWERS ROACH

This technical data sheet was compiled by the Building Research Establishment (BRE) at the request of Albion Stone and is updated by Albion Stone to incorporate current test results. The 1097 tests have been carried out in accordance with current European standards by the BRE on Albion Stone's behalf, or by other accredited testing houses. The early test data that pre-dates the introduction of Euro-codes has been included providing the test methods were very similar. The work carried out by the BRE on this technical data sheet has been undertaken as a paid commission and does not represent an endorsement of the stone by the BRE. This data includes the Lowest and Highest Expected Values (LEV & HEV) using the statistical calculations from the Euro-codes. We are confident that these results give a good indication of the stones value, but as it is a natural material we, like other stone producers, are unable to guarantee individual results for specific stones. Instead, we recommend that an appropriate factor of safety is used to ensure satisfactory performance, Cladding Annex 1 of the Technical Manual provides further information, but we suggest that a suitably qualified stone consultant with geological and testing experience is employed to provide further information.

Petrography

The stone is an open textured oolitic limestone from the Portlandian formation (Jurassic). The stone is formed from ooliths in a micrite (fine grained calcium carbonate) matrix. It is an extremely shelly stone with a large number of holes scattered throughout it. The holes are due to the removal of fossil shells by percolating rain. The finer-grained parts of the stone is very similar to Whitbed.

Strength

Compression - BS EN 1926
Lowest Expected Value 23.96 MPa
Highest Expected Value 75.09 MPa
Average: 44.24 MPa from 32 tests

Flexural Strength - BS EN 13161
Lowest Expected Value 2.02 MPa
Highest Expected Value 6.70 MPa
Average: 3.94 MPa from 140 tests

Breaking Load at Dowel Hole (75mm thick stone) - BS EN 13364
Lowest Expected Value 1,981 N
Highest Expected Value 8,264 N
Average: 4,287.90 N from 30 tests

Durability

Water Absorption - BS EN 13755
Lowest Expected Value 3.59%
Highest Expected Value 10.70%
Average: 6.28% from 153 tests

Density - BS EN 1936
Lowest Expected Value 1,868 kg/m³
Highest Expected Value 3,952 kg/m³
Average: 2,254 kg/m³ from 213 tests

Porosity - BS EN 1936
Lowest Expected Value 10.28%
Highest Expected Value 30.74%
Average: 17.92% from 267 tests

www.albionstone.com
t 01737 771772 e enquiries@albionstone.com

Saturation Coefficient - BS EN 1936
Lowest Expected Value 0.53
Highest Expected Value 0.72
Average: 0.62 from 173 tests

Salt Crystallisation - BS EN 12370
Lowest Expected Value 1.18%
Highest Expected Value 5.91%
Average: 2.88% from 11 tests

Flooring / Paving

Stone from Bowers and Jordans Mine and Jordans Quarry compared to those collected from buildings, exposure trials and tests on quarry samples collected by BRE during the last 80 years shows that this stone compares very well with the traditional view of Portland Roach.

Abrasion Resistance - EN14157
Lowest Expected Value 20.12
Highest Expected Value 26.04
Average: 22.93 from 18 tests

Slip Resistance - TRRL Pendulum Test: Grit 120 Filled (Internal Flooring)
Lowest Expected Value 74.7
Highest Expected Value 91.6
Wet Average 82.85 from 60 tests
Lowest Expected Value 74.5
Highest Expected Value 83.2
Dry Average 78.75 from 12 tests

Light Reflectance - tested using NCL Colour Scan instrument - Grit 60: Mean Value 57
(Value from Grove Whitbed test, however these stones are very similar)

Internal Flooring

Bowers Roach is suitable for all flooring applications up to intensive use such as shopping centres and airports with estimated visitor numbers of 500,000,000 with a service life without significant wear of 20 years. The dry slip resistance results of over 40 demonstrate that the stone will be safe in all normal applications.

Technical Summary

Prepared by: Dr T Yates, BRE (Building Research Establishment): **Durability and Weathering**
It is important that the results from the sodium sulphate crystallisation tests are not viewed in isolation. They should be considered with the results from the porosity and water absorption tests and the performance of the stone in existing buildings. Stone from the Portland Roach Bed is traditionally acknowledged as generally being a very durable and is comparable with Whitbed. It has been used in extreme environments, for example coastal walls. It is difficult to compare the results for the Roach Bed Stone from Jordans Mine to those collected from buildings and exposure trails as the stone has been little used in building construction. However, the overall test results suggest that the stone compares well with the traditional view of Portland Whitbed. Previous research by the BRE has shown that Portland Limestone which has a low saturation coefficient (>0.72) will have good weathering resistance when used on buildings. The crystallisation tests results show the stone to be Class A-B which BRE Report 141 suggests that it is suitable for most uses.
Based on current research it seems likely that the stone would weather at a rate of between 1 and 2 mm per 100 years but it could be greater in severe exposures.
(Weathering rates are based on the BRE interpretation of historical data dating from 1932).

April 2019

www.albionstone.com
t 01737 771772 e enquiries@albionstone.com

Stone

Stone Type D - Portland Whitbed, Honed Finish

ALBION STONE

portland stone – naturally

JORDANS WHITBED

This technical data sheet was compiled by the Building Research Establishment (BRE) at the request of Albion Stone and is updated by Albion Stone to incorporate current test results. The 862 tests have been carried out in accordance with current European standards by the BRE on Albion Stone's behalf, or by other accredited testing houses. The early test data that pre-dates the introduction of Euro-codes has been included providing the test methods were very similar. The work carried out by the BRE on this technical data sheet has been undertaken as a paid commission and does not represent an endorsement of the stone by the BRE.

This data includes the Lowest and Highest Expected Values (LEV & HEV) using the statistical calculations from the Euro-codes. We are confident that these results give a good indication of the stones value, but as it is a natural material we, like other stone producers, are unable to guarantee individual results for specific stones. Instead, we recommend that an appropriate factor of safety is used to ensure satisfactory performance, Cladding Annex 1 of the Technical Manual provides further information, but we suggest that a suitably qualified stone consultant with geological and testing experience is employed to provide further information.

Petrography

The stone was classified as a moderately sorted, moderately compacted, clast supported Oosparite Limestone. The clasts were predominantly composed of ooliths, but mollusc shell and echinoderm fragments and quartz were also present. The matrix was composed of sparitic syntaxial carbonate and some micritic carbonate. There was a moderate to high abundance of open voidage space. There was possibly some evidence of sedimentary bedding by the preferred alignment of elongate clasts.

Strength

Compression - BS EN 1926
Lowest Expected Value 36.80 MPa
Highest Expected Value 61.38 MPa
Average: 47.97 Mpa from 36 tests

Flexural Strength - BS EN 13161
Lowest Expected Value 3.81 MPa
Highest Expected Value 8.50 MPa
Average: 5.86 MPa from 111 tests

Breaking Load at Dowel Hole - BS EN 13364:2002

Specimen Thickness (mm)	Mean Breaking Load (N)	Lowest Expected Value (N) / Highest Expected Value (N)
75	4667	3383 / 6281
60	2249	1777 / 2816
50	1860	1460 / 2342
40	1191	922 / 1519
30	667	539 / 817

www.albionstone.com
t 01737 771772 e enquiries@albionstone.com

Durability

Water Absorption - BS EN 13755
Lowest Expected Value 3.28%
Highest Expected Value 10.87%
Average: 6.08% from 121 tests

Density - BS EN 1936
Lowest Expected Value 2,013 kg/m³
Highest Expected Value 2,388 kg/m³
Average: 2,196 kg/m³ from 168 tests

Porosity - BS EN 1936
Lowest Expected Value 11.99%
Highest Expected Value 26.68%
Average: 18.56% from 200 tests

Saturation Coefficient - BS EN 1936
Lowest Expected Value 0.52
Highest Expected Value 0.82
Average: 0.64 from 108 tests

Salt Crystallisation – BS EN 12370
Lowest Expected Value 0.12%
Highest Expected Value 17.97%
Average: 2.05% from 6 tests

Thermal Shock Resistance—BS EN 14066
(% change in elastic modulus)
Lowest Expected Value 0%
Highest Expected Value 32%
Average: 4.51% from 10 tests

Water Absorption by Capillarity - BS EN 1925
59.41g/m².sec^{-2}

Flooring / Paving

Abrasion Resistance - EN 14157
Lowest Expected Value 22.10
Highest Expected Value 25.30
Average: 23.63 from 12 tests

Slip Resistance - TRRL Pendulum Test: Grit 120 (Flooring)
Lowest Expected Value 66
Highest Expected Value 87
Wet Average value 76 from 24 tests
Lowest Expected Value 76
Highest Expected Value 102
Dry Average value 88 from 24 tests

Freeze/Thaw — Flexural Strength - BS EN 12372 & 14066 (Pre-thermal testing)
Lowest Expected Value 3.65 MPa
Highest Expected Value 7.31 MPa
Average: 5.25 MPa from 20 tests

www.albionstone.com
t 01737 771772 e enquiries@albionstone.com

Stone

Stone Type D - Portland Whitbed, Honed Finish

Freeze/Thaw—BS EN 12372 & 14066 (Average figure 14-168 cycles)
Lowest Expected Value 1.70 MPa
Highest Expected Value 9.42 MPa
Average: 4.37 MPa from 50 tests

Freeze/Thaw — Flexural Strength - BS EN 12372 & 14066 (After 14 (20) cycles) For cladding in accordance with EN 1469
Lowest Expected Value 3.30 MPa
Highest Expected Value 7.70 MPa
Average: 5.15 MPa from 20 tests

Freeze/Thaw — Flexural Strength - BS EN 12372 & 14066 (After 56 cycles) For paving in accordance with EN 1341
Lowest Expected Value 1.15 MPa
Highest Expected Value 12.16 MPa
Average: 4.16 MPa from 7 tests

Freeze/Thaw — Flexural Strength - BS EN 12372 & 14066 (after 168 cycles) in accordance with EN 771-6
Lowest Expected Value 1.33 MPa
Highest Expected Value 7.84 MPa
Average: 3.48 MPa from 10 tests

Light Reflectance - tested using NCL Colour Scan instrument - Grit 60: Mean Value 57.00
(Value from Grove Whitbed test, however these stones are very similar)

Internal Flooring

Jordans Whitbed is suitable for all flooring applications up to semi-intensive use such as shops and offices with estimated visitor numbers of 5,000,000 with a service life without significant wear of 20 years. The slip resistance results of over 40 demonstrate that the stone will be safe in all applications.

Technical Summary

Prepared by Dr T Yates, BRE (Building Research Establishment): Durability and Weathering
It is important that the results from the sodium sulphate crystallisation tests are not viewed in isolation. They should be considered with the results from the porosity and water absorption tests and the performance of the stone in existing buildings. Stone from the Portland Whitbed is traditionally acknowledged as generally being a very durable building stone and it has been used extensively in many towns and cities in the UK. Comparing the results for the Whitbed Stone from Jordans Mine to those collected from buildings, exposure trials and tests on quarry samples collected by BRE during the last 70 years shows that this stone compares very well with the traditional view of Portland Whitbed. Previous research at BRE has shown that Portland limestone which has a low saturation coefficient (<0.72), a low microporosity (<11.0 of the stone by volume) and an open oolitic structure generally performs well over long periods when used on buildings. The results summarised on these sheets show that the limited number of samples tested meet these criteria. The average crystallisation test results show the stone to be Class C which BRE Report 141 suggests is suitable for most uses including where exposure conditions are to be more severe, for example high concentrations of sulphur dioxide or severe frosts, or where a long life is required (for example >50 years). In all cases it is important that the detailing of the stonework is designed to offer the maximum protection from rainwater and rainwater runoff.
Based on current research it seems likely that the stone would weather at a rate of between 1 and 2 mm per 100 years but it could be greater in severe exposures.
(Weathering rates are based on the BRE interpretation of historical data dating from 1932).

April 2019

www.albionstone.com
t 01737 771772 e enquiries@albionstone.com

Brickwork

Consent 2012 / 6858 / P
Condition No 15

Brick Type A
White Glazed Brick

Wienerberger

PRODUCT TECHNICAL INFORMATION SHEET

PRODUCT NAME	:	**GLAZED – WHITE**
REF. CODE	:	**11029110 (PANNINGEN)**
DESCRIPTION	:	**GLAZED**
MANUFACTURE	:	**EXTRUSION**
APPEARANCE	:	**SMOOTH**
CONFIGURATION	:	**PERFORATED – 20 HOLES VERTICAL**
WORK SIZE*	:	**215 x 102 x 65mm**

GUARANTEED PROPERTIES		**EN771-1 : 2003**
COMPRESSIVE STRENGTH	:	**MIN. 50N/mm^2**
WATER ABSORPTION	:	**MAX. 2%**
DURABILITY DESIGNATION	:	**F2**
ACTIVE SOLUBLE SALTS	:	**S2**
SIZE TOLERANCE * (/ RANGE)	:	**T2 – R2**
GROSS DENSITY (Tolerance)	:	**1700Kg/m^3 (D1)**
NET DENSITY (Tolerance)	:	**1800Kg/m^3 (D1)**
THERMAL CONDUCTIVITY (λ_{10},dry)	:	**P=90% 0.55 W/m.K**
INITIAL RATE OF WATER ABS.	:	**0.1/m^2.minute**
BOND STRENGTH (General Mortar)	:	**0.15 N/mm^2 (fixed value)**
REACTION TO FIRE	:	**Class A1**
WATER VAPOUR PERMEABILITY (μ)	:	**5/10 (tabulated)**
PACK QUANTITY	:	**384 no**
PACK SIZE (APPROX. mm)	:	**860 x 845 x 820 H**
TYPICAL PACK WEIGHT	:	**931 Kg**

ISSUE : JANUARY 2012

TERCA BAGGERIDGE

Brick Type B
London Stock Brick

Wienerberger

Bronsgroen

Cream Soft Mud Creased Multi Brick

Terca

Request sample

Add to my favourites

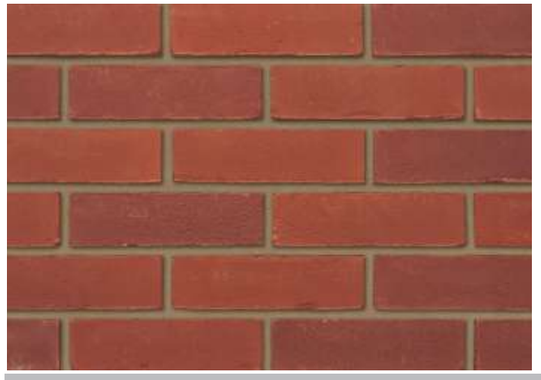
Technical information

Collection Point / Location	Hull & Purfleet
Size tolerances, mean and range	T2 / R1
Durability EN 771-1	F2
Active soluble salts EN 771-1	S2
Compressive strength (N/mm²) EN 771-1	>=25
Water Absorption (%) EN 771-1	<=12
Pack quantity	552
Configuration	Frogged
Dimensions	215 x 102.5 x 65

Brick Type C
Red Brick

Heritage Red Blend

IBSTOCK BRICK
an IBSTOCK plc company



Product Information	
Ibstock Code:	4986
Type:	Stock
Facing Description:	Sandfaced
Dry Brick Weight (kg):	2.2kg
Pack Quantity:	500
Packaging (standard):	Banded (plastic) & Shrinkwrapped
Factory:	Ellistown
Technical Specification (to BS EN 771-1)	
Brick Dimensions (L x W x H mm):	215x102x65
Size Tolerances Mean & Range:	T2 R1
Configuration:	Single Frog
Voids (%):	8-13
Compressive Strength (N/mm²):	20
Active Soluble Salts:	S2
Water Absorption (% weight):	19
Durability:	F2
Gross Dry Density (Sound Insulation) (Kg/m³):	1530
Equivalent Thermal Conductivity "K" value 5% Exposed:	Refer to Ibstock
Initial Rate of Absorption (Suction Rate) (Kg/m²/min):	Refer to Ibstock
EAN:	5036335035245

09/05/2019

Brick Type D
Black Brick

Himley Ebony Black

IBSTOCK BRICK
an IBSTOCK plc company

Product Information	
Ibstock Code:	0354
Type:	Wirecut
Facing Description:	Dragfaced
Dry Brick Weight (kg):	2.3kg
Pack Quantity:	316
Packaging (standard):	Banded (plastic)
Factory:	Aldridge
Technical Specification (to BS EN 771-1)	
Brick Dimensions (L x W x H mm):	215x102x65
Size Tolerances Mean & Range:	T2 R1
Configuration:	Vertically Perforated
Voids (%):	23-28
Compressive Strength (N/mm²):	40
Active Soluble Salts:	S2
Water Absorption (% weight):	12
Durability:	F2
Gross Dry Density (Sound Insulation) (Kg/m³):	1500
Equivalent Thermal Conductivity "K" value 5% Exposed:	Refer to Ibstock
Initial Rate of Absorption (Suction Rate) (Kg/m²/min):	Refer to Ibstock
EAN:	5036335030400

09/05/2019

Brick Type G2

Black Glazed Brick

PRODUCT TECHNICAL INFORMATION SHEET

PRODUCT NAME	:	**GLAZED – BLACK**
REF. CODE	:	**11029610 (PANNINGEN)**
DESCRIPTION	:	**GLAZED**
MANUFACTURE	:	**EXTRUSION**
APPEARANCE	:	**SMOOTH**
CONFIGURATION	:	**PERFORATED – 20 HOLES VERTICAL**
WORK SIZE*	:	**215 x 102 x 65mm**

GUARANTEED PROPERTIES		**EN771-1 : 2003**
COMPRESSIVE STRENGTH	:	**MIN. 50N/mm^2**
WATER ABSORPTION	:	**MAX. 2%**
DURABILITY DESIGNATION	:	**F2**
ACTIVE SOLUBLE SALTS	:	**S2**
SIZE TOLERANCE * (/ RANGE)	:	**T2 – R2**
GROSS DENSITY (Tolerance)	:	**1700Kg/m^3 (D1)**
NET DENSITY (Tolerance)	:	**1800Kg/m^3 (D1)**
THERMAL CONDUCTIVITY (λ_{10},dry)	:	**P=90% 0.55 W/m.K**
INITIAL RATE OF WATER ABS.	:	**0.1/m^2.minute**
BOND STRENGTH (General Mortar)	:	**0.15 N/mm^2 (fixed value)**
REACTION TO FIRE	:	**Class A1**
WATER VAPOUR PERMEABILITY (μ)	:	**5/10 (tabulated)**
PACK QUANTITY	:	**384 no**
PACK SIZE (APPROX. mm)	:	**860 x 845 x 820 H**
TYPICAL PACK WEIGHT	:	**931 Kg**

ISSUE : JANUARY 2012

Render

Consent 2012 / 6858 / P
Condition No 15

Technical Data Sheet
Stolit® K

Organic finishing render to achieve a stippled texture

CE

Characteristics

Area of application

- exterior
- onto masonry, insulated facades and rainscreen cladding facades with a base coat
- on mineral and organic substrates
- not suitable for horizontal or sloping surfaces that are exposed to weathering

Properties

- render in accordance with EN 15824
- maximum reliability with regard to application, value retention, colour shade, and stability
- A2-s1, d0 in accordance with EN 13501-1
- with encapsulated film protection
- Shockproof and highly resistant to cracks and hail when combined with StoTherm Classic®
- highly permeable to water vapour
- highly water-repellent
- weather-resistant
- water-dilutable

Appearance

- stippled render texture

Information/notes

- see Services/Silo overview in the product guide or price list
- if the selected colour shade has a light reflectance value ≥ 15, no additional finish is necessary

Technical data

Criterion	Standard / test specification	Value/ Unit	Notes
Density	EN ISO 2811	1.7 - 1.9 g/cm³	
Diffusion-equivalent air layer thickness	EN ISO 7783	0.18 - 0.19 m	V2 medium, determined range for K 2

Technical Data Sheet
Stolit® K

Water permeability rate w	EN 1062-1	< 0.05 kg/(m²h$^{0.5}$)	W3 low
Water vapour diffusion-equivalent air layer thickness µ	EN ISO 7783	90 - 100	V2 medium
Reaction to fire (class)	EN 13501-1	A2-s1, d0	
Thermal conductivity	DIN 4108	0.7 W/(m*K)	

The characteristic values stated are average values or approximate values. Due to the natural raw materials in our products, the stated values can vary slightly in the same delivery batch; this does not affect the suitability of the product for its intended use.

Substrate

Requirements

The substrate must be firm, dry, clean, load-bearing, and free from sinter layers, efflorescence and release agents. Damp or not fully cured substrates can lead to defects in the following coatings, e.g. bubble formation, cracks.

If the finishing render has a grain size < 2.0 mm, it may be necessary to take additional measures to level the substrate.

Preparations

Check whether existing coatings are load-bearing. Remove any non load-bearing or structurally weak coatings.

Application

Application temperature

Lowest temperature of substrate/air: +5 °C

Material preparation

Dilute with as little water as possible to achieve application consistency. Stir the material well before application. If applying the material by machine or pump, adjust the application consistency accordingly. Do not dilute intensely tinted material, or only use very little water. Too much dilution impairs the properties of the material, e.g. with regard to application, hiding power, and colour shade intensity.

Consumption

Type	Approx. consumption	
K 1.0	1.80	kg/m²
K 1.5	2.30	kg/m²
K 2.0	3.00	kg/m²
K 3.0	4.30	kg/m²
K 6.0	6.00	kg/m²

Material consumption depends on the application, substrate, and consistency, among other factors. The stated consumption values are only to be used as a guide. If required, determine precise consumption values on the basis of the specific project.

Coating build-up

Primer:

Technical Data Sheet
Stolit® K

	Depending on the type and condition of the substrate, it may be necessary to apply consolidating, absorbency-regulating prime coatings. Intermediate coat on load-bearing, mineral substrates: If using on a mineral substrate, we recommend using an absorbency-equalising and adhesion-promoting intermediate coat.Note:If intermediate coats are omitted, this can impair the application properties and the product's appearance. Products: Sto-Primer or StoPrep QS (alkalinity-isolating) Intermediate coat on load-bearing, organic substrates: Recommendation:If the colour shade of the finishing render differs significantly from the colour shade of the substrate, apply an intermediate coat that aligns the colour shades.If applying a finishing render with a rilled texture, always apply an intermediate coat that has a similar colour shade. Products: Sto-Primer or StoPrep QS (alkalinity-isolating)
Application	manually, by machine As a rule, it is necessary to manually rework the freshly applied finishing render in order to achieve the desired texture and functionality. Use a rust-free steel trowel to trowel off the product evenly to grain size. Texture the surface with a hard plastic trowel or a PU plasterer's float. If using a finishing render ≥ grain size 3.0, it can be textured with a wooden float. The product can be applied with a hopper gun or commonly-available fine render sprayers. The application method, tools, and substrate have a significant impact on the result. The tools mentioned are recommendations only.
Drying, curing, ready for next coat	The product dries physically, in that water evaporates.The product is fully dry after approx. 14 days.Higher humidity, lower temperatures, and low air exchange prolong the curing and drying times. During unfavourable weather conditions it is very important to apply suitable protective measures (e.g. protection against rain) to the work in progress and freshly completed facades. At +20 °C temperature (air and substrate) and 65 % relative humidity, the product is over-coatable after 24 hours at the earliest.
Cleaning the tools	Clean tools with water immediately after use.
Delivery	
Colour shade	white, tintable in accordance with the StoColor System

Technical Data Sheet
Stolit® K

Colour shades with lower light reflectance values must be assessed and approved for the relevant system on a project-specific basis by the system manufacturer.

Colour stability:
Weathering, intensity of UV radiation, and moisture penetration change the surface over time. Visible changes in colour shade are possible.
This change process is influenced by material and project conditions.
Recommendation: A build-up of additional paint coats improves the colour stability of intense and/or very dark colour shades.

Texturing grain:
Natural white marble types are used as texturing grain. The natural graining of the marble can become partially visible and appear as darker texture grain in the finishing render.
With light clear (and especially clear yellow) colour shades, the colour of the texturing grain can shine through the finishing render across an area. This is due to the contrast between the colour shade of the finishing render and the colour shade of the marble grain.
Both effects are due to the basic appearance of a marble-filled finishing render and attest to the natural properties of the raw materials used. This does not influence the product quality or functionality.

Colour accuracy:
Different weather and project conditions influence colour shade accuracy and colour shade uniformity. Avoid the following conditions (a - d) in every case:
a) uneven absorbency of the substrate
b) different levels of substrate moisture over an area
c) partly very different alkalinity and/or substances in the substrate
d) direct sunlight with sharp, clear shadows on a still-damp coating

Washout of processing aids:
If water such as condensation, fog, or rain comes into contact with not fully dry coatings, processing aids may be released from the coating and build up on the surface. Whether the effect is strongly visible or not depends on the intensity of the colour shade. This does not influence the product quality. The effects disappear when the surface is exposed to further weathering.

Tintable	Possible to tint with max. 1 % StoTint Aqua.
Possible special options	There are no special settings for this product.
Packaging	Pail
Storage	
Storage conditions	Store tightly sealed in frost-free conditions. Protect from heat and direct sunlight.
Storage life	The quality of the product in its original container is guaranteed until the maximum storage life has expired. The storage life date can be deduced from the batch

Technical Data Sheet
Stolit® K

number of the container.
Batch number explanation:
Number 1 = the last number of year, numbers 2 + 3 = a calendar week
i.e.: 9450013223 – storage life until week 45 of the year 2019

Certificates/approvals

ETA-03/0027	StoTherm Classic® 1 (EPS and StoArmat Classic) European Technical Approval
ETA-05/0098	StoTherm Classic® 2 (EPS and StoLevell Classic) European Technical Approval
ETA-06/0004	StoTherm Classic® 3 (EPS and Sto-Reinforcement Fibre Plaster) European Technical Approval
ETA-13/0223	StoTherm Classic® 4 (EPS and StoArmat Classic AS) European Technical Approval
ETA-09/0058	StoTherm Classic® 5 (EPS and StoArmat Classic plus) European Technical Approval
ETA-11/0504	StoTherm Classic® 6 (timber frame construction - EPS and Sto-RFP, fixing: bonded) European Technical Approval
ETA-11/0505	StoTherm Classic® 7 (timber frame construction - EPS and StoPrefa Armat, fixing: bonded) European Technical Approval
ETA-09/0266	StoTherm Classic® 8 (EPS and StoArmat Classic/Classic plus) European Technical Approval
ETA-13/0582	StoTherm Classic® 9 (EPS and StoArmat RC) European Technical Approval
ETA-07/0156	StoTherm Classic® 1 MW/MW-L (StoArmat Classic) European Technical Approval
ETA-07/0088	StoTherm Classic® 2 MW/MW-L (StoLevell Classic) European Technical Approval
ETA-09/0288	StoTherm Classic® 5 MW/MW-L (StoArmat Classic plus) European Technical Approval
ETA-12/0533	StoTherm Classic® 10 MW/MW-L (StoArmat Classic S1) European Technical Approval
ETA-06/0003	StoTherm Classic® QS 1 (EPS and StoArmat Classic QS) European Technical Approval
ETA-06/0148	StoTherm Classic® QS 2 (EPS and StoLevell Classic QS) European Technical Approval
ETA-05/0130	StoTherm Vario 1 (EPS and StoLevell Uni) European Technical Approval
ETA-06/0045	StoTherm Vario 3 (EPS and StoLevell Novo) European Technical Approval
ETA-06/0107	StoTherm Vario 4 (EPS and StoLevell Duo) European Technical Approval
ETA-03/0037	StoTherm Vario 5 (EPS and StoLevell Beta) European Technical Approval
ETA-12/0561	StoTherm Vario 7 (EPS and StoLevell FT) European Technical Approval

Technical Data Sheet
Stolit® K

ETA-09/0231	StoTherm Mineral 1 (MW/MW-L and StoLevell Uni) European Technical Approval
ETA-07/0027	StoTherm Mineral 3 (MW/MW-L and StoLevell Novo) European Technical Approval
ETA-13/0901	StoTherm Mineral 5 (MW/MW-L and StoLevell FT) European Technical Approval
ETA-13/0581	StoTherm Mineral 8 (timber frame construction - MW-L and StoLevell Uni/StoLevell Novo, fixing: bonded) European Technical Approval
ETA-08/0303	StoTherm Wood 1 (timber frame construction - soft wood fibre and StoLevell Uni/StoLevell FT/StoLevell Novo, fixing: anchor-fixed) European Technical Approval
ETA-09/0304	StoTherm Wood 2 (timber frame construction - soft wood fibre and StoLevell Uni/StoLevell FT, anchor/adhesive) European Technical Approval
ETA-06/0197	StoTherm Cell European Technical Approval
ETA-09/0267	StoTherm Resol European Technical Approval
ETA-13/0580	StoTherm Resol Plus European Technical Approval
ETA-17/0041	StoTherm PIR European Technical Approval
ETA-17/0406	StoVentec R European Technical Approval

Identification

Product group	Render

Composition

In accordance with the VdL directive (German Paint and Printing Ink Association)
on coating materials for buildings
polymer dispersion
titanium dioxide
mineral extenders
aluminium hydroxide
silicate extenders
organic extenders
water
aliphatics
glycol ether
hydrophobic agents
dispersing agent
thickener
wetting agents
coating protection agent based on OIT / diuron
storage protection agent based on BIT/MIT (1:1)

Technical Data Sheet
Stolit® K

Safety	Observe the Safety Data Sheet! Safety instructions refer to the ready-to-use, unapplied product.
EUH210	Safety data sheet available on request.
EUH208	Contains 2-octyl-2H-isothiazol-3-one, 1,2-benzisothiazol-3(2H)-one, mixture of: 5-chloro-2-methyl-4-isothiazolin-3-one [EC no. 247-500-7] and 2-methyl-2H-isothiazol-3-one [EC no. 220-239-6] (3:1), 2-methyl-2H-isothiazol-3-one. May produce an allergic reaction. These are preservatives.

Special notes

The information in this Technical Data Sheet serves to ensure the product's intended use, or its suitability for use, and is based on our findings and experience. Users are nevertheless responsible for establishing the product's suitability and use.
Applications not specifically mentioned in this Technical Data Sheet are permissible only after prior consultation. Where no approval is given, such applications are at the user's own risk. This applies in particular when the product is used in combination with other products.

When a new Technical Data Sheet is published, all previous Technical Data Sheets are no longer valid. The latest version is available on the Internet.

Sto SE & Co. KGaA
Ehrenbachstr. 1
79780 Stühlingen / Germany
Phone: +49 7744 57-0
Fax: +49 7744 57-2178
Infoservice.export@sto.com
www.sto.com

Metal Finishes

Consent 2012 / 6858 / P
Condition No 15

PVD Stainless steel ‘brass’ cladding

Charing Cross Road Elevation

mirrorINOX
METAL I SURFACE I TREATMENT

Product Data Sheet

mirrorINOX product name: **HAIRLINE GOLD TiN t*finish***

Substrate Material:

Stainless steel grades 316

Substrate Finish:

HAIRLINE finish

Composition and ingredients of PVD-Coating:
Titanium Nitride
CAS no. 25583-20-4
% at. 99+

Dimensions and thicknesses:

Max. length:	6000 mm
Max. width:	2000 mm
Thickness:	0,8 - 3,0 mm

General information about the PVD-process

The abbreviation PVD stands for **Physical Vapour Deposition**.
When larger areas, in this case stainless steel sheets, are coated with the PVD-process, ARC-evaporation is used.

mirrorINOX places the material in sheetsform in a fixture, which is put into a high-vacuum chamber.

By evaporating a solid matter , the so-called target, via an electric arc and by utilizing suitable reactive gases, different temperatures and other machine parameters, a chemical compound of metal and non-metal is deposited onto the metals sheets.

The deposition process is continued until the desired colour and coating thickness is achieved and then the sheets are removed from the vacuum chamber.

Application:

Project “St. Giles” , GB London

Client: Frener & Reifer

PVD - TITANIUM NITRIDE COATING

The PVD - TiN coating of large surfaces (sheets) using ARC evaporation, which evaporates the solid, the so-called target, via an electric arc.

By utilizing suitable reactive gases, different temperatures, and other machine parameters, a chemical compound of metal and non-metal is coated onto the sheet (or workpiece). Various colours can be obtained in this manner.

DIMENSIONS

Width: 0 – 1500 mm
Length: 0 – 6000 mm
Hight / thickness: 0.5 – 400 mm

MATERIAL

Rust-free stainless steel

COLOURS

gold
rose-gold
brass
champagne
bronze
copper
black
blue

BASE SURFACE

All variations are possible in this respect, i.e.

Work surface 2B, 2R
- Ground (brushed lengthwise, cross section grinding, vibration grinding, cross-hatch, hairline)
- Polished (industry polish no. 7, high gloss polish no. 8)
Patterned, pattern rolled (leather, linen, diamond, checked, 5 WL, 6 WL, 7 WL, etc.)
Blasted (from very fine to coarse)

SPECIAL FEATURES

Option of design one or both sides.

mirrorINOX
METAL I SURFACE I TREATMENT

Product Data Sheet

mirrorINOX product name: **TiN t*finish***

Substrate:

Stainless steel surfaces,
such as Super Mirror No. 8, SATIN, HAIRLINE, PATTERNED and other finishes

Composition and ingredients of PVD-Coating:

Titanium Nitride
CAS no. 25583-20-4
% at. 99+

Hazard Identification

HAZARD OVERVIEW:
We do not consider this product in the form (solid) it is sold to constitute a physical hazard or a health hazard.
Subsequent operations such as abrading, melting, welding, cutting or processing in any other fashion may produce

CARCINOGENIC REFERENCES: Components are -
Not recognized by OSHA as a carcinogen; Not listed in the National Toxicology Program;
Not listed as a carcinogen by the International Agency on Research on Cancer

First Aid Measures

FIRST AID FOR EYES: Dust or powder should be flushed from the eyes with running water for 15 minutes. If irritation persists obtain medical assistance.
FIRST AID FOR SKIN: Skin cuts and abrasions can be treated by standard first aid. Skin contamination with dust or powder can be removed with soap and water. If irritation persists obtain medical assistance
FIRST AID FOR INGESTION: Obtain medical assistance at once.
FIRST AID FOR INHALATION: Breathing difficulty, caused by inhalation of dust or fume requires removal to fresh air. If breathing has stopped perform artificial respiration and seek medical assistance at once.

Fire Fighting Measures

FLAMMABILITY: In solid form, not flammable
EXTINGUISHING MEDIA: Ordinary extinguishers are often in effective against metal fires; use Class “D” extinguishing agents.
SPECIAL FIRE FIGHTING PROCEDURES: Self-contained breathing apparatus should be worn when fighting metal dust fires. High levels of dust or fine particles in the air may ignite or explode.

Accidental Release Measures

SPILL OR LEAK PROCEDURES: In solid form this material poses no special clean-up problems. Use normal clean up procedures; wet sweeping or HEPA vacuum.

Storage and Handling

In solid form this material poses no special problems. Store metal in a dry area away fro moisture. Do not store adjacent to acids

Exposure Control/Personal Protection

EXPOSURE LIMIT VALUES:
Not established for product as whole. TLV, ACGIH: N/A mg/m$_3$ PEL, OSHA: N/A mg/m$_3$

PERSONAL PROTECTIVE EQUIPMENT:
Eye protection requirements: Safety glasses are recommended.
Skin protection requirements: Protective gloves are recommended, to prevent mechanical irritation.
Respiratory protection: Not normally required, use an appropriate NIOSH approved respirator if airborne dust concentration exceed the OSHA, PEL or ACGIH, TLV
Other protective equipment: Eye wash fountain should be readily available in areas of use or handling.

VENTILATION REQUIREMENTS:
Local Exhaust: Recommended, when cutting, grinding or melting or any other operation where dust or fumes are created
General Exhaust: Recommended.

ENVIRONMENTAL SURVEILLANCE: If the operation generates dust or fumes, exposure to airborne materials should be determined by having air samples taken in the employees breathing zone and work area

Physical and Chemical Properties

PHYSICAL FORM: Solid metal COLOR: Gray
ODOR: None MELT POINT: 2950$_o$
SOLUBILITY IN WATER: Insoluble SPECIFIC GRAVITY: N/A
VOLATILE BY WEIGHT: Essentially zero DENSITY: 5.22 g/cm$_3$

Reactivity

STABILITY: This is a stable material. HAZARDOUS POLYMERIZATION: Will not occur.
INCOMPATIBILITIES: Oxidizing agents
DECOMPOSITION PRODUCTS: None under proper usage conditions.
CONDITIONS TO AVOID: Conditions which create dust or fumes. High heat and flame

Toxicological Information

Under normal use of the solid form of this material there are few health hazards. Welding, cutting grinding or any process creating dust, fume or oxide may cause hazardous levels of certain elements, as addressed in Section 3.

PVD Stainless steel ‘mirror’ cladding

Pressed Insulated Recessed Panels - Building A

Ecological Information

In solid form this material poses no special environmental problems. Metal powder or dust may have significant impact on air and water quality. Emissions, spills and releases to the environment should be controlled immediately.

Disposal Considerations

Dispose of in accordance with all applicable Federal, State and Local Regulations.

Transportation Information

GROUND TRANSPORTATION:
D.O.T. SHIPPING NAME: Flammable solid, inorganic, n.o.s.
(Titanium nitride)
D.O.T. HAZARD CLASS: 4.1
UN/NA NUMBER: 3178
PACKING GROUP; III
AIR TRANSPORT:
ICAO-TI & IATA- DGR: Same as DOT

This MSDS has been revised following the guidelines outlined in the American National Standard for Hazardous
Materials Z400.1.1393 “ Material Safety Data Sheets – Preparation”
DISCLAIMER:

The information and recommendations are taken from sources believed to be accurate.
mirrorINOX gives no warranty in respect to the accuracy of the information or the suitability of the recommendations, and assumes no liability to any user thereof.
Employers should use this information only as a supplement to other information gathered by them, and should make independent judgment of suitability of this information to ensure proper use and protect the health and safety of employees.

MIRROR POLISHING

During mechanical polishing the surface is stripped and smoothed by the polishing carrier in conjunction with polishing agents. Different results (grades) can be achieved depending on the base material, base surface, and working phase. The roughness, the degree of gloss, and the visual impression provide a basis for inspection checks.

Multiple polishing machines enable mirrorINOX to have a high production depth, various surface finishes, and sufficient capacity.

DIMENSIONS

Width: 0 – 2050 mm
Length: 0 – 10,000 mm
Hight / thickness: 0.5 – 500 mm

MATERIAL

Austenitic rust-free stainless steel (preferably mat. 1.4301 and 1.4404)
Brass
Aluminium

FORMS / GEOMETRIES

Sheets
Pipes rectangular, square
Flat materials

QUALITIES

Rust-free stainless steel, industrial-polished directionless, no.7
Glossy/mirror polished, no. 8 (Super Mirror 2P)
Glossy/mirror polished, no. 10 (Perfect Mirror)
Brass, bright rolled, high gloss polish
Aluminium, bright rolled, high gloss polish

SPECIAL FEATURES

Option of design for one or both sides. High inventories and sufficient production capacity guarantee the fastest possible delivery service. Modern special equipment also allows us to mirror polish mold parts (e.g. housings, finished parts) up to a height of 500 mm as well as material edges and flat materials.

Polyester Powder Coated (PPC)

Aluminium Louvres / Cladding / Coping

IGP-HWF*classic*

5903, mat

Highly **W**eather-resistant Facade Quality

IGP-HWF*classic* 5903 is a highly weather resistant coating powder with reduced stoving conditions from 170°C for process- and energy-efficient coating solutions.

Technical Data Sheet

Product description

IGP-HWF*classic* 5903 is the result of many years of development by IGP involving the production of **highly weather-resistant coatings for architectural applications** on saturated polyester resin base and with declaration-free hardeners.

Characteristics / application

- Façade elements
- Window profile sections

The coatings have good mechanical values and high resistance to chemicals.
High UV resistance, slower film degradation and the dirt-repelling properties of the film surface allow much longer intervals between facade cleaning operations.

By the addition of the IGP-DURA®*clean*-effect the IGP-HWF products possess a surface which can be cleaned eysily.

Product range

Surface appearance

- **5903A**, smooth flowing, mat with IGP-DURA®*clean*-effect
- **5903E**, pearl mica effects, mat with IGP-DURA®*clean*-effect

Gloss, DIN EN ISO 2813: 25-35 R′/60°

Colour shades
Due to the limited selection of highly weather-resistant pigments, the product range includes only a limited number of different colours according to the special IGP colour chart.

Powder specification

- Particle size: < 100 µm
- Solids: approx. 99%
- Density depending on colour: 1.2-1.6 kg/l
- Storage stability: min. 24 months
- Storage temperature: < 25° C

Packing

- Carton with antistatic PE liner, capacity 20 kg.
- Carton container 25 antistatic PE liners, capacity 500 kg.

Material approvals:
GSB No. 173o, Master
Qualicoat N° P-1137, class 2
AAMA 2604-13,
independent inspection documentation

Article-specific safety data sheet and further risk management measures at:
www.igp-powder.com

IGP Pulvertechnik AG
Ringstrasse 30
CH-9500 Wil
Telefon +41 (0)71 929 81 11
Telefax +41 (0)71 929 81 81
www.igp-powder.com
info@igp-powder.com

www.doldgroup.com

IGP Pulvertechnik AG · Ringstrasse 30 · CH-9500 Wil · Tel. +41 (0)71 929 81 11 · Fax +41 (0)71 929 81 81 · www.igp-powder.com · info@igp-powder.com

IGP-HWF*classic* 5903

Processing instructions

Pre-treatment
The substrate to be coated must be free of oxidation products, or residue from scale, oil, grease or release agents. Depending on application range and the planned usage duration, a pre-treatment suitable for the substrate is used:

Aluminium substrate:

Chromating:	DIN EN 12487
Chrome-free pre-treatment:	possible option
Pre-anodisation:	possible option

Steel substrate:
Zinc or iron (Fe) phosphating
Galvanised sheet metal: Chromatising in accordance with DIN EN 12487

For improved corrosion protection for applications on steel / galvanised steel, the use of corrosion protection primer IGP-KORROPRIMER 10 is recommended.
The suitability of the pre-treatment method used is generally to be tested by the coater in advance with appropriate test methods. The minimum requirement for aluminium substrates / galvanised steel components intended for architectural applications is performing a boil test / pressure cooker test with a subsequent cross-cut adhesion and pull-off test. We refer to the guidelines of the GSB certifications and Qualicoat.
For further information: see also our special leaflet on pre-treatment (IGP-TI 100).

Coating equipment
All commercially available electrostatic systems, both "corona" and Tribo charge" type, with the exception of pearl mica effects which must be processed only with "corona" charging. Relevant regulations: VDE requirements and VDM data sheet 24371.
IGP processing instructions for "Pearl Mica Effects": VR 201.

Coating / recycling
Recycled powder should be added to the fresh powder in small amounts, as far as possible automatically. Important: Overspray should always be kept to a minimum.

Stoving conditions
The temperature and time combinations resulting in optimum cross-linking of the coating are shown

Object-temperature	*Retention time at object-temperature*	
	minimum	*maximum*
170°C	20 min.	30 min.
180°C	**15 min.**	25 min.
190°C	10 min.	20 min.

You are advised to carry out practical trials adapted to the object in question and the stoving oven in order to determine the optimum stoving conditions. Our Technical Department will be glad to help.

Technological values

To determine the following data, IGP-HWF*classic* 5903 was applied as follows:

- Aluminium sheet (AlMg1 H14 or „Q Panel AA 5005-H24") 0.8 mm, chromatised
- Coating thickness 60 µm
- Object temperature 180°C, 15 min.

Gloss, DIN EN ISO 2813	25-35 R′/60°
Cross-cut adhesion test, DIN EN ISO 2409	Gt 0
Mandrel bending test, DIN EN ISO 1519/tape test:	< 5 mm
Reverse Impact, DIN EN ISO 6272/tape test:	> 2,5 Nm
Erichsen cupping, DIN EN ISO 1520/tape test:	> 5 mm
Buchholz hardness, DIN EN ISO 2815	> 80

Weathering
3 years Florida, 5° south: > 50% residual gloss

Accelerated weathering
1000h DIN EN ISO 16474-2: > 90% residual gloss

1000h Condensation test, DIN EN ISO 6270-2 AT:
no infiltration, no bubbles.

1000h Salt spray test, DIN EN ISO 9227 AASS:
no infiltration, no bubbles.

Mortar resistance, ASTM D 3260:
easily removable after 24h without residues.

See also "Qualicoat" testing standards (Issue 13.09.2012), Class 2 Powder.

Cleaning

The coated parts are to be cleaned according to the specifications RAL-GZ 632 or SZFF 61.01.

For Pearl Mica effects, the Technical Information IGP-TI 106 must be observed in addition.

Note

Our technical advice on application, given verbally, in writing or through trials is provided to the best of our knowledge but is to regarded solely as non-binding information and does not release you from the need to carry out your own tests and trials. Application, use and processing of the products take place outside our ability to supervise and are therefore exclusively your own responsibility.

POWDER COATINGS.

07.16 · TDS classic 5903 / V15 · WM

Anodised aluminium

Aluminium Cladding

Authorization
to use the quality sign

QUALITY LABEL
INTERNATIONAL
FOR ANODISING
Qualanod
ARCHITECTURE

This is to certify that

AGRU Oberflächentechnik GmbH

Steyrstrasse 31
AT – 4595 Waldneukirchen

Licence number: 102

is authorized to use the quality sign which is shown above, according to the regulations for the use of the quality label for ARCHITECTURAL ANODIZING as described in the current edition of the Specifications for the QUALANOD quality label for sulfuric acid-based anodizing of aluminium (Edition 01.01.2019). Architectural anodizing is one of the four types of anodizing covered by the Specifications.

Date of issue of the licence: **14.07.1976**

Period of validity of the licence: **until 31.12.2019**

Zurich, 20 November 2018

QUALANOD **CERTIFICATION BODY**

Remco Bartmaans
President

Josef Schoppig
General Secretary

Mailing address:
QUALANOD, P.O. Box 1507, CH-8027 Zurich

Domicile:
QUALANOD
c/o ARCO Association Management AG
(certification body)
Tödistrasse 42, CH-8002 Zurich

Website: www.qualanod.net
E-Mail: josef.schoppig@arco.swiss // Phone: +41 (0)43 305 09 70

ELOXAL

Einflüsse auf die Qualität

- Wir eloxieren nach den Richtlinien des EURAS/EWAA und nach ÖNORM C2531. Ausgenommen ist der Schleiftest bei Farbeloxal (aus optischen Gründen) und bei Bauteilen mit einer Bautiefe über 300 mm und bei Sonderkonstruktionen. Zur Erzielung einer einwandfreien Eloxalqualität ist darauf zu achten, dass Aluminium mit einer hochwertigen und dekorativen Eloxierqualität verwendet wird. Beachten Sie ÖNORM C2531.
- Es wird empfohlen, zu anodisierende Teile, die zu einer geschlossenen Fläche zusammengesetzt werden (z.B. eine Fassadenseite), in einer Materialzusammensetzung zu bestellen, da unterschiedliche Legierungen zu Farbabweichungen führen können.
- Halbzeugbedingte optische Mängel können erst nach dem Anodisieren sichtbar werden, z. B. verursacht durch:
  - Strangpressnähte
  - Warmverformungen
  - Zusammentreffen unterschiedlicher Walzrichtungen
  - Streifenbildung, Stegabzeichnungen
  - Korrosionen, Oxideinschlüsse, Magnesiumabscheidungen, Grobkorn
  - Walzwellen bei Blechen
  - Schweißnähte
- Zusammengesetzte, genietete oder gebördelte Teile sind nicht zulässig, da die aus Fugen und Kapillarhohlräumen schwierig zu entfernenden Elektrolytreste zu späteren Korrosionsschäden führen können.
- An den zu anodisierenden Teilen dürfen keine Konstruktionsteile aus anderen Materialien vorhanden sein.
- Weiters ist darauf zu achten, dass aus Hohlräumen der Elektrolyt sicher und restlos entfernt werden kann (z. B. durch Bohrungen).
- Besonders bei Präzisionsteilen (z. B. Maschinenteile) ist darauf zu achten, dass durch den Eloxiervorgang eventu-ell geringe maßliche Änderungen auf-treten können.
- Bei der Eloxierung ist ein fester elektrischer Kontakt (Kontaktpunkte und Kon-taktstreifen) erforderlich. Eine Zeich-nung mit Sichtseitenangabe ist daher unbedingt dem Anlieferungsschein beizuheften. Bei Blechen werden üblicherweise an der Rückseite Kontaktstreifen und an der Vorderseite Kontaktpunkte angebracht. Profile werden an beiden Enden (2 - 3 cm) kontaktiert!
- Gesonderte Kontaktierungswünsche müssen auf sämtlichen Anlieferdokumenten angeführt werden!
- Bei Rahmenkonstruktionen/Hohlräumen: Ein- und Ablaufbohrungen sind vom Kunden anzubringen. (siehe Seite 16). Sind die Ablaufbohrungen nicht korrekt angebracht oder z.B. durch ALU-Späne verlegt, so kann die Vorbehandlungsflüssigkeit nicht ordnungsgem. aus dem Hohlraum auslaufen. Ist aufgrund des geschilderten Fehlers eine Nacharbeit erforderlich, so bitten wir um Ihr Verständnis, dass diese zu Ihren Lasten duchrgeführt wird!
- Eloxierungen von Materialen mit Wandstärken < 1 mm können nur auf Risiko des Kunden durchgeführt werden.

Produktionsablauf:

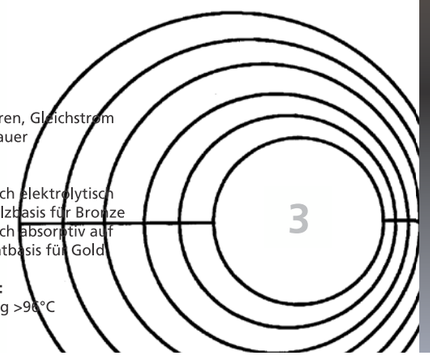
Vorbehandlung:
- Alkalische Entfettung
- Alkalische Beize auf Basis Natronlauge (Ätznatron)
- Anstatt der chem. Vorbehandlung ist auch eine mechanische Vorbehandlung (E1 – E5) möglich.

Feinbeize:
- Dekapierung auf Basis HNO3+H2S04+H202

Eloxal:
- GS-Verfahren, Gleichstrom Schwefelsauer

Farbeloxal:
- Anorganisch elektrolytisch auf Zinnsalzbasis für Bronze
- Anorganisch absorptiv auf Ferrooxalatbasis für Gold

Verdichtung:
- Heißsealing >98°C



ELOXAL

Vor-behandlung

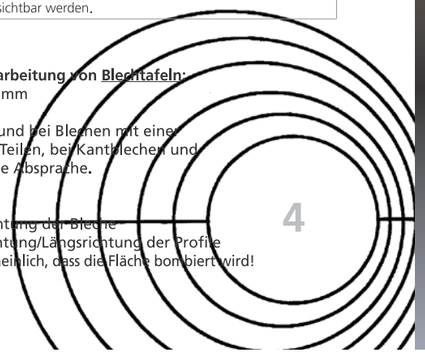
Lieferübersicht lt. ÖNORM C 2531
Die mechanische und/oder chemische Vorbehandlung dient dazu, die Oberfläche der Teile für die anodische Oxidation vorzubereiten. Hierdurch können bestimmte Oberflächeneffekte erzielt wer-

Code	Art der Vorbehandlung	Erläuterungen
E0	ENTFETTEN UND DESOXIDIEREN	Die Oberflächenbehandlung erfolgt vor dem Andosieren, bei der die Oberfläche ohne weitere Vorbehandlung entfettet und desoxidiert wird. Vorhandene mechanische Oberflächenfehler, zB Eindrücke, Kratzer, Riefen, Einschlüsse und Korrosionserscheinungen, bleiben sichtbar. Vor der Behandlung kaum wahrgenommene Oberflächenfehler können nach der Behandlung sogar verstärkt sichtbar werden. AGRU beizt trotzdem 3 min.! Bitte bei Passungen berücksichtigen.
E1	SCHLEIFEN	Schleifen führt zu einem vergleichsweise einheitlichen, aber etwas matteren Aussehen. Vorhandene mechanische Oberflächenfehler, zB. Eindrücke, Kratzer, Riefen, Einschlüsse und Korrosionserscheinungen, werden teilweise beseitigt. Je nach Schleifmittelkörnung sind grobe bis feine Schleifriefen sichtbar. Vorher nicht sichtbare Korrosionserscheinungen, die bei den Behandlungen E0 oder E6 sichtbar werden können, werden teilweise beseitigt (kein Planschliff).
E2	BÜRSTEN	Mechanisches Bürsten bewirkt eine einheitliche, glänzende Oberfläche mit sichtbaren Bürstenstrichen. Vorhandene mechanische Oberflächen- fehler, zB Eindrücke, Kratzer, Riefen, Einschlüsse und Korrosionser- scheinungen, können nur in begrenztem Umfang entfernt werden. Vorher nicht sichtbare Korrosionserscheinungen, die bei den Behandlungen E0 – E6 sichtbar werden können, werden nicht beseitigt (kein Planschliff).
E3	POLIEREN	Mechanisches Polieren führt zu einer glänzenden, blanken Oberfläche. Vorhandene mechanische Oberflächenfahler, zB Eindrücke, Kratzer, Rie- fen, Einschlüsse und Korrosionserscheinungen, bleiben sichtbar und wer- den nicht beseitigt. Vorher nicht sichtbare Korrosionserscheinungen, die bei den Behandlungen E0 oder E6 sichtbar werden können, werden nicht beseitigt (kein Planschliff).
E4	SCHLEIFEN UND BÜRSTEN	Durch Schleifen und Bürsten wird eine einheitlich glänzende Oberfläche erreicht. Vorhandene mechanische Oberflächenfehler, zB Eindrücke, Kratzer, Riefen, Einschlüsse und Korrosionserscheinungen, werden teil- weise beseitigt. Vorher nicht sichtbare Korrosionserscheinungen, die bei den Behandlungen E0 oder E6 sichtbar werden können , werden teilweise beseitigt (kein Planschliff).
E5	SCHLEIFEN UND POLIEREN	Durch Schleifen und Polieren wird ein glattes, glänzendes Erscheinungsbild erreicht. Vorhandene mechanische Oberflächenfehler, zB Eindrücke, Kratzer, Riefen, Einschlüsse und Korrosionserscheinungen, werden teilweise beseitigt. Vorher nicht sichtbare Korrosionserscheinungen, die bei den Behandlungen E0 oder E6 sichtbar werden können , werden teilweise beseitigt (kein Planschliff).
E6	BEIZEN	Nach dem Entfetten und Beizen erhält die Oberfläche in der Regel eine satinierte, mattierte Oberfläche, indem sie in speziellen alkalischen Beiz- lösungen behandelt wird. Vorhandene mechanische Oberflächenfehler, zB Eindrücke, Kratzer, Riefen, Einschlüsse und Korrosionserscheinungen, werden nicht beseitigt. Diese können durch eine mechanische Vorbehandlung (E1, E4 oder E5) vor dem Beizen teilweise beseitigt werden. Gefügeunregelmäßigkeiten, zB Grobkornbildung, Streifenbildung sowie auch Schweißnähte, können insbesondere durch diese Behandlung sichtbar werden. Vor der Behandlung kaum wahrgenommene Oberflächenfehler können nach der Behandlung sogar verstärkt sichtbar werden.

Maximale Bearbeitungsgröße bei der mech. Bearbeitung von Blechtafeln:
E1, E2-microliert und E4-microliert: 3300 x 1800 mm

E2-gebürstet, E3, E4-gebürstet, E5: Bei Profilen und bei Blechen mit einer max. Breite von 200 mm möglich. Bei größeren Teilen, bei Kantblechen und bei Teilen über 20 kg ersuchen wir um vorherige Absprache.

Bitte beachten Sie:
Schleifrichtung bei Blechen ist immer = Walzrichtung der Bleche
Schleifrichtung bei Profilen ist immer = Pressrichtung/Längsrichtung der Profile
Bei Schleifbreiten kleiner 30 mm ist es sehr wahrscheinlich, dass die Fläche bombiert wird!



ELOXAL

Farbgebung

Lieferübersicht
Als Standardfarben bieten wir Natur-, Bronze- und Goldtöne lt. AGRU-Eloxalfarbfächer an.

Code	Farbbezeichnung	Hinweise
C0	UNGEFÄRBT	Bei dieser Ausführung wird nach dem GS-Bad keine Einfärbung vorgenommen. Der helle **Naturton** bleibt erhalten.
C31 C32 C33 C34 C35	LEICHTBRONZE HELLBRONZE MITTELBRONZE DUNKELBRONZE SCHWARZ	**Bronzetöne** (Brauntöne) werden auf elektrolytischem Wege mit Hilfe von Wechselstrom und Metallsalzlösungen erzielt.
C2 C3 C4	HELLGOLD MITTELGOLD DUNKELGOLD	**Goldtöne** werden in anorganischen Farbstofflösungen erzielt.

Farbtöne lt. AGRU-Eloxalfarbfächer

Sonderfarben
Diverse Farbtöne können im GS-Bad erzeugt werden, unter der Voraussetzung, dass bestimmte Aluminiumlegierungen verwendet werden.
Für Projekte können auf Wunsch auch Zwischenfarbtöne hergestellt werden.

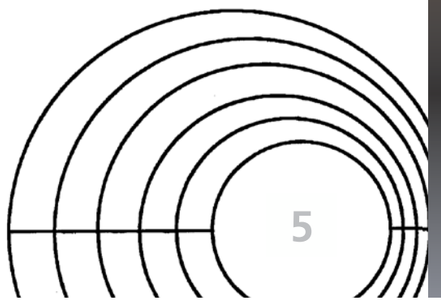
Meist kann das Aussehen der Oberfläche nach der Anodisierung mit einfachen Messmethoden nicht erfasst werden. Dekoratives Aussehen, Glanz und Farbe sind daher anhand von Grenzwertmustern, getrennt nach Halbzeug, von Ihnen zum Anfordern.

Farbunterschiede sind verfahrens- und halbzeugbedingt möglich.

Maximale Bearbeitungsgrößen (sofern mittige Kontaktierung möglich):

Natur: 750 x 7500 x 2100 mm
Bronze: 500 x 7500 x 2100 mm
Gold: 500 x 7500 x 2100 mm
Größere Teile auf Anfrage!

Ab einer Schichtdicke von 20 my max. Bautiefe 300 mm!



ELOXAL

- **Güteanforderung**
  (nach ÖNORM C 2531)

- **Dicke der Oxidschicht**
  Die erforderliche Dicke der Oxidschicht richtet sich nach den chem. und / oder mechanischen Beanspruchungen.

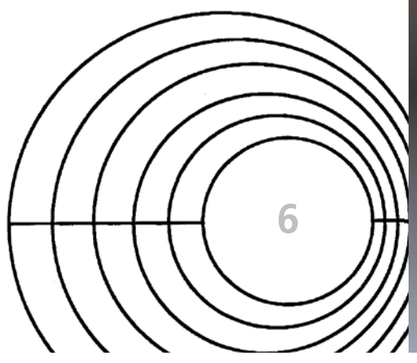
Lage und Beanspruchung	Dickenklasse
Innen trocken	10
Innen, zeitweise nass, Außen, ländliche Atmosphäre ohne Luftverunreinigungen (nur geringe SO_2-Mengen aus Haus- und Industriefeuerungen)	15
Außen, Stadt- und Industrieatmosphäre (SO_2 aus Verbrennungs- und Industrieabgasen)	20
Aggressive Atmosphäre wie Straßenbau/Seeklima	25

- Die Messung der Schichtstärken erfolgt mit Wirbelstromgeräten.
  Die Messgenauigkeit beträgt ±2 µm.

  Es ist zu beachten, dass die Schichtdicke in zB Nuten, Kavitäten, Hohlräumen, verdeckten Kanten und bei größeren Bautiefen verfahrensbedingt geringer sein kann. Daher kann bei diesen Stellen die vereinbarte Dickenklasse nicht erreicht werden.

  Die von EURAS/EWAA vorgeschriebenen Werte das Schleiftestes werden bis zu einer Bautiefe von max. 300 mm eingehalten.

  Hinweis: Erfolgt vom Kunden am Lieferschein – welcher für uns als Bestellung gilt, keine Angabe bzgl. Schichtstärke, so wird auf 15 µm eloxiert.



Metallic Lead

British Lead

1. IDENTIFICATION OF SUBSTANCE/PREPARATION AND COMPANY/UNDERTAKING

Product Name: Metallic Lead

Use: Used in the construction industry for roofing, flashing and cladding applications. Also used as shielding in the x-ray and nuclear industries and sound attenuation applications.

Supplier: British Lead
Peartree Lane
Welwyn Garden City
Hertfordshire AL7 3UB
Telephone: 01707 324595
Fax: 01707 328941

2. COMPOSITION/INFORMATION ON INGREDIENTS

Ingredient: Lead
EU No: 231-100-4
Cas No: 7439-92-1
Content %: >99

3. HAZARDS IDENTIFICATION

Main Hazards: Lead in its solid metallic state (Lead sheet) would not normally present a hazard. However, Lead is a toxic metal and may present a hazard via Lead fumes when melted and/or from Lead dust. Low concentrations of other various elements will be present, some as alloying constituents, others, as impurities. Oxidation of the surface of the Lead will occur forming a surface layer of Lead compounds.

4. FIRST AID MEASURES

The measures below are unlikely to be relevant whilst Lead is in its solid metallic state. However they are relevant if there is a likelihood of exposure to fumes from melting Lead and Lead dust compounds on the surface caused by oxidation.

Inhalation of Fumes or Dust: Move person to fresh air. Seek medical attention.

Ingestion of Dust: Do not induce vomiting, encourage drinking of water. Seek immediate medical attention.

Eye Contact from Dust: Ensure that any contact lenses are removed from the eyes before rinsing. Irrigate eyes with plenty of water for 5 minutes and seek medical attention if irritation persists.

Skin Contact: Remove potentially contaminated clothing after using Lead products. Wash affected area with soap and water. Lead would not normally irritate the skin. Seek medical attention if irritation persists as it maybe due to contact with other substances or chemicals.

5. FIRE-FIGHTING MEASURES

Extinguishing Media: Non flammable but molten Lead may ignite adjacent materials. Use Dry powder, CO_2 or Foam. Do not use water.

Exposure Hazards: Toxic Fumes may be produced during a fire.

Protection of Firefighters: Wear positive pressure self contained breathing apparatus and suitable protective clothing.

6. ACCIDENTAL RELEASE MEASURES

Personal Protection: No special measures required whilst Lead is in its solid metallic state. When melting Lead or cleaning up any Lead spillage protective clothing must be worn, this would include eye protection, gloves and an approved face mask. This precaution also applies if Lead dust is present.

Environmental Precaution: Avoid entry into water courses.

Clean-up Procedures: Spillages should be cleaned and placed in to a sealed container and then sent to a Lead processing company for treatment.

7. HANDLING AND STORAGE

Handling Precautions: Lead is a heavy metal; extreme care should be taken when lifting the material. Follow the guidelines set out in the HSE Manual Handling Regulations. Wear gloves, protective clothing and boots and follow standard personal hygiene procedures.

Storage: Store in a dry area, ensure that the floor loading is not exceeded.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Component: TWA
Lead 8 Hours 0.15mg/m^3

Respiratory Protection: Wear approved face masks when melting Lead or working in the vicinity of Lead dust particles especially when stripping old Lead roofs – make sure the face mask meets the standard required. Employ mechanical ventilation equipment when melting Lead in enclosed areas.

Hand Protection: Wear suitable gloves.

Eye Protection: Wear safety goggles when melting Lead or Lead welding.

Skin Protection: Wear gloves and protective clothing. Follow standard personal hygiene procedures.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Bluish grey soft metal
Melting Temperature: 327°c
Fuming Temperature: 500°c
Density: 11.34g/cm^3
Odour: None
Flash Point: N/A
Solubility in Water: Insoluble

10. STABILITY AND REACTIVITY

Stability: Stable under normal conditions at low temperature.
Conditions to Avoid: N/A
Materials to Avoid: Ammonium nitrate, chloride trifluoride, hydrogen peroxide, potassium, sodium azide, sodium carbide and zirconium.

Hazardous Decomposition Products: Lead is a toxic metal and may produce hazardous fumes when melted.

11. TOXICOLOGICAL INFORMATION

The details below are unlikely to be relevant whilst Lead is in its solid metallic state. However they are relevant when exposed to fumes from melting Lead and Lead compounds on the surface caused by oxidation and from Lead dust.

Inhalation: Prolonged unprotected exposure could lead to various symptoms typical of Lead poisoning although this is extremely rare.

Ingestion: Could cause nausea or abdominal pain. Prolonged exposure could lead to various symptoms typical of Lead poisoning although this is extremely rare.

Skin Contact: Prolonged unprotected contact with Lead could lead to absorption of Lead particles into the blood stream, eventually leading to various symptoms typical of Lead poisoning although this is extremely rare.

Eye Contact: Possible irritation.

12. ECOLOGICAL INFORMATION

Mobility: Not considered mobile whilst Lead is in its solid metallic state. Particles can be dispersed through the air or in water courses .

Degradation: Not biodegradable.

Accumulation: Lead compounds have bioaccumulation potential.

Other Adverse Effects: Lead compounds are toxic to aquatic organisms.

13. DISPOSAL CONSIDERATIONS

Waste from Residues: Surplus metal may be returned to British Lead for recycling. Disposal of compounds must be to a licensed waste collection point, observe any local and national regulations.

Contaminated Packaging: N/A

14. TRANSPORT INFORMATION:

No restrictions on transportation.

Lead

Domer Roofs and Cheeks - Buildings B&D

15. REGULATORY INFORMATION

Label for Supply:	N/A
Text of Risk Phrases Used in Section 2:	N/A
Text of Safety Phrases Used in Section 2:	N/A
Statutory Instrument:	Chemicals (Hazards Information and Packaging) Regulations 2009 SI 716. Control of Substances Hazardous to Health 2002; SI 1000/437. Control of Lead at Work Regulations 2002; SI 2002/2676.
Approved Codes of Practice:	Classification and Labelling of Substances and Preparations Dangerous for Supply. The Compilation of Safety Data Sheets (3rd Edition).
Guidance:	Occupational Exposure Limits EH40 COSHH Essentials: Easy steps to control chemicals. Control of Substances Hazardous to Health Regulations; HSG193 CHIP for Everyone HSG108.

16. OTHER INFORMATION

The application of the soft metal presents negligible risks providing standard sensible workplace cleanliness is adopted. Working with molten Lead or Lead alloys requires the use of approved eye protection and other recognized personal protection such as approved protective face masks. The appropriate health and safety requirements are defined in the Control of Lead at Work Regulations 2009. It is recommended that a simple work place risk assessment is made in accordance with the point stated on pages 1, 2 & 5 of the regulations. In general, working with the metal in the open air presents negligible risk providing adequate washing facilities are available at the workplace for hand cleaning.

The data contained in this Safety Data Sheet has been supplied as required by the Chemical (Hazard Identification and Packaging) Regulations 2009, as amended, for the purpose of protecting the health and safety of industrial and commercial users who are deemed capable of understanding and acting on the information provided. Please ensure that it is passed to the appropriate person(s) in your company, who are capable of acting on the information. This information is given in good faith, being based on the latest knowledge available to British Lead. No known relevant information has been omitted from this Material Safety Data Sheet and the information provided is designed to enable the user to use the product safely. The user should not assume on the basis of the information provided in this sheet that the product is suitable for any abnormal use. The company can not accept liability to any customer, their employees or any other person whatsoever for any loss, injury or damage, whether direct or consequential, which may be caused by any error or omission from this sheet, whether such error or omission is negligent or otherwise. If the information provided is insufficient to ensure safety in any particular application, contact British Lead for further advice before the proposed application is undertaken.

02/11

British Lead, Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UB
Tel: 01707 324 595 Fax: 01707 328 941 email: sales@britishlead.co.uk

Concrete finish

Consent 2012 / 6858 / P
Condition No 15

Precast Concrete
Zone 1

GB Architectural
Wetcast Technical Specification

Composition
Wet Cast components are manufactured in accordance with BS 1217:1997 and BS 8110 in a homogenous wet cast mix. Using natural occurring aggregates, sand, Portland cement and pigments are added were necessary.

Constituents
All products used are manufactured to the following current British Standards.

Portland cement to **BS12:1989**
Aggregates to **BS882:1983** and Tested in accordance with **BS812**
Sands to **BS1200**
Water Repellant Additives to **BS1014: 1975**
Pigments to **BS1014**

Structural Use
Heads are suitable for structural use up 1500mm (including 150mm bearings), or greater. But this must be confirmed by your Structural Engineers.

Quoins, Plinths and String Courses can be used in load bearing situations when used in compression. All units are reinforced as follows: **except where stated otherwise**.

All reinforcement used is mild steel, galvanized or stainless steel available subject to additional costs.

Compressive Strength
When tested in accordance with BS1881: Part 116: 1983 and BS1217: 1997 and the United Kingdom cast Stone Association, the cast stone was tested over three 150mm cubes giving an average crushing strength well in excess of **35KN/mm^2.**

Density
The typical mean density of Wet Cast architectural masonry is 2400kg/m^3

GB Architectural Cladding Products Limited
Spen Valley Works, Carr Street, Liversedge, West Yorkshire WF15 6EE
Telephone : 01924 404045 **Facsimile:** 01924 401070

Initial Surface Absorption
When tested in accordance with BS1217: 1997 the average result over three samples was generally in accordance with **Grade A**.

When tested in accordance with the UKCSA specification with an immersion time of ten minutes, the mean water absorption due to capillary action of three samples

Was: **<3gcm^{-2} min $^{-1/2}$**

Manufacturing Tolerances
All GB architectural masonry complies with following tolerances unless otherwise agreed in writing by us.

The actual dimensions of individual regular units should conform to the stated dimensions subject to the tolerances below:

Length *****

Tolerance in MM	Length	Width	Thickness
Up to 600mm	+/-2	+/-2	+/-2
Over 600mm to 1000mm	+/-3	+/-3	+/-3
Over 1000mm to 2500mm	+/-4	+/-4	+/-4
Over 2500mm to 4000mm	+/-5	+/-5	+/-5
Over 4000mm	+/-6	+/-6	+/-6

*****With the exception of textured or moulded faces.

Fire Resistance
Units manufactured in accordance with the standard are non-flammable, non-combustible and do not give off toxic gases and can provide a barrier to the spread of smoke and flames.

Weathering
Many factors influence the way cast stone weathers, such as design, exposure, climate and surrounding. All pigments used are colorfast and durable and confirm to BS1014. Wet Cast architectural dressings will weather in a similar manner to natural stone, when exposed to similar conditions.

Cementitious Efflorescence
As with all reconstructed stone and cement based products there is the possibility that the temporary phenomenon known as efflorescence will occur causing lightening of colour. This will reduce over a period of time with natural weathering**.**

GB Architectural Cladding Products Limited
Spen Valley Works, Carr Street, Liversedge, West Yorkshire WF15 6EE
Telephone : 01924 404045 **Facsimile:** 01924 401070

Precast Concrete
Zone 1 Copings/Lintels

Resistance to Rain Penetration
As with all facing masonry, (reconstructed stone walling bricks, natural stone etc) external skins of cavity walls are not totally impervious to heavy driving rain as there is the possibility that water penetration will take place through the mortar joints. To avoid this, normal good building practice should be observed.

Cutting
Cast Stone should be designed in such a way as to avoid any site cutting. If cutting is required please consult our technical department.

C.O.S.H.H.
Controls of substances hazardous to Health see COSHH Data Sheet

Health, Safety and welfare
The contractor shall ensure that safety; Health and Welfare measures required or by virtue of the provision of any enactment or regulation or the working rules of the industry are complied with.

Surface Finish
The colour and texture of the exposed face of the cast stone should be agreed between the client/architect and ourselves. As with differences in the way units are manufactured this lends itself to subtle variation in the colour. Cement and aggregates used are carefully chosen for their quality and consistency, are all obtained from natural sources and are therefore subject to variations beyond our control. We do and always make every effort to ensure consistency in colour and texture of units manufactured but no guarantees can be given.

Cleaning of Cast Stone
Due to the fine textures and pale colors of cast stone the removal of staining of mortar and other forms of staining can be difficult. It is for this reason that every effort must be made to avoid contamination at early stages.

British Standards
The following British Standards give guidelines and information on the various aspects of design, construction and usage of Cast Stone:

BS 5628 - Codes of Practice for the Use of Masonry Part 3:1985 Materials and components, design and workmanship.

BS 6457 1984 - Specification for Reconstructed Masonry Units.

BS 6073:1981 - Specification for Precast Concrete Masonry Units.

BS8000:1989 - Workmanship on Building Sites Part 3 Code of Practice for Masonry.

BS 5642 1978 - Specification for Window Cills & Copings, Precast Concrete or Cast Stone.

GB Architectural Cladding Products Limited
Spen Valley Works, Carr Street, Liversedge, West Yorkshire WF15 6EE
Telephone : 01924 404045 **Facsimile:** 01924 401070

Precast Concrete
Copings - Zone 2

ARTIFICIAL STONE COMPANY LTD
Bespoke Stonework

Unit G2 Manor Way Business Park
Manor Way
Swanscombe
Kent DA10 0PP
Tel: 01322 370332
Mobile: 07821924271
Fax: 01322 370980
E-Mail: artificialstoneltd@gmail.com
www.artificialstoneltd.co.uk

PRODUCT DATA SHEET.

Cast Bath, Portland and York Stone.

Description
The manufacture of bespoke reconstituted stone units to replace natural stone/stucco, using a variety of graded chippings, cements, mineral dyes and sands. The components are individually selected for each project to replicate the textures and colours of the existing materials.

- **Definition:** A homogenous material consisting of cement binder, course and fine stone aggregates and natural pigments, if required.
- **Compressive Strength:** In accordance with BS EN 12390-2/3. The average strength in excess of 35MPA (35N/mm^2) after 28 days. Recent testing undertaken 20/03/2013 after 28 days: 57.9MPA (57.9N/ mm^2) e.g. cast Portland.
- **Surface Finish:** To the agreed sample.
- **Tolerances:** In accordance with BS EN 1217:2008

Dimensions (mm)	Tolerance (mm)
<600	±2
601 to 1000	±3
1001 to 2500	±4
2501 to 4000	±5
4000	±6

- **Flatness of plane surface:** In accordance with BS1217, the unit shall not deviate from a plane by more than 0.3% of the diagonal length or 2mm.
- **Average Density:** 2370kg/m^3 (Recent testing undertaken 20/03/2013).
- **Capillary Absorption:** in accordance with BS 1217:2008

Specimen:	Cast Cubes	Cast Cubes
	Not treated	Water sealed
Average Capillary	0.5	0.7

  Absorption mg/mm^2 conformity requirement of BS1217, clause 10.1 – Average shall not exceed 1.0mg/mm^2 nor shall any individual value exceed 1.3 mg/mm^2.
- **Reinforcement:** Only non-corroding metals shall be used with this product. These materials shall have a minimum actual cover of 10mm or two bar dimensions, which ever is the greater. Size specific Rock bar is inserted into the required units for handling safety.
- **Cleaning & Repair:** Refer to BS EN 1991-1
- **Product Strength:** Function of unit geometry in accordance with Annex C-Guidance on slenderness ratios. For structural requirements reference should be made to BS EN 1991-1-1.
- **Stone Aggregates:** Course aggregates 4-10 mm in accordance with BS EN 12620. Fine aggregate 0-5 mm in accordance with BS EN 12620

Specification for the Manufacture, Curing & Testing of Glassfibre Reinforced Concrete (GRC) Products.

The International Glassfibre Reinforced Concrete Association (GRCA)

October 2017

The International Glassfibre Reinforced Concrete Association (GRCA) has relationships with other associations connected with the GRC industry. Further information, together with a full list of GRCA Members, can be found on The International Glassfibre Reinforced Concrete Association (GRCA) website: www.grca.org.uk.

Membership of the GRCA is open to:

- Companies who manufacture or develop GRC products,
- Plant or material suppliers to the industry
- Professional partnerships or consultants
- Other interested parties.

Associate Membership is open to individuals with an interest in GRC who are not engaged in manufacture, other than at development or small company level.

Specification for the Manufacture, Curing & Testing of Glassfibre Reinforced Concrete (GRC) Products.

Published by: The International Glassfibre Reinforced Concrete Association (GRCA)
This edition published: October 2017
ISBN 0 946691 78 9

The International Glassfibre Reinforced Concrete Association

PO Box 1454,
NORTHAMPTON
NN2 1DZ
United Kingdom

Tel: +44 (0) 330 111 GRCA
+44 (0) 330 111 4 7 2 2

Web: www.grca.org.uk

Email: info@grca.org.uk

SPECIFICATION FOR THE MANUFACTURE, CURING & TESTING OF GRC PRODUCTS

CONTENTS

FOREWORD

This Specification is designed to enable architects, engineers and specifiers to specify GRC. It covers all aspects of GRC production from raw materials, through production, curing and storage to quality assurance and testing.

Grades of GRC covered are:

– General purpose cast premix GRC: Grades 8 and 8P

– Sprayed premix or high quality cast premix GRC: Grades 10 and 10P

– Normally sprayed GRC: Grades 18 and 18P

where ‘P’ refers to the use of acrylic polymer emulsion in the GRC mix design.

In consultation with a producer, the specifier should select the grade of GRC required. The specifier can then ensure that the product is manufactured and tested according to the specification.

The Specification is a material and manufacturing specification. An engineer should be consulted to ensure that the material grade selected is consistent with the engineering design of the product.

This Specification supersedes all previous GRCA GRC specifications. It has been prepared by the GRCA Technical Group.

This Specification should be used in conjunction with the GRCA’s “Methods of Testing Glassfibre Reinforced Concrete (GRC) Material”

1 INTRODUCTION

1.1 Scope

This specification covers the requirements for the manufacture, curing and testing of GRC products. It gives detailed requirements for grades of GRC manufactured by three different methods:

- 'Spray' Grades 18 and 18P
- 'Premix' Grades 10 and 10P
- 'Premix' Grades 8 and 8P

'P' refers to the use of acrylic thermoplastic polymer emulsion in the GRC mix design.

The specification covers mixes with and without polymers. Selection of the applicable grade should be made by the producer in consideration of the engineering design of the product. This choice should then be approved by the purchaser.

1.2 References

Standards and other publications referred to in this specification are listed in "Further reading".

1.3 Definitions

Aggregate/cement ratio
The ratio of the mass of total dry aggregate to the mass of dry cement in the GRC.

AMS
The GRCA Approved Manufacturer Scheme.

AMS Member
A GRC manufacturing Member of the GRCA who has been audited by an independent certifying body appointed by the GRCA and accepted into the GRCA as an AMS Member.

'**Bag and bucket' tests**
Methods for the calibration of GRC spray equipment.

Characteristic property
The value of a property above which 95% of the population of all possible measurements of that property of the specified GRC are expected to lie.

Dry curing
A method of curing which prevents early loss of moisture and allows curing to take place without keeping the GRC damp. Dry curing is carried out by adding an appropriate quantity of the polymer into the GRC mix. (See Tables 3 & Section 4.5.)

Engineer
The person or authority responsible for the design of the GRC component.

Extremes of dimensional variations
The maximum dimensional variations (residual hydraulic shrinkage and reversible expansion) of a GRC composition attributable to variations in the water content to which products exposed to the elements may be subjected.

Facing coat
An initial layer without fibre but containing decorative sands or aggregates and often pigment.

Glassfibre content by weight (WF)
The ratio (expressed as a percentage) of the mass of glassfibre to the mass of GRC in the uncured [wet mix] state.

GRCA
The International Glassfibre Reinforced Concrete Association.

High shear mixer
A mixer with a high shear action capable of the preparation of the fine sand/cement slurries required for the spray process.

Limit of proportionality (LOP)
Also known as elastic limit. The stress in a flexural bending test where the stress/strain plot deviates from a straight line.

MFFT
Minimum film formation temperature (for acrylic polymers).

Mist coat
An initial cementitious sprayed coating without glassfibre.

Modulus of rupture (MOR)
The highest stress on a stress/strain plot during a flexural bending test.

Polymer-modified GRC
GRC which has been modified by the addition of an acrylic thermoplastic polymer dispersion either for 'dry curing' or for property enhancement.

Premix GRC
A method of manufacture in which the pre-cut AR glassfibres and the cementitious slurry are blended during mixing.

Premix mixer
A two-stage or variable speed mixer designed to prepare fine sand/ cement slurries (stage 1) and to blend in chopped AR glassfibres (stage 2) in the premix process.

Producer
The person or authority entering into a contract to manufacture a GRC product.

Purchaser
The person or authority entering into a contract to buy a GRC product.

Simultaneous Sprayed GRC
A method of manufacture in which GRC is produced by simultaneously spraying the cementitious slurry and the AR glassfibre which is chopped from roving within the spray gun.

Slump test
A test for measuring the consistency of the cementitious slurry.

Supplier
The person or authority entering into a contract to supply goods to the producer.

Test board
A sheet of GRC manufactured during production for the purpose of assessing the quality of the GRC products being made. The test board may be a specimen of the product itself. The test board must be made in the same way and at the same time as the GRC product so that it is representative of the quality of the GRC.

Test board mean
The arithmetic mean value for a property calculated from all the individual test coupon results from one test board. For statistical analysis, this mean is regarded as one result.

Test coupons
Number of specimens taken from a test board for the purpose of determining a property.

Top/bottom ratio
The ratio of the MOR results of samples tested with the mould face in tension to those with the trowelled face in tension.

Uncured state
The stage in the manufacture of GRC when all physical processes that could alter the composition of the material are complete but the fibre can still be separated from the matrix by the action of running water.

Water/cement ratio
The ratio of the mass of total water to the mass of dry cement in the GRC in the uncured state. When pozzolanic fillers are used they can be considered as cementitious and the water/cement ratio can be expressed as a water/total binder ratio; examples of such pozzolanic fillers are fly ash, silica fume and metakaolin.

2 CONSTITUENT MATERIALS

2.1 Alkali-resistant glassfibre

Glassfibre shall be an alkali-resistant continuous filament fibre developed and formulated to have high strength retention in hydraulic cement environments. The producer shall provide certification from the supplier to show that the glass fibre conforms to EN 15422:2008 or approved National Standard

2.2 Cement

Cement shall be supplied by a manufacturer of assessed capability, made to recognised standards such as BS EN 197 or appropriate national standard and supported by suitable certification. Cement shall be correctly stored and kept dry to avoid deterioration.

2.3 Fine aggregates

Fine aggregate or sand shall be washed and dried to remove soluble matter and permit accurate control of the water/cement ratio. The particle shape should be round or irregular and should have a smooth surface without honeycombing.

For spray GRC, the maximum particle size shall be 1.2mm; for premix GRC, the maximum particle size shall be 2.4mm. In both cases the fine fraction, i.e. sand passing a 150 micron sieve, shall be less than 10% of the total weight of sand.

Silica sands are widely used and should conform to the specification in Table 1.

Sands with a higher moisture content may be used provided the moisture content is known and the mix design is altered accordingly.

Sands other than silica sands may be used but the producer should provide evidence of their suitability. Soft building sands must not be used.

Table 1: Specification for silica sand

Silica content	> 96%
Moisture content	< 2%
Loss-on-ignition	< 0.5%

2.4 Water

Water shall be clean and free from deleterious matter, see BS EN 1008, *Mixing water for concrete.*

2.5 Admixtures

Admixtures are permitted and their use is encouraged as they can enhance the properties of GRC. They should always be used strictly in accordance with the suppliers' recommendations and the producer must ensure that their use has no adverse effect on the product.

Calcium chloride-based admixtures must not be used if the GRC component contains steel reinforcement, fixing sockets or other cast-in devices.

2.6 Acrylic polymers

Acrylic thermoplastic polymer dispersions should be used in accordance with the manufacturers' instructions and should conform to the specification in Table 2.

Polymers with properties outside the above specification may be used with the agreement of the purchaser and adequate test results.

Table 2: Specification for polymer curing aid.

Compound type	Aqueous thermoplastic polymer dispersion
Polymer type	Acrylic based
Solids	45-55%
Appearance	Milky white creamy, free from lumps
Minimum film-formation temperature	7-12 °C
Ultraviolet resistance	Good
Alkali resistance	Good

2.7 Pigments

Powder pigments or dispersions may be used to produce coloured GRC. The pigments should conform to international or national standards. The purchaser should recognise that colour variation may occur and must agree an acceptable range of variation with the producer.

2.8 Other component materials

Other component materials (e.g. silica fume, metakaolin, fly ash, reinforcing fillers, admixtures, meshes), may be added to modify the properties of the mix. They must be used in accordance with the supplier's instruction and the producer must demonstrate that their use will not adversely affect the properties of the GRC

3 COMPOSITION OF GRC

3.1 Mix design

It is the responsibility of the producer to select a suitable mix design for the product. The mix design must be such that the mechanical properties of the GRC in Section 8 of this Specification are achieved and that these requirements are consistent with the engineering design of the product.

The mix designs in Table 3a, 3b and 3c are intended as a guide indicating typical figures; designs falling outside these guidelines may be acceptable but should be scrutinised before use.

Table 3a: Guide mix designs — Grade 8

Premix Grade	Grade 8	Grade 8P
Description	General purpose premix	
Aggregate/cement ratio	0.5 -1.50	0.5 -1.50
Water/cement ratio	0.30 - 0.40	0.30 - 0.40
Glassfibre content (% by weight of total mix)	2.0 - 3.0%	2.0 - 3.0%
Polymer solids content (% by weight of cement)	Nil	4-7%
Extreme dimensional variations mm/m	0.6 – 1.2	0.6 – 1.2
Water Absorption	5 – 11%	5 – 11%
Minimum bulk dry density kg/m^3	1800	1800
Minimum bulk wet density kg/m^3	2000	2000

Table 3b: Guide mix designs — Grade 10

Premix Grade	Grade 10	Grade 10P
Description	Sprayed premix or High quality cast premix	
Aggregate/cement ratio	0.5 -1.50	0.5 -1.50
Water/cement ratio	0.30 - 0.38	0.30 - 0.38
Glassfibre content (% by weight of total mix)	2.0 - 3.5%	2.0 - 3.5%
Polymer solids content (% by weight of cement)	Nil	4-7%
Extreme dimensional variations mm/m	0.6 – 1.2	0.6 – 1.2
Water Absorption	5 – 11%	5 – 11%
Minimum bulk dry density kg/m^3	1800	1800
Minimum bulk wet density kg/m^3	2000	2000

Table 3c: Guide mix designs — Grade 18

Spray Grade	Grade 18	Grade 18P
Description	Direct sprayed GRC	
Aggregate/cement ratio	0.5 -1.5	0.5 -1.5
Water/cement ratio	0.30 - 0.38	0.30 - 0.38
Glassfibre content (% by weight of total mix)	4.0 - 5.5%	4.0 - 5.5%
Polymer solids content (% by weight of cement)	Nil	4-7%
Extreme dimensional variations mm/m	0.6 – 1.2	0.6 – 1.2
Water Absorption	5 – 11%	5 – 11%
Minimum bulk dry density kg/m^3	1800	1800
Minimum bulk wet density kg/m^3	2000	2000

4 MANUFACTURE

GRC products manufactured only by premix and spray production methods are covered in this Specification.

4.1 Manufacture by simultaneous spray

4.1.1 Weighing/batching
Dry ingredients shall be batched by weight using calibrated weighing equipment capable of an accuracy of ± 2% of the stated batch weight. Liquids should be weighed, volume batched or automatically dispensed. The producer must demonstrate that the method employed will give an accuracy of ± 2%.

4.1.2 Mixing
The cementitious slurry should be mixed in a suitable mixer in accordance with the manufacturer's instructions and using the stated mix design. The producer must demonstrate that this type of mixing system is to be used. The consistency of the mix should be tested by measuring the slump in accordance with GRCA's Methods of Testing GRC Part 5 or applicable national standards

4.1.3 Spraying
Spraying should be carried out using specialist equipment that allows the simultaneous deposition of known quantities of cementitious slurry and chopped glassfibre. Before starting production, the spray equipment must be calibrated to ensure that the specified glassfibre percentage is achieved. Calibration to measure the deposition rates of the glassfibre and cementitious slurry should be carried out using 'bag and bucket tests' in accordance with GRCA's Methods of Testing GRC Part 4 or applicable national standards.

These tests should be carried out for each pump at the beginning of each shift, after any alteration of the equipment controls and after any unsatisfactory 'wash out' test results (Section 7.1).

If the equipment used gives continuous readings of glass and slurry output these tests need not be carried out.

A mist coat without fibre may be sprayed; this coat should be as thin [$\sim 1mm$] as practicable and should be followed immediately by the first GRC spray.

When a facing coat is used this may be sprayed or poured. This coat may be allowed to stiffen but the first GRC coat must be applied before initial set takes place. Typical thickness is 3-5mm depending on subsequent treatment e.g. grit blasting or acid etching.

The GRC materials must be sprayed and built up in thin layers of 3-4mm until the required thickness is achieved. The sprayed GRC should be compacted by a hand roller before spraying the next layer. After the final layer has been sprayed the thickness of the GRC must be checked using a template or depth gauge and compared to the design thickness.

Unless specifically stated in the agreed product manufacturing specification, the design thickness should be considered as a minimum and no part of the component should be below this thickness.

Over-thickness will be permitted and is to be expected particularly at corners or areas with a deep profile. It will not be permitted if:

1. Any flat areas exceed the design thickness by 4mm.
2. The weight of the component exceeds the maximum design weight as specified by the engineer.

After checking the thickness, any areas of under-thickness should be re-sprayed and areas of over-thickness removed and the material discarded. The specified finish to the ' back' of the unit should be applied using a float or roller.

4.2 Manufacture by premix

4.2.1 Weighing/batching
Dry ingredients should be batched by weight using calibrated weighing equipment capable of an accuracy of ± 2% of the stated batch weight. Liquids should be weighed, volume batched or automatically dispensed. The GRC manufacturer should demonstrate that the method employed will give an accuracy of ± 2%.

4.2.2 Mixing
The GRC should be mixed in a two-stage or other suitable mixer**.** The producer must demonstrate that the equipment is suitable for manufacturing premix GRC.

First the cementitious slurry should be mixed at high speed in an intensive shear mixer or other approved mixer. The slurry is then transferred to a second mixer or the mixing action of the shear mixer adapted so that the AR glassfibre is blended uniformly into the slurry.

The AR glassfibre may be added manually or automatically as chopped fibres or automatically as AR glassfibre roving using a fibre chopper.

4.2.3 Cast Premix
The premixed GRC material should be pumped or carried in a holding vessel to the filling station. The material should then be poured or pumped into the mould ensuring that the method of filling expels the air from the product and planes of weakness are avoided. Compaction may be by internal or external vibration or by the use of a 'self-compacting' mix. The producer must ensure that the method chosen is consistent with the required surface finish and mechanical properties.

4.2.4 Sprayed Premix
The premixed GRC material may also be sprayed onto or into moulds using specialist sprayed premix equipment. A facing coat or a mist coat may be sprayed first. The GRC material should be sprayed in layers 4-6mm and compacted by roller before spraying the next layer. The thickness should be checked as in 4.1.3

4.3 Storage before demoulding

Filled moulds must be stored at temperatures between 5°C and 40°C. 'P' grades must be stored at a temperature higher than the MFFT but below 40°C.

Moulds must be stored on a level surface and supported in such a manner that they will not bow or twist.

Once the initial set has taken place the mould shall be covered with polythene of 500 gauge or above and should not be moved until demoulding.

4.4 Demoulding [inc. lifting and fixing]

The GRC component must not be demoulded until it has gained sufficient strength to be removed from the mould and transported without being over-stressed. The time required will be temperature dependent.

Demoulding must be carried out in such a manner that no damage occurs to the component. Unique demoulding, lifting and fixings sockets must be embedded in the component. All embedded items should be of a suitable material [preferably austenitic stainless steel or non-ferrous] and encapsulated in a block of GRC; size and procedures to be used should be agreed with the engineer before starting production.

4.5 Curing

4.5.1 Moist curing (for non-polymer grades)
GRC components should be cured at controlled temperature and humidity. Ideally this should be for seven days at 20°C and 95% RH. This is not always practical and alternative curing regimes are satisfactory providing the producer demonstrates that the procedure:

1. Enables the component to achieve the physical properties given in Section 8.
2. Ensures that excess shrinkage caused by a too rapid drying of the product does not occur.
3. The curing method is acceptable to the purchaser and engineer.

4.5.2 Curing of polymer grades
Components produced using polymer grades of GRC should be loosely covered overnight and should be dry cured after demoulding. Moist curing can be detrimental. Temperature above 35°C or below 5°C should be avoided for the first two days after manufacture.
Products should not be exposed to drying winds or excessive heat for a <u>minimum</u> of two days.

4.6 Storage, handling and transport

GRC components must be stored, handled and transported in such a way that:

1. No part of the component is overstressed.
2. Bowing or twisting is not induced in the component.
3. No damage is caused to any part of the component, particularly edges and corners.
4. No permanent staining or discoloration is caused either by the storage conditions or the stacking/protection material.

For large components, the method of handling, storage, loading and transporting shall be agreed with the engineer.

<u>5 QUALITY CONTROL AND ASSURANCE</u>

5.1 Quality management system

The manufacturer should demonstrate that a quality assurance system is operated. This shall comply with the GRCA Full Member Regulations, ISO 9001 or similar

<u>6 SAMPLING</u>

6.1 Sampling and Test Boards

Tests may be carried out on coupons cut from the GRC components themselves but this is not normally practical. It is acceptable to produce a Test Board for testing. This shall be manufactured, demoulded and cured in the same manner as the component it represents. Its quality should be the same as the component, as far as possible.

However, due to testing equipment restraints, the thickness should be limited to 12mm. Test Boards must be large enough for sufficient coupons to be cut to meet the testing requirements; 500 x 800mm is proposed so that with spray processes, any directional effects can be identified.

6.2 Frequency

The frequency of production of Test Boards shall be not less than 1 board per day per mixer/pump, for both spray and premix processes. Spray process Test Boards not tested shall be kept for a minimum of one year for any future testing requirements.

<u>7 TESTING</u>

The following tests shall be carried out and the required properties shall be as shown in Tables 3a, 3b, 3c, 4 and 5.

7.1 AR Glassfibre content

The AR glassfibre content shall be determined in accordance with either the "GRCA Methods of Testing Glassfibre Reinforced Concrete (GRC) Material Part 1" or BS EN 1170-2 or other approved national standards. With spray processes, the test shall be carried out once per day per spray station as a minimum.

7.2 Limit of proportionality [LOP] and modulus of rupture [MOR]

The LOP and MOR shall be determined at 7 and/or 14 and/or 28 days in accordance with either the "GRCA Methods of Testing Glassfibre Reinforced Concrete (GRC) Material Part 3" or EN 1170-5 or other approved national standards. 7 and 14 day results shall only be acceptable if they already exceed design requirements.

Additional information such as % Strain to LOP, % Strain to MOR and Young's Modulus provided by modern test equipment should be recorded for information only.

The minimum LOP and MOR testing frequency shall be:
Spray: Twice per week per spray station or every 10 tonnes of GRC produced, whichever is the greater.
Premix: Once per week per mixer or every 10 tonnes of GRC produced, whichever is the greater.

These frequencies are an absolute minimum and individual manufacturers may elect to test more frequently, as they feel appropriate.

Table 4: Characteristic Values

GRADE	8 or 8P	10 or 10P	18 or 18P
Characteristic LOP*	5	6	7
Characteristic MOR*	8	10	18

*A minimum of 40 Test Board Mean shall be analysed in the calculation of the Characteristic Values.

7.3 Bulk density, water absorption and apparent porosity

These properties shall be determined in accordance with either the "GRCA Methods of Testing Glassfibre Reinforced Concrete (GRC) Material Part 2" or BS EN 1170-6 or other approved national standards. All of these tests shall be carried out a minimum of once per month.

7.4 Other tests

Other tests of GRC may be carried out when required by the purchaser, including extreme dimensional variation tests BS EN 1170-7, full-scale load tests of products and components, fire tests, performance testing of cast-in fixings etc. These tests should be supervised by the Engineer.

8 COMPLIANCE

8.1 General

The constituent materials should comply with the requirements of Section 2 and the composition of the GRC shall comply with Section 3. The GRC should be produced and cured in accordance with Section 4. It should be sampled at a frequency complying with Section 6 and tested in accordance with Section 7. It should meet the requirements of Section 8.

8.2 Minimum values for compliance

Table 5 indicates minimum LOP and MOR values using in-process inspection results as a guideline for initial compliance only. To conform to this specification, the manufacturer must also be able to demonstrate via their testing regime and documentation that analysis shows Characteristic Values as shown in Table 4. This analysis must form part of their Quality Assurance procedures to be allowable.

If other properties, e.g. density or porosity, are considered to be critical for an application, compliance values and testing frequency should be agreed between the purchaser and the producer.

9 NON COMPLIANCE

9.1 Failure to comply

a. If any single test board fails to meet any of the compliance requirements, the GRC at risk shall be that produced between the previous complying test board and the next complying test board.

b. Where testing is not carried out on a daily basis retained sample boards (see 6.2) may be tested to determine the extent of the non compliant product.

9.2 Action in the event of non-compliance

The action to be taken over GRC products that do not comply with this specification should be determined with due regard to the technical consequences of adopting remedial measures or replacing the rejected products.

In estimating the quality of the sub-standard GRC and in determining the action to be taken, the following should be established wherever possible.

The validity of the testing shall be confirmed by checking that the sampling, testing and calculations have been carried out in accordance with this specification.

a. That the raw materials and mix proportions used in the GRC under investigation comply with both the specifications and/or with those agreed between purchaser and producer.

b. That the curing regime adopted before testing complies with the recommendations in this Specification. Re-testing of test boards may be appropriate when it is considered that the storage conditions of the product might result in improved properties because of extended curing.

c. The effect of any reduction in GRC properties on the strength and durability of the product.

Three points should be considered:

i. The safety factors adopted in the design.
ii. The thickness of GRC produced compared to the design thickness.
iii. LOP/MOR strengths required by engineering calculations

Table 5: Minimum strengths

GRADE	8 or 8P	10 or 10P	18 or 18P
LOP MPa			
Mean of 4 consecutive test board means	7.25	8.00	8.00
Minimum for individual test board mean	5.75	6.00	6.00
MOR MPa			
Mean of 4 consecutive test board means	9.50	12.00	21.00
Minimum for individual test board mean	7.50	8.50	15.00

FURTHER READING

GRCA "Methods of Testing Glassfibre Reinforced Concrete (GRC) Material"

GRCA "Specifiers Guide to Glassfibre Reinforced Concrete"

GRCA "Assessment of GRC Test Results"

GRCA "Approved Manufacturer Scheme (AMS) Regulations"

Other GRCA Publications: See www.grca.org.uk for up to date list of publications.

The Concrete Bookshop
Tel: 07004 607777 (UK only) or +44 (0)1276 607140
Email: enquiries@concretebookshop.com
Web: www.concretebookshop.com

In addition, The International Glassfibre Reinforced Concrete Association (GRCA) holds a database of past GRCA Congress Proceedings and many other GRC related publications including some free downloads. Web: www.grca.org.uk.

NBS Specification H40 May 2002 *Glassfibre reinforced concrete cladding components*.

European Standards

BS EN 1169: 1999: *Precast concrete products — General rules for factory production control of glass-fibre reinforced cement products.*

BS EN 1170: 1998: *Parts 1-8 Precast concrete products: Test methods for glass-fibre reinforced cement.*

Part 1. Measuring the plasticity of the mortar— 'Slump test' method.
Part 2. Measuring the fibre content in fresh GRC, Wash out test'.
Part 3. Measuring the fibre content of sprayed GRC.
Part 4. Measuring bending strength — 'Simplified bending test' method.
Part 5. Measuring bending strength — 'Complete bending test' method.
Part 6. Determination of the absorption of water by immersion and determination the dry density
Part 7. Measurement of extremes of dimensional variations due to moisture content.
Part 8. Cyclic weathering type test

BS EN 14649: 2005 *Precast concrete products — Test method for strength retention of glass fibres in cement and concrete (SIC TEST).*

BS EN 15422: 2008 *Precast Concrete Products - Specification of glassfibres for reinforcement of mortars and concretes.*

USA

Prestressed Concrete Institute (PCI) USA

Tel: +1 312 786 0300.
Web: www.pci.org

Recommended Practice for Glass Fiber Reinforced Concrete Panels - **Fourth Edition, 2001.**
Manual for Quality Control for Plants and Production of Glass Fiber Reinforced Concrete Products, **1991.**

ACI 549.2R-04
Thin Reinforced Cementitious Products. Report by ACI Committee 549
ACI 549.XR. Glass Fiber Reinforced Concrete premix. Report by ACI Committee 549

ASTM
C948 Standard Test Method for Wet Bulk Density, Water Absorption and Apparent Porosity of Thin Section Glass Fiber Reinforced Concrete.
C1229 Standard Practice for Preparing Coupons for Flexural and Washout Test for Glass Fiber Reinforced Concrete.
C1229 Standard Test Method for Determination of Glass Fiber Content in Glass Fiber Reinforced Concrete
C1230 Standard Test Method for Performing Tension Tests on Glass Fiber Reinforced Concrete [GFRC] Bonding Pads
C1560 Standard Test Method for Hot Water Accelerated Aging of Glass Fiber Reinforced Concrete

AUSTRALIA

National Precast Concrete Association of Australia (GRC Industry Group)

Tel: +61 (029890) 8853
Email: info@npcaa.com.au
Web: www.npcaa.com.au

Design, Manufacture and Installation of Glass Reinforced Concrete (GRC)

Glass

Consent 2012 / 6858 / P
Condition No 15

Glass
Specification - Glass Type D01 & D02

PERFORMANCE CALCULATOR

Calculation Standard: EN 410:2011 / EN 673:2011

D01_55_4PVB_SN70/37HT#4_SZR16_55_4PVB

Outdoors

GLASS 1	Guardian Float Glass ExtraClear (CE) Thickness = 5mm	#1 ----- #2 -----
INTERLAYER 1	PVB Clear 1.52mm (CE)	
GLASS 2	Guardian Float Glass ExtraClear (CE) Thickness = 5mm	#3 ----- #4 SunGuard® SN 70/37 HT (CE)
GAP 1	10% Air, 90% Argon, 16mm (.630")	
GLASS 3	Guardian Float Glass ExtraClear (CE) Thickness = 5mm	#5 ----- #6 -----
INTERLAYER 2	PVB Clear 1.52mm (CE)	
GLASS 4	Guardian Float Glass ExtraClear (CE) Thickness = 5mm	#7 ----- #8 -----

Total Unit (Nominal) = 1 1/2 in / 39.048 mm — Slope = 90°

Estimated Nominal Glazing Weight: 51.74 kg/m²

Indoors

D02_55_2PVB_SN70/37HT#4_SZR14_44_2PVB

Outdoors

GLASS 1	Guardian Float Glass ExtraClear (CE) Thickness = 5mm	#1 ----- #2 -----
INTERLAYER 1	PVB Clear 0.76mm (CE)	
GLASS 2	Guardian Float Glass ExtraClear (CE) Thickness = 5mm	#3 ----- #4 SunGuard® SN 70/37 HT (CE)
GAP 1	10% Air, 90% Argon, 14mm (.551")	
GLASS 3	Guardian Float Glass ExtraClear (CE) Thickness = 4mm	#5 ----- #6 -----
INTERLAYER 2	PVB Clear 0.76mm (CE)	
GLASS 4	Guardian Float Glass ExtraClear (CE) Thickness = 4mm	#7 ----- #8 -----

Total Unit (Nominal) = 1 9/32 in / 33.524 mm — Slope = 90°

Estimated Nominal Glazing Weight: 45.06 kg/m²

Indoors

Glass
Specification - Glass Type D03 & D07

PERFORMANCE CALCULATOR

D03_88_2SR_SN70/37HT#4_SZR16_66_2SR

Outdoors

GLASS 1	Guardian Float Glass ExtraClear (CE) Thickness = 8mm	#1 ----- #2 -----
INTERLAYER 1	PVB Noise Reduction SR 0.76mm Clear (CE)	
GLASS 2	Guardian Float Glass ExtraClear (CE) Thickness = 8mm	#3 ----- #4 SunGuard® SN 70/37 HT (CE)
GAP 1	10% Air, 90% Argon, 16mm (.630")	
GLASS 3	Guardian Float Glass ExtraClear (CE) Thickness = 6mm	#5 ----- #6 -----
INTERLAYER 2	PVB Noise Reduction SR 0.76mm Clear (CE)	
GLASS 4	Guardian Float Glass ExtraClear (CE) Thickness = 6mm	#7 ----- #8 -----

Total Unit (Nominal) = 1 3/4 in / 45.524 mm — Slope = 90°

Estimated Nominal Glazing Weight: 69.55 kg/m²

Indoors

D07_66_4PVB_SN51/28HT#4_SZR18_66_4PVB

Outdoors

GLASS 1	Guardian Float Glass ExtraClear (CE) Thickness = 6mm	#1 ----- #2 -----
INTERLAYER 1	PVB Clear 1.52mm (CE)	
GLASS 2	Guardian Float Glass ExtraClear (CE) Thickness = 6mm	#3 ----- #4 SunGuard® SN 51/28 HT (CE)
GAP 1	10% Air, 90% Argon, 18mm (.709")	
GLASS 3	Guardian Float Glass ExtraClear (CE) Thickness = 6mm	#5 ----- #6 -----
INTERLAYER 2	PVB Clear 1.52mm (CE)	
GLASS 4	Guardian Float Glass ExtraClear (CE) Thickness = 6mm	#7 ----- #8 -----

Total Unit (Nominal) = 1 3/4 in / 45.048 mm — Slope = 90°

Estimated Nominal Glazing Weight: 61.64 kg/m²

Indoors

Glass
Specification - Glass Type D13 & S01

PERFORMANCE CALCULATOR

D13_55_4PVB_SZR18_#5CG1.0+T_55_4PVB

Outdoors

GLASS 1	Guardian Float Glass ExtraClear (CE) Thickness = 5mm	#1 ----- #2 -----
INTERLAYER 1	PVB Clear 1.52mm (CE)	
GLASS 2	Guardian Float Glass ExtraClear (CE) Thickness = 5mm	#3 ----- #4 -----
GAP 1	10% Air, 90% Argon, 18mm (.709")	
GLASS 3	Guardian Float Glass ExtraClear (CE) Thickness = 5mm	#5 ClimaGuard 1.0+ T (CE) #6 -----
INTERLAYER 2	PVB Clear 1.52mm (CE)	
GLASS 4	Guardian Float Glass ExtraClear (CE) Thickness = 5mm	#7 ----- #8 -----

Total Unit (Nominal) = 1 19/32 in / 41.048 mm — Slope = 90°

Estimated Nominal Glazing Weight: 51.74 kg/m²

Indoors

S01_55_4_SG_HDN67#2

Outdoors

GLASS 1	Guardian Float Glass ExtraClear (CE) Thickness = 5mm	#1 ----- #2 SunGuard® HD Neutral 67 (CE)
INTERLAYER 1	PVB Clear 1.52mm (CE)	
GLASS 2	Guardian Float Glass ExtraClear (CE) Thickness = 5mm	#3 ----- #4 -----

Total Unit (Nominal) = 7/16 in / 11.524 mm — Slope = 90°

Estimated Nominal Glazing Weight: 25.87 kg/m²

Indoors

Glass
Specification - Glass Type S02 & S03B

PERFORMANCE CALCULATOR

S02_66_4_SG_HDN67#2

Outdoors

GLASS 1	Guardian Float Glass ExtraClear (CE) Thickness = 6mm	#1 ----- #2 SunGuard® HD Neutral 67 (CE)
INTERLAYER 1	PVB Clear 1.52mm (CE)	
GLASS 2	Guardian Float Glass ExtraClear (CE) Thickness = 6mm	#3 ----- #4 -----

Total Unit (Nominal) = 17/32 in / 13.524 mm — Slope = 90°

Estimated Nominal Glazing Weight: 30.82 kg/m²

Indoors

S03B_1212_4SG_UltraClear

Outdoors

GLASS 1	Guardian Float Glass UltraClear (CE) Thickness = 12mm	#1 ----- #2 -----
INTERLAYER 1	PVB Clear 1.52mm (CE)	
GLASS 2	Guardian Float Glass UltraClear (CE) Thickness = 12mm	#3 ----- #4 -----

Total Unit (Nominal) = 1/1 in / 25.524 mm — Slope = 90°

Estimated Nominal Glazing Weight: 60.4 kg/m²

Indoors

Glass

Specification - Glass Type S04 & D07 + Milky Interlayer

GUARDIAN GLASS | PERFORMANCE CALCULATOR

S01_55_4_SG_HDN67#2

Outdoors

GLASS 1	Guardian Float Glass ExtraClear (CE) Thickness = 5mm	#1 ----- #2 SunGuard® HD Neutral 67 (CE)
INTERLAYER 1	PVB Clear 1.52mm (CE)	
GLASS 2	Guardian Float Glass ExtraClear (CE) Thickness = 5mm	#3 ----- #4 -----

Total Unit (Nominal) = 7/16 in / 11.524 mm — Slope = 90°

Estimated Nominal Glazing Weight: 25.87 kg/m²

Indoors

D07_66_4PVB_SN51/28HT#4_SZR18_66_4PVB

Outdoors

GLASS 1	Guardian Float Glass ExtraClear (CE) Thickness = 6mm	#1 ----- #2 -----
INTERLAYER 1	PVB Clear 1.52mm (CE)	
GLASS 2	Guardian Float Glass ExtraClear (CE) Thickness = 6mm	#3 ----- #4 SunGuard® SN 51/28 HT (CE)
GAP 1	10% Air, 90% Argon, 18mm (.709")	
GLASS 3	Guardian Float Glass ExtraClear (CE) Thickness = 6mm	#5 ----- #6 -----
INTERLAYER 2	PVB Clear 1.52mm (CE)	
GLASS 4	Guardian Float Glass ExtraClear (CE) Thickness = 6mm	#7 ----- #8 -----

Total Unit (Nominal) = 1 3/4 in / 45.048 mm — Slope = 90°

Estimated Nominal Glazing Weight: 61.64 kg/m²

Indoors

Glass

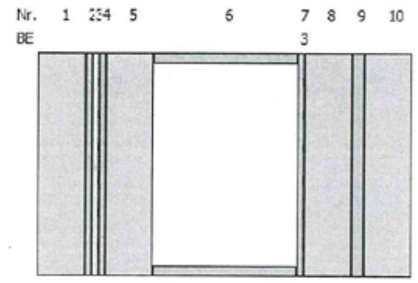
Specification - Glass Type D06

BGT Bischoff Glastechnik AG

Project: St. Giles, London
Position: D06

Layer assembly (external to internal)

No.	CL	Name	mm
1		Float ExtraClear	6,00
2		SentryGlas®	1,00
3		PR 260/55 Gold	
4		SentryGlas®	1,00
5		Float ExtraClear	6,00
6		90% Argon	18,00
7	3	ClimaGuard Premium2 T (εn=3%)	
8		Float ExtraClear	6,00
9		PVB-Foil	1,52
10		Float ExtraClear	6,00
			45,52



Rw (C;Ctr) dB = npd

Transmittance, reflectance, absorption

ρ_v = 0,16 (external light reflectance)
ρ'_v = 0,11 (internal light reflectance)
ρ_e = 0,16 (external solar direct reflectance)
ρ'_e = 0,16 (internal solar direct reflectance)
α_e 1 = 0,55; 3 = 0,05 (solar direct absorptance)

T_{UV} = **0,00** (ultraviolet transmittance)
T_v = **0,40** (light transmittance)
T_e = **0,24** (solar direct transmittance)
R_a = 97 (general colour rendering index)

EN 410

SC = 0,35 (Shading Coefficient, g/0,87)
b-Factor = 0,38 (VDI 2078, g/0,80)

q_i = **0,07** (secondary internal heat transfer factor)
g = 0,31 (total solar energy transmittance (solar factor))

EN 673 Installation angle = 90° vertical

U_g = 1,1 W/m²K (heat flow coefficient)

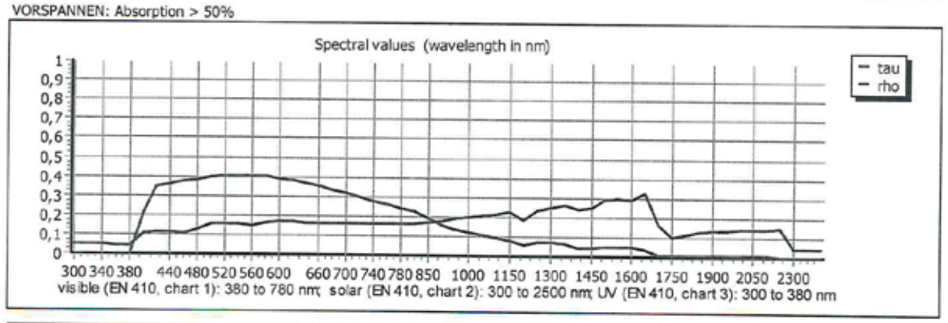
EN ISO 52022-3 T_e = 5,00 °C T_i = 20,00 °C E_s = 300,00 W/m² Height of installation = 1,50 m

g_{th} = 0,044 (thermal radiation factor)
g_c = 0,034 (convection factor)
g_v = 0,000 (ventilation factor)

$h_{c,e}$ = 18,00 W/m²K
$h_{c,i}$ = 3,60 W/m²K

q_i = **0,078** (secondary internal heat transfer factor)
g = 0,31 (total solar energy transmittance (solar factor))

VORSPANNEN: Absorption > 50%



Variations of the light and radiation characteristics are possible caused by the chemical composition of glass and the production process. The specified values consider accredited tolerances of the finished product, the basic glass and the coating in accordance to the respective product standards. The result is no information about the technical feasibility.
EN 410, EN 673, EN ISO 52022-3

Certified by ift, validation report No. 410 42167
Licensed to: BGT-Bischoff Glastechnik AG - BGT-Bischoff Glastechnik AG
SommerGlobal 7.1207 Copyright Sommer Informatik GmbH, Rosenheim
ADMIN 15.03.2018 - 12:52:35
1 / 1

Windows

Consent 2012 / 6858 / P
Condition No 15

Windows
Metal Frame

Janisol Arte 2.0

Materials / surface finish
- Strip galvanised steel
- Stainless steel 1.4401
- Corten

Window types / opening types
- Side-hung window and window with meeting stile, single and double-vent, inward and outward-opening
- Inward-opening bottom-hung window
- Top-hung and projected top-hung window, outward-opening
- Horizontal pivot window
- Vertical pivot window
- Fixed glazing

Fittings
- Multi-point locking
- Surface-mounted fitting version
- Electric drive

Special technical features
Basic depth of 60 mm

Very narrow face widths:
- Fixed glazing 25 mm
- Window vent 20 mm
- Window meeting stile design 60 mm
- Easy to fabricate
- Window sizes up to 1000 x 2400 mm
- Glass thicknesses of 20 to 47 mm
- Max. weight 150 kg

Test certificates
CE marking in accordance with product standard EN 14351-1
- Resistance to wind load C5 (2000 Pa)
- Watertightness up to class 9A (600 Pa)
- Sound reduction up to 45 dB
- Thermal transmittance of Uf from 1.9 W/m2K
- Air permeability class 4 (600 Pa)
- Load-bearing capacity of safety devices met
- Mechanical strength class 4
- Dangerous substances in accordance with ISO 16000 met
- Durability class 4 (50,000 cycles)
- Impact resistance class 4
- Prefabricated glazing suitable for safety barrier loading DIN 18008-4 met

Windows
Timber Frame

CHÊNE

Family: FAGACEAE (angiosperm)
Scientific name(s): Quercus petraea
Quercus robur
Commercial restriction: no commercial restriction
Note: OAK trees are the dominant broad-leaved species of temperate Europe.

WOOD DESCRIPTION

Color: light brown
Sapwood: clearly demarcated
Texture: medium
Grain: straight
Interlocked grain: absent
Note: Light brown wood to straw colour turning darker with light. The texture is medium but can be fine or coarse according to its origin. The pearly white silver figure is large and well visible.

LOG DESCRIPTION

Diameter: from 40 to 80 cm
Thickness of sapwood: from 1 to 4 cm
Floats: pointless
Log durability: moderate (treatment recommended)

PHYSICAL PROPERTIES

MECHANICAL AND ACOUSTIC PROPERTIES

Physical and mechanical properties are based on mature heartwood specimens. These properties can vary greatly depending on origin and growth conditions.

	Mean	Std dev.
Specific gravity *:	0,74	0,05
Monnin hardness *:	4,2	0,8
Coeff. of volumetric shrinkage:	0,44 %	0,05 %
Total tangential shrinkage (TS):	9,7 %	0,9 %
Total radial shrinkage (RS):	4,5 %	0,5 %
TS/RS ratio:	2,2	

	Mean	Std dev.
Crushing strength *:	58 MPa	7 MPa
Static bending strength *:	105 MPa	15 MPa
Modulus of elasticity *:	13300 MPa	1750 MPa

(*: at 12% moisture content, with 1 MPa = 1 N/mm²)

Fiber saturation point: 31 %
Stability: moderately stable to poorly stable
Note: Oak trees with a slow growth have a smaller density than oak trees with a rapid growth.
European standard EN 14081-1 "Timber structures - Strength graded structural timber with rectangular cross-section" gives the scope of the requirements found in NF B 52001 and applying to timber structures for visual grading of French timbers.

NATURAL DURABILITY AND TREATABILITY

Fungi and termite resistance refers to end-uses under temperate climate. Except for special comments on sapwood, natural durability is based on mature heartwood. Sapwood must always be considered as non-durable against wood degrading agents.
E.N. = Euro Norm

Funghi (according to E.N. standards): class 2 - durable
Dry wood borers: durable - sapwood demarcated (risk limited to sapwood)
Termites (according to E.N. standards): class M - moderately durable
Treatability (according to E.N. standards): class 4 - not permeable
Use class ensured by natural durability: class 3 - not in ground contact, outside
Species covering the use class 5: No
Note: This species is listed in the European standard NF EN 350-2.
Durability is linked to the presence of water soluble tanins. It decreases with tanins washing in case of harsh exposition.
According to the European standard NF EN 335, performance length might be modified by the intensity of end-use exposition.

REQUIREMENT OF A PRESERVATIVE TREATMENT

Against dry wood borer attacks: does not require any preservative treatment
In case of risk of temporary humidification: does not require any preservative treatment
In case of risk of permanent humidification: requires appropriate preservative treatment

 26/03/2012

CHÊNE

DRYING

Drying rate: slow
Risk of distortion: high risk
Risk of caseharagain: no
Risk of checking: high risk
Risk of collapse: yes
Note: Must be dried slowly and carefully.

Possible drying schedule: 6

M.C. (%)	Temperature (°C) dry-bulb	wet-bulb	Air humidity (%)
Green	42	41	94
50	48	43	74
30	54	46	63
20	60	51	62
15	60	51	62

This schedule is given for information only and is applicable to thickness lower or equal to 38 mm.
It must be used in compliance with the code of practice.
For thickness from 38 to 75 mm, the air relative humidity should be increased by 5 % at each step.
For thickness over 75 mm, a 10 % increase should be considered.

SAWING AND MACHINING

Blunting effect: normal
Sawteeth recommended: stellite-tipped
Cutting tools: tungsten carbide
Peeling: good
Slicing: nood
Note: Steaming is recommended before slicing.

ASSEMBLING

Nailing / screwing: good but pre-boring necessary
Gluing: correct
Note: Gluing must be done with care: wood is dense, slightly acid and rich in tanins.
Nail or screw corrosion if in contact with humidity.

COMMERCIAL GRADING

Appearance grading for sawn timbers: According to European standard EN 975-1 (April 2009)
Possible grading for boules: Q-BA, Q-B1, Q-B2, Q-B3
Possible grading for individual selected boards: Q-SA, Q-S1, Q-S2, Q-S3
Possible grading for strips and square edged timbers (sapwood excluded): Q-FA, Q-F1a, Q-F1b, Q-F2, Q-F3
(for strips and square edged timbers, X or XX suffix indicates the presence and the size of sound sapwood)
Possible grading for baulks: Q-PA, Q-P1, Q-P2

Visual grading for structural applications: Traded timber with CE marking. Possible strength classes: D18, D24 or D30 related to the European standard EN 14081 (May 2006).

FIRE SAFETY

Conventional French grading: Thickness > 14 mm : M.3 (moderately inflammable)
Thickness < 14 mm : M.4 (easily inflammable)

Euroclasses grading: D s2 d0
Default grading for solid wood, according to requirements of European standard EN 14081-1 annex C (April 2009). It concerns structural graded timber in vertical uses with mean density upper 0.35 and thickness upper 22 mm.

END-USES

Exterior joinery
Cabinetwork (high class furniture)
Heavy carpentry
Cooperage
Sleepers
Seats
Turned goods
Interior joinery
Flooring
Stairs (inside)
Moulding
Hydraulic works (fresh water)
Sliced veneer
Wood-ware

Note: Tanins create a risk of smudges on woods if not well dried or if machined in a non protected area or if no product is used for protection or finish.

 26/03/2012

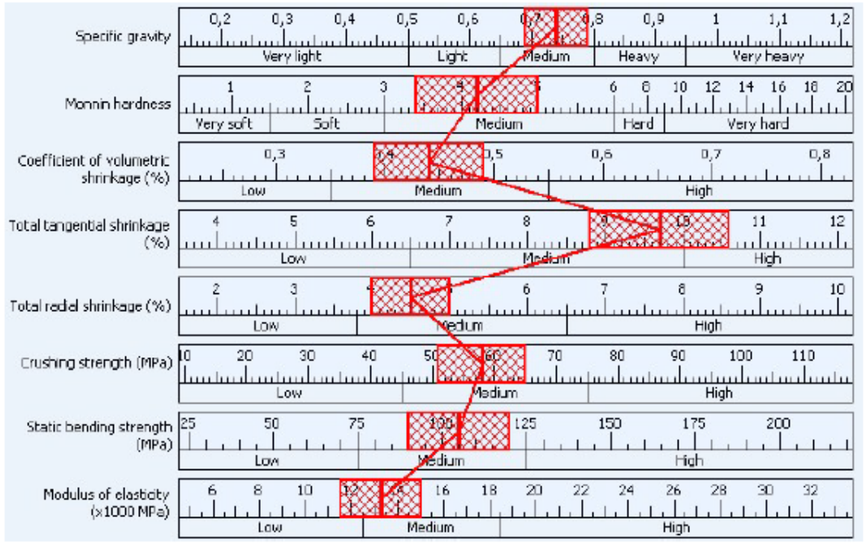
CHÊNE

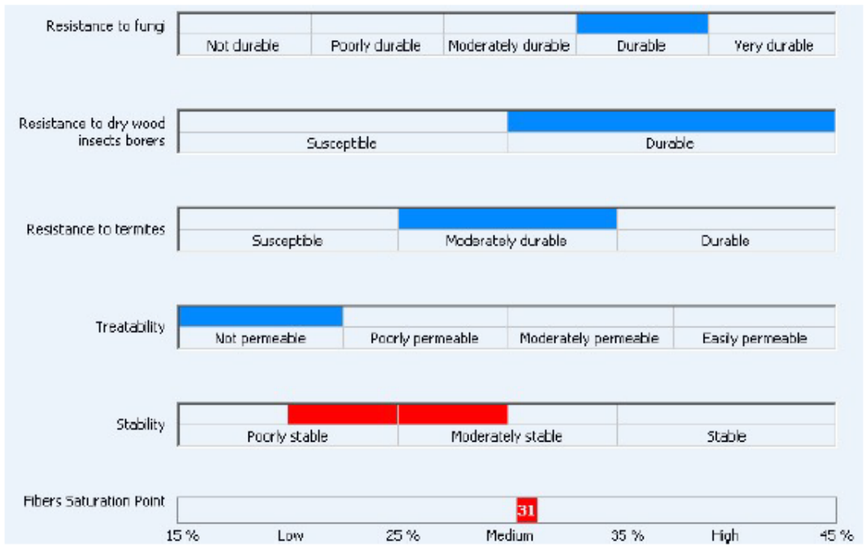
MAIN LOCAL NAMES

Country	Local name	Country	Local name
Germany (temperate timber)	EICHE	Spain (temperate timber)	ROBLE
France (temperate timber)	CHÊNE	France (temperate timber)	CHÊNE BLANC EUROPEEN
Italia (temperate timber)	QUERCIA	United Kingdom (temperate timber)	OAK

 26/03/2012

CHÊNE





 26/03/2012

GUARDIAN GLASS
See what's possible™

PERFORMANCE CALCULATOR

D13_55_4PVB_SZR18_#5CG1.0+T_55_4PVB

Outdoors

GLASS 1	Guardian Float Glass ExtraClear (CE) Thickness = 5mm	#1 ----- #2 -----
INTERLAYER 1	PVB Clear 1.52mm (CE)	
GLASS 2	Guardian Float Glass ExtraClear (CE) Thickness = 5mm	#3 ----- #4 -----
GAP 1	10% Air, 90% Argon, 18mm (.709")	
GLASS 3	Guardian Float Glass ExtraClear (CE) Thickness = 5mm	#5 ClimaGuard 1.0+ T (CE) #6 -----
INTERLAYER 2	PVB Clear 1.52mm (CE)	
GLASS 4	Guardian Float Glass ExtraClear (CE) Thickness = 5mm	#7 ----- #8 -----

Total Unit (Nominal) = 1 19/32 in / 41.048 mm Slope = 90°

Estimated Nominal Glazing Weight: 51.74 kg/m²

Indoors

IGP-HWF*classic*

5903, mat

Highly **W**eather-resistant Facade Quality

IGP-HWF*classic* 5903 is a highly weather resistant coating powder with reduced stoving conditions from 170°C for process- and energy-efficient coating solutions.

Technical Data Sheet

Product description

IGP-HWF*classic* 5903 is the result of many years of development by IGP involving the production of **highly weather-resistant coatings for architectural applications** on saturated polyester resin base and with declaration-free hardeners.

Characteristics / application

- Façade elements
- Window profile sections

The coatings have good mechanical values and high resistance to chemicals.
High UV resistance, slower film degradation and the dirt-repelling properties of the film surface allow much longer intervals between facade cleaning operations.

By the addition of the IGP-DURA®*clean*-effect the IGP-HWF products possess a surface which can be cleaned eysily.

Product range

Surface appearance

- **5903A**, smooth flowing, mat with IGP-DURA®*clean*-effect
- **5903E**, pearl mica effects, mat with IGP-DURA®*clean*-effect

Gloss, DIN EN ISO 2813: 25-35 R'/60°

Colour shades
Due to the limited selection of highly weather-resistant pigments, the product range includes only a limited number of different colours according to the special IGP colour chart.

Powder specification

- Particle size: < 100 µm
- Solids: approx. 99%
- Density depending on colour: 1.2-1.6 kg/l
- Storage stability: min. 24 months
- Storage temperature: < 25° C

Packing

- Carton with antistatic PE liner, capacity 20 kg.
- Carton container 25 antistatic PE liners, capacity 500 kg.

Material approvals:
GSB No. 173o, Master
Qualicoat N° P-1137, class 2
AAMA 2604-13,
independent inspection documentation

Article-specific safety data sheet and further risk management measures at:
www.igp-powder.com

IGP Pulvertechnik AG
Ringstrasse 30
CH-9500 Wil
Telefon +41 (0)71 929 81 11
Telefax +41 (0)71 929 81 81
www.igp-powder.com
info@igp-powder.com

www.doldgroup.com

IGP-HWF*classic* 5903

Processing instructions

Pre-treatment
The substrate to be coated must be free of oxidation products, or residue from scale, oil, grease or release agents. Depending on application range and the planned usage duration, a pre-treatment suitable for the substrate is used:
Aluminium substrate:

Chromating:	DIN EN 12487
Chrome-free pre-treatment:	possible option
Pre-anodisation:	possible option

Steel substrate:
Zinc or iron (Fe) phosphating
Galvanised sheet metal: Chromatising in accordance with DIN EN 12487

For improved corrosion protection for applications on steel / galvanised steel, the use of corrosion protection primer IGP-KORROPRIMER 10 is recommended.
The suitability of the pre-treatment method used is generally to be tested by the coater in advance with appropriate test methods. The minimum requirement for aluminium substrates / galvanised steel components intended for architectural applications is performing a boil test / pressure cooker test with a subsequent cross-cut adhesion and pull-off test. We refer to the guidelines of the GSB certifications and Qualicoat.
For further information: see also our special leaflet on pre-treatment (IGP-TI 100).

Coating equipment
All commercially available electrostatic systems, both "corona" and Tribo charge" type, with the exception of pearl mica effects which must be processed only with "corona" charging. Relevant regulations: VDE requirements and VDM data sheet 24371.
IGP processing instructions for "Pearl Mica Effects": VR 201.

Coating / recycling
Recycled powder should be added to the fresh powder in small amounts, as far as possible automatically. Important: Overspray should always be kept to a minimum.

Stoving conditions
The temperature and time combinations resulting in optimum cross-linking of the coating are shown

Object-temperature	*Retention time at object-temperature*	
	minimum	*maximum*
170°C	20 min.	30 min.
180°C	**15 min.**	25 min.
190°C	10 min.	20 min.

You are advised to carry out practical trials adapted to the object in question and the stoving oven in order to determine the optimum stoving conditions. Our Technical Department will be glad to help.

Technological values

To determine the following data, IGP-HWF*classic* 5903 was applied as follows:
- Aluminium sheet (AlMg1 H14 or „Q Panel AA 5005-H24") 0.8 mm, chromatised
- Coating thickness 60 µm
- Object temperature 180°C, 15 min.

Gloss, DIN EN ISO 2813	25-35 R´/60°
Cross-cut adhesion test, DIN EN ISO 2409	Gt 0
Mandrel bending test, DIN EN ISO 1519/tape test:	< 5 mm
Reverse Impact, DIN EN ISO 6272/tape test:	> 2,5 Nm
Erichsen cupping, DIN EN ISO 1520/tape test:	> 5 mm
Buchholz hardness, DIN EN ISO 2815	> 80

Weathering
3 years Florida, 5° south: > 50% residual gloss

Accelerated weathering
1000h DIN EN ISO 16474-2: > 90% residual gloss

1000h Condensation test, DIN EN ISO 6270-2 AT:
no infiltration, no bubbles.

1000h Salt spray test, DIN EN ISO 9227 AASS:
no infiltration, no bubbles.

Mortar resistance, ASTM D 3260:
easily removable after 24h without residues.

See also "Qualicoat" testing standards (Issue 13.09.2012), Class 2 Powder.

Cleaning

The coated parts are to be cleaned according to the specifications RAL-GZ 632 or SZFF 61.01.

For Pearl Mica effects, the Technical Information IGP-TI 106 must be observed in addition.

Note

Our technical advice on application, given verbally, in writing or through trials is provided to the best of our knowledge but is to regarded solely as non-binding information and does not release you from the need to carry out your own tests and trials. Application, use and processing of the products take place outside our ability to supervise and are therefore exclusively your own responsibility.

IGP
POWDER COATINGS.

IGP Pulvertechnik AG · Ringstrasse 30 · CH-9500 Wil · Tel. +41 (0)71 929 81 11 · Fax +41 (0)71 929 81 81 · www.igp-powder.com · info@igp-powder.com

07.16 · TDS *classic* 5903 / V15 · WM

Architectural Metalwork

Consent 2012 / 6858 / P
Condition No 15

Architectural metalwork
Balustrades

IGP-HWF*classic*
5903, mat

Highly **W**eather-resistant Facade Quality

IGP-HWF*classic* 5903 is a highly weather resistant coating powder with reduced stoving conditions from 170°C for process- and energy-efficient coating solutions.

Technical Data Sheet

Product description
IGP-HWF*classic* 5903 is the result of many years of development by IGP involving the production of **highly weather-resistant coatings for architectural applications** on saturated polyester resin base and with declaration-free hardeners.

Characteristics / application
- Façade elements
- Window profile sections

The coatings have good mechanical values and high resistance to chemicals.
High UV resistance, slower film degradation and the dirt-repelling properties of the film surface allow much longer intervals between facade cleaning operations.

By the addition of the IGP-DURA®*clean*-effect the IGP-HWF products possess a surface which can be cleaned eysily.

Product range
Surface appearance
- **5903A**, smooth flowing, mat with IGP-DURA®*clean*-effect
- **5903E**, pearl mica effects, mat with IGP-DURA®*clean*-effect

Gloss, DIN EN ISO 2813: 25-35 R′/60°

Colour shades
Due to the limited selection of highly weather-resistant pigments, the product range includes only a limited number of different colours according to the special IGP colour chart.

Powder specification
- Particle size: < 100 µm
- Solids: approx. 99%
- Density depending on colour: 1.2-1.6 kg/l
- Storage stability: min. 24 months
- Storage temperature: < 25° C

Packing
- Carton with antistatic PE liner, capacity 20 kg.
- Carton container 25 antistatic PE liners, capacity 500 kg.

Material approvals:
GSB No. 173o, Master
Qualicoat N° P-1137, class 2
AAMA 2604-13,
independent inspection documentation

Article-specific safety data sheet and further risk management measures at:
www.igp-powder.com

IGP Pulvertechnik AG
Ringstrasse 30
CH-9500 Wil
Telefon +41 (0)71 929 81 11
Telefax +41 (0)71 929 81 81
www.igp-powder.com
info@igp-powder.com

www.doldgroup.com

IGP Pulvertechnik AG · Ringstrasse 30 · CH-9500 Wil · Tel. +41 (0)71 929 81 11 · Fax +41 (0)71 929 81 81 · www.igp-powder.com · info@igp-powder.com

IGP-HWF*classic* 5903

Processing instructions
Pre-treatment
The substrate to be coated must be free of oxidation products, or residue from scale, oil, grease or release agents. Depending on application range and the planned usage duration, a pre-treatment suitable for the substrate is used:
Aluminium substrate:

Chromating:	DIN EN 12487
Chrome-free pre-treatment:	possible option
Pre-anodisation:	possible option

Steel substrate:
Zinc or iron (Fe) phosphating
Galvanised sheet metal: Chromatising in accordance with DIN EN 12487

For improved corrosion protection for applications on steel / galvanised steel, the use of corrosion protection primer IGP-KORROPRIMER 10 is recommended.
The suitability of the pre-treatment method used is generally to be tested by the coater in advance with appropriate test methods. The minimum requirement for aluminium substrates / galvanised steel components intended for architectural applications is performing a boil test / pressure cooker test with a subsequent cross-cut adhesion and pull-off test. We refer to the guidelines of the GSB certifications and Qualicoat.
For further information: see also our special leaflet on pre-treatment (IGP-TI 100).

Coating equipment
All commercially available electrostatic systems, both "corona" and Tribo charge" type, with the exception of pearl mica effects which must be processed only with "corona" charging. Relevant regulations: VDE requirements and VDM data sheet 24371.
IGP processing instructions for "Pearl Mica Effects": VR 201.

Coating / recycling
Recycled powder should be added to the fresh powder in small amounts, as far as possible automatically. Important: Overspray should always be kept to a minimum.

Stoving conditions
The temperature and time combinations resulting in optimum cross-linking of the coating are shown

Object-temperature	*Retention time at object-temperature*	
	minimum	*maximum*
170°C	20 min.	30 min.
180°C	**15 min.**	25 min.
190°C	10 min.	20 min.

You are advised to carry out practical trials adapted to the object in question and the stoving oven in order to determine the optimum stoving conditions. Our Technical Department will be glad to help.

Technological values
To determine the following data, IGP-HWF*classic* 5903 was applied as follows:
- Aluminium sheet (AlMg1 H14 or „Q Panel AA 5005-H24") 0.8 mm, chromatised
- Coating thickness 60 µm
- Object temperature 180°C, 15 min.

Gloss, DIN EN ISO 2813	25-35 R′/60°
Cross-cut adhesion test, DIN EN ISO 2409	Gt 0
Mandrel bending test, DIN EN ISO 1519/tape test:	< 5 mm
Reverse Impact, DIN EN ISO 6272/tape test:	> 2,5 Nm
Erichsen cupping, DIN EN ISO 1520/tape test:	> 5 mm
Buchholz hardness, DIN EN ISO 2815	> 80

Weathering
3 years Florida, 5° south: > 50% residual gloss

Accelerated weathering
1000h DIN EN ISO 16474-2: > 90% residual gloss

1000h Condensation test, DIN EN ISO 6270-2 AT: no infiltration, no bubbles.

1000h Salt spray test, DIN EN ISO 9227 AASS: no infiltration, no bubbles.

Mortar resistance, ASTM D 3260: easily removable after 24h without residues.

See also "Qualicoat" testing standards (Issue 13.09.2012), Class 2 Powder.

Cleaning
The coated parts are to be cleaned according to the specifications RAL-GZ 632 or SZFF 61.01.

For Pearl Mica effects, the Technical Information IGP-TI 106 must be observed in addition.

Note
Our technical advice on application, given verbally, in writing or through trials is provided to the best of our knowledge but is to regarded solely as non-binding information and does not release you from the need to carry out your own tests and trials. Application, use and processing of the products take place outside our ability to supervise and are therefore exclusively your own responsibility.

POWDER COATINGS.

07.16 · TDS classic 5903 / V15 · WM

Paving

Consent 2012 / 6858 / P
Condition No 15

Marshalls
Creating Better Spaces

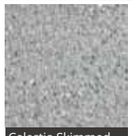
Landscape House, Premier Way,
Lowfields Business Park,
Elland HX5 9HT
Tel: 03704 11 22 33
https://www.marshalls.co.uk/commercial

T: 01422 312000
F: 01422 312943
E: services.advisory@marshalls.co.uk

Celestia Skimmed 300 x 300 x 50

Date Created: 07/02/19


Celestia Skimmed - Luna


Celestia Skimmed - Nebula


Celestia Skimmed - Grava


Celestia Skimmed - Lyra

For contemporary design and visual impact, Marshalls' Celestia paving is a high-performance, high-quality product that can complement any modern development.

This linear paving is available in four carefully balanced colours on the grey/green/blue spectrum – choose between Nebula, Luna, Grava and Lyra.

Celestia paving is manufactured using the highest-quality granite aggregates and is ideal for use where designers are striving to create distinctive, contemporary outdoor spaces with hard-wearing chamfered edges.

Available in plan thickness of 50mm or 63mm, Celestia's elongated proportions ensure it can work well to create an eye-catching centrepiece or perform a subtle role as part of a bigger, more involved outdoor design.

DESCRIPTION		
Appearance	Solid unit with skimmed surface	
Manufacturing Process	Hydraulically pressed concrete	
Base Raw Material	Pigmented & unpigmented concrete utilising specially selected aggregates	
Governing Manufacturing Standards	All data where relevant to be established in accordance with BS EN 1339 : 2003	
CE Marking/DOP	https://www.marshalls.co.uk/dop	
NBS Specification	Q25 31	Q25 315

Marshalls
Creating Better Spaces

Landscape House, Premier Way,
Lowfields Business Park,
Elland HX5 9HT
Tel: 03704 11 22 33
https://www.marshalls.co.uk/commercial

T: 01422 312000
F: 01422 312943
E: services.advisory@marshalls.co.uk

Celestia Skimmed 300 x 300 x 50

Date Created: 07/02/19

PHYSICAL PROPERTIES	Minimum (mm)	Maximum (mm)
Tolerances		
Length	296	300
Width	296	300
Thickness	47	53
Work Dimensions (mm)	298 x 298 x 50	
Nominal Dimensions (mm)	300 x 300 x 50	
Tolerances on Work Dimensions (mm)	Length ±2mm, width ±2mm, thickness ±3mm	
Abrasion Resistance (mm)	≤ 23mm (Wide Wheel Abrasion Test)	
Durability (Freeze-thaw)	≤ 1.0 kg/m² as a mean with no individual value > 1.5 kg/m²	
Material Density	2300 kg/m³ (typically)	
Slip/Skid Resistance (polished)	Mean polished skid resistance value (PSRV) : > 45	
Slip/Skid Resistance (unpolished)	Mean unpolished skid resistance value (USRV) : > 45.	
Thermal Conductivity (K value)	Design data as defined to BS EN 13369 : 2013	

SPECIFICATION	
Approx unit weight (kg)	10.5
Emission of Asbestos	No content
External Fire Performance	Deemed to satisfy. See commission decision 2000/553/ECU
Reaction to fire	Class A1, see commission decision 2000/605/EC

SUSTAINABILITY	
Breeam	These units can achieve an "A" rated system when used in conjunction with the correct sub-base components
Carbon Footprint	25 kg CO2 m²

APPLICATION	
Loading Classification	Category 6 - 10 large goods vehicles per week (0.15 msa)

SITE WORKS	
Coverage	11 no per m²

SUPPLY	
Av. pack size (m2)	3.6
Units Per Pack	40
Av. pack weight (kg)	425
Packaging	All packs are suitable for crane off-load Fork lift off-load on request

FURTHER INFORMATION	
Cleaning & Maintenance	Cleaning & maintenance details are available on request
Efflorescence	Any product containing cement during its early life may exhibit a temporary white discolouration known as efflorescence. This is not a product fault and will gradually disappear with exposure to natural weathering and trafficking
Weathering	It should be appreciated that with all products weathering and site conditions can cause shade variation to appear across the surface of individual units. This does not in any way affect the performance of the units and any such variation will diminish over a period of time as the product matures.
Product Evolution	The evolution of new product design is continuous and information is subject to change without notice. Customers should check with the supplier to ensure that they have the latest details. Marshalls reserve the right to amend the technical information as deemed necessary and in accordance with the relevant national and international standards without notice
Contact Us	For technical information on the design, specification and construction when utilising the product, contact the Technical Advisory Services Department on 0370 411 2233

Consent 2012 / 6858 / P
Condition No 16

Property: 23-25 Denmark Street

/ Note: The information about the facing materials included in this section is also relevant to Consent 2012/6858/P, Condition 15 /

WELSH SLATE
Part of the Breedon Group

Welsh Slate, Penrhyn Quarry, Bethesda, Bangor,
Gwynedd, LL57 4YG
Tel : +44(0)1248 600 656
www.welshslate.com

EN 12326-1:2014				Page 1 of 4
Reference of this commercial document:	IMSD 8.2.4-22a		Date of issue	May 2018 (Issue 2)
Commercial document issued by: Welsh Slate, Penrhyn Quarry, Bethesda, Bangor, Gwynedd, LL57 4YG United Kingdom				
Location of mine quarry : Penrhyn Quarry, Bethesda, Bangor, Gwynedd				
This document records the conformity of the product described below and is incomplete without the explanation of the meaning of the test results and the requirements of EN 12326-1:2014. The tests referred to and the criteria are contained in EN 12326-1:2014 and EN 12326-2:2011				
Date of sampling	December 2017		Date of testing	Jan - April 2018
Product description and commercial name Relation between bedding and cleavage	Penrhyn Capital Roofing Slate 300x200mm Beds parallel to cleavage			Conformity
1. Dimensional tolerances				
Format	Rectangular			
Deviation from declared length			±0mm	YES
Deviation from declared width			±0mm	YES
Deviation from declared squareness			1.0%	YES
Deviation from straightness of edges			1.0mm	YES
Slate type for deviation of flatness	Very flat	Flat (Capital)	Normal (County)	Non-flat (Celtic)	
Deviation from flatness	0.1%				YES
2. Thickness					
Nominal thickness and variation of individual thickness against nominal thickness	5.5mm, ± 35%				YES
3. Strength					
Characteristic MoR	Transverse	54.9 N/mm²	Longitudinal	79.1 N/mm²	NR
4. Water absorption	Code W1 (≤0.6): 0.21%				YES
5. Freeze thaw					NR
6. Thermal cycle test				T1	YES
7. Apparent calcium carbonate content				0.0%	YES
8. Sulfur dioxide exposure tests: ≤ 20% apparent calcium carbonate				S1	YES
8. Sulfur dioxide exposure tests: > 20% apparent calcium carbonate					NA
9. Non-carbonate carbon content				0.9%	YES
10. External fire exposure	Deemed to satisfy class B_{roof}				YES
11. Reaction to fire	Deemed to satisfy class A1				YES
12. Release of dangerous substances	None in conditions of use as roofing or external cladding				NR

WELSH SLATE
Part of the Breedon Group

Welsh Slate, Penrhyn Quarry, Bethesda, Bangor,
Gwynedd, LL57 4YG
Tel : +44(0)1248 600 656
www.welshslate.com

EN 12326-1:2014			Page 2 of 4
Date of sampling and testing	If more than one date is applicable to sampling or testing they should be indicated against the individual test results		
Product description	Slate for roofing and external cladding or carbonate slate for roofing and external cladding. Slate type and origin		
1. Dimensional tolerances			
Length and width	Maximum deviation ± 5mm		
Deviation from squareness	Maximum deviation ± 1% of the length		
Deviation from straightness of edges	Slate length ≤ 500mm Permitted deviation ≤ 5mm		
	Slate length > 500mm Permitted deviation ≤ 1% of the length		
Flatness : The limits of deviation from the flatness are defined for four types of slate. The bevelled edges shall be applied to the convex face. Slates with deviation from flatness in excess of the limit may be used for special applications.	Slate type	Maximum deviation from flatness as a % of the slate length	
	Very flat	< 0.9	
	Flat	< 1.0	
	Normal	< 1.5	
	Non-flat	< 2.0	
2. Thickness:	The basic nominal thickness is determined as a function of the bending strength using the formulae given in 3, local climate conditions and traditional construction techniques. The basic nominal thickness is increased in relation to the slates performance in the appropriate sulfur dioxide test (if required) as shown in 7 and 8 below.		
3. Strength:	Longitudinal and transverse characteristic modulus of rupture; there is no limit for characteristic modulus. However the basic nominal thickness is determined as a function of the bend strength using the formulae given below, local climate conditions and traditional construction techniques.		

$$el = X\sqrt{\frac{l}{Rcl}}$$

and

$$et = X\sqrt{\frac{b}{Rct}}$$

Where
el is the longitudinal thickness , (in mm);
et is the transverse thickness, (in mm);
l is the length of the slate, (in mm);
b is the width of the slate, (in mm);
Rcl is the characteristic longitudinal modulus of rupture, (in N/mm²);
Rct is the characteristic transverse modulus of rupture, (in N/mm²);
X is a constant determined as a function of climate and the traditional construction techniques (in N½.mm-½). NOTE: It may be different for each formula and is selected for the member state of use according to the table below.

National X Factors:

Member state	Transverse	Longitudinal	Member state	Transverse	Longitudinal
Belgium	1.0	1.0	Czech Repub.	1.2	1.2
Ireland	0.9	1.1	Italy	1.2	1.2
France	1.0	1.0	Spain	1.0	1.0
Germany	1.2	1.2	UK	0.9	1.1

Those member states that have not declared a national value should select a value or pair of values in relation to their countries climate and traditional construction techniques. It should not be less than the minimum value or pair of values given above.

el and et are determined by using the length l and the width b of the slates. The maximum value determined is the basic individual thickness of the slate, ebi. The basic individual thickness is increased in relation to the slates performance in the appropriate sulphur dioxide test as shown in 7 and 8 below.

WELSH SLATE
Part of the Breedon Group

Welsh Slate, Penrhyn Quarry, Bethesda, Bangor,
Gwynedd, LL57 4YG
Tel : +44(0)1248 600 656
www.welshslate.com

EN 12326-1:2014			Page 3 of 4
4. Water Absorption:	Code W1 (≤0.6), W1 (>0.6), or W2		
5. Freeze-thaw test:	Slates tested indicate the mean value of the modulus of rupture after 50 cycles in transverse and longitudinal directions before and after the freeze/thaw test, if relevant (test (if W1(>0.6)), or not required).		
6. Thermal cycle test:	The following table explains the meaning of the test codes		
Code	Observation in the test	Conformity to the standard	
T1	No changes in appearance. Surface oxidation of metallic minerals. Colour changes that neither affect the structure nor form runs of discolouration.	Acceptable	
T2	Oxidation or appearance changes of the metallic inclusions with runs of discolouration but without structural changes.	Acceptable	
T3	Oxidation or appearance changes of the metallic minerals which penetrate the slate and risk the formation of holes.	Acceptable subject to the note below	
NOTE : It is best only to use slates within code T3, which potentially may result in water penetration selectively with suitable methods of construction that avoid such penetration. Slates showing exfoliation splitting or other structural changes in this test are not acceptable.			
7. Apparent calcium carbonate content:	There is no limit on apparent calcium carbonate content. However, the apparent calcium carbonate content determines which sulfur dioxide exposure test procedure should be carried out and, together with the strength, the minimum nominal thickness of the product. If the carbonate content is less than or equal to 20% then the sulfur dioxide exposure test procedure in EN 12326-2:2011, 14.1 applies. If the carbonate content is more than 20%, the sulfur dioxide exposure test procedure in EN 12326-2:2011, 14.2 applies. The minimum thickness is calculated using the table below.		
8. Minimal nominal thickness in relation to apparent calcium carbonate content and sulfur dioxide exposure code			
Carbonate content %	SO2 exposure test code from EN 12326-2:2011, 14.1	Depth of softened layer from EN12326-2:2011, 14.2	Thickness adjustment
≤ 5.0	S1		None
	S2		ebi + 5%
	S3		ebi ≥ 8.0mm or switch to the test in EN 12326-2:2011, 14.2
> 5.0	S1		ebi + 5%
	S2		ebi + 10%
≤ 20.0	S3		ebi ≥ 8.0mm or switch to the test in EN 12326-2:2011, 14.2
> 20.0		0mm to 0.70mm	ebi + 0.50mm + 7t²
ebi is the basic individual thickness obtained from 3 above (in mm) t is the thickness of the softened layer obtained from EN 12326-2:2011, 14.2 (in mm)			
9. Non-carbonate carbon content: The non-carbonate carbon content shall be less than 2%			

WELSH SLATE
Part of the Breedon Group

Welsh Slate, Penrhyn Quarry, Bethesda, Bangor,
Gwynedd, LL57 4YG
Tel : +44(0)1248 600 656
www.welshslate.com

CE Marking	Page 4 of 4

Welsh Slate roofing products conform to the requirements of the CE mark.

The following table provides the necessary information required to demonstrate conformity of

Penrhyn Capital Roofing Slate

CE
0086

Welsh Slate Ltd, Penrhyn Quarry, Bethesda, Near Bangor, Gwynedd, Wales, UK, LL57 4YG	
10	
001PQ-DoP2015-05-28	
EN 12326-1:2014	
Penrhyn Capital	
Intended to be used as discontinuous roofing and external cladding	
Dimensional variation	
Nominal thickness	5.5mm
Individual thickness	5.5mm (< +/- 35%)
Deviation of length and width	Complies
Deviation of edge straightness	Complies
Deviation of rectangularity	Complies
Mechanical resistance (Characteristic modulus of rupture)	
Transverse	54.9 N/mm²
Longitudinal	79.1 N/mm²
Water permeability - water absorption	**W1** (≤0.6%)
Apparent calcium carbonate content	≤ 5%
Durability	
Water absorption	**W1** (≤0.6%)
Freeze-thaw cycling	Not required
Thermal cycling	**T1**
Sulfur dioxide exposure	**S1**
Non-carbonate carbon content	Complies: ≤ 2%
Release of dangerous substances: None in conditions of use as roofing or external cladding	
External fire performance: Deemed to satisfy	

Copper

Product Data Sheet **TECU® Classic**
Status: 2012.09.21

International Standards		
International Standards	Symbol	Number
DIN EN 1172: 2012-02	Cu-DHP	CW024A
UNS*	C 12200	*Unifield Numbering System (USA)

Chemical composition in %		
Element	min.	max.
Cu	99.90	-
P	0.015	0.040

Technical Data: Thickness 0.50 - 1.00 mm	
applicable width range	500 mm - 1250 mm
width tolerance	0 / + 2 mm
length tolerance for sheets	0 / + 10 mm
thickness tolerance	+/- 0.02 mm
longitudinal edge straightness tolerance - sheets up to 3000 mm - strips	 up to 1 mm per 1000 mm, max. 3 mm for 3000 mm gauge length up to 1 mm per 1000 mm, max. 5 mm for 5000 mm gauge length
flatness (transverse to rolling direction)	< 0.2 % of strip width
Tensile strength (R_m) Proof Strength ($R_{p0.2}$) Elongation (A50)	240 - 285 N/mm² 180 - 230 N/mm² ≥ 15 %
hardness HV	max. 90

Availability	
coil inside diameter Ø - big coil	500 mm, 600 mm
sheets	on request
surface	copper red mill finish
temporary protective plastic film	on request - foliation on one side possible
product application	construction
Envionmental Product Declaration	ISO 14025
CE-marked according to EN 14783 and EU directive 89 / 106 / Eec (CPD) - more information on www.kme.com/ce	

Physical Properties	
density	8.93 g/cm³
coefficient of expansion	1.7 mm/m ∆ T 100 K
modulus of elasticity at 20° C	132 kN/mm²

To be read in conjunction with KME document "Important instructions for Storage, Application and Processing of TECU® Classic".

KME Germany GmbH & Co. KG
Architectural Solutions

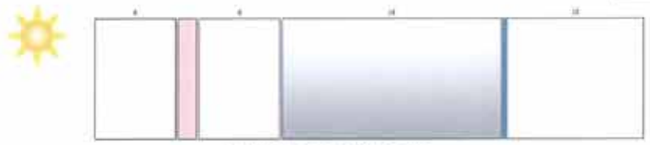
Klosterstraße 29, 49074 Osnabrück, Germany
Tel.: +49 (0) 541 / 321-2000
Fax: +49 (0) 541 / 321-2111
www.kme.com/tecu, info-tecu@kme.com

Glass

GUARDIAN CONFIGURATOR
GLASS PERFORMANCE CALCULATOR

KIWA confirms to have verified the calculation engine of the software Guardian Configurator 4.1 TESTED BY kiwa to be compliant to EN 410 and EN 673.

Product code
70 / 49 / 1.0



total thickness = 39.52 mm

Glazing from external to internal:

Pane 1		Pane 2	
6 mm	Float Glass Guardian UltraClear		ClimaGuard A 1.0
1.52 mm	PVB Clear	10 mm	Float Glass Guardian UltraClear
6 mm	Float Glass Guardian UltraClear		

Spacer 1 - 16 mm

10%	Air
90%	Argon

Results

Visible light (EN 410 - 2011)		Solar energy (EN 410 - 2011)	
transmittance [%]	τ_v = 69.7	solar factor [%]	g = 49.1
reflectance external [%]	ρ_v = 20.3	shading coefficient [g/0.87]	sc = 0.56
reflectance internal [%]	ρ_v = 21.9	direct transmittance [%]	τ_e = 43.0
general colour rendering index	R_a = 97.3	direct reflectance external [%]	ρ_e = 31.4
		direct reflectance internal [%]	ρ_e = 37.9
Thermal properties (EN 673 - 2011)		direct absorption [%]	a = 25.6
U-value [W/(m²K)]	slope α = 90°	UV transmittance [%]	τ_{uv} = 0.0
according to EN:	U_g = 1.0	secondary internal heat transfer factor	q_i = 6.1
3 decimal places:	U_g = 1.025	**Other data**	
		estimated sound reduction index [dB]	R_w = NPD
		(EN 717-1)	C = NPD
			C_{tr} = NPD

The calculated values are for orientation only and do not offer any guarantee regarding the fabrication of the un- intended end- product. Glass configurations do not amount to a guarantee of product availability.

LONDON ARCHITECTURAL GLASS
London Architectural Glass
LAG-UKdylan

Date: 28/09/2018
Database version: 20171211
Program version: 4.1.210

Metallic Lead

British Lead

1. IDENTIFICATION OF SUBSTANCE/PREPARATION AND COMPANY/UNDERTAKING

Product Name: Metallic Lead

Use: Used in the construction industry for roofing, flashing and cladding applications. Also used as shielding in the x-ray and nuclear industries and sound attenuation applications.

Supplier: British Lead
Peartree Lane
Welwyn Garden City
Hertfordshire AL7 3UB
Telephone: 01707 324595
Fax: 01707 328941

2. COMPOSITION/INFORMATION ON INGREDIENTS

Ingredient: Lead
EU No: 231-100-4
Cas No: 7439-92-1
Content %: >99

3. HAZARDS IDENTIFICATION

Main Hazards: Lead in its solid metallic state (Lead sheet) would not normally present a hazard. However, Lead is a toxic metal and may present a hazard via Lead fumes when melted and/or from Lead dust. Low concentrations of other various elements will be present, some as alloying constituents, others, as impurities. Oxidation of the surface of the Lead will occur forming a surface layer of Lead compounds.

4. FIRST AID MEASURES

The measures below are unlikely to be relevant whilst Lead is in its solid metallic state. However they are relevant if there is a likelihood of exposure to fumes from melting Lead and Lead dust compounds on the surface caused by oxidation.

Inhalation of Fumes or Dust: Move person to fresh air. Seek medical attention.

Ingestion of Dust: Do not induce vomiting, encourage drinking of water. Seek immediate medical attention.

Eye Contact from Dust: Ensure that any contact lenses are removed from the eyes before rinsing. Irrigate eyes with plenty of water for 5 minutes and seek medical attention if irritation persists.

Skin Contact: Remove potentially contaminated clothing after using Lead products. Wash affected area with soap and water. Lead would not normally irritate the skin. Seek medical attention if irritation persists as it maybe due to contact with other substances or chemicals.

5. FIRE-FIGHTING MEASURES

Extinguishing Media: Non flammable but molten Lead may ignite adjacent materials. Use Dry powder, CO_2 or Foam. Do not use water.

Exposure Hazards: Toxic Fumes may be produced during a fire.

Protection of Firefighters: Wear positive pressure self contained breathing apparatus and suitable protective clothing.

6. ACCIDENTAL RELEASE MEASURES

Personal Protection: No special measures required whilst Lead is in its solid metallic state. When melting Lead or cleaning up any Lead spillage protective clothing must be worn, this would include eye protection, gloves and an approved face mask. This precaution also applies if Lead dust is present.

Environmental Precaution: Avoid entry into water courses.

Clean-up Procedures: Spillages should be cleaned and placed in to a sealed container and then sent to a Lead processing company for treatment.

7. HANDLING AND STORAGE

Handling Precautions: Lead is a heavy metal; extreme care should be taken when lifting the material. Follow the guidelines set out in the HSE Manual Handling Regulations. Wear gloves, protective clothing and boots and follow standard personal hygiene procedures.

Storage: Store in a dry area, ensure that the floor loading is not exceeded.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Component: TWA

Lead 8 Hours 0.15mg/m^3

Respiratory Protection: Wear approved face masks when melting Lead or working in the vicinity of Lead dust particles especially when stripping old Lead roofs – make sure the face mask meets the standard required. Employ mechanical ventilation equipment when melting Lead in enclosed areas.

Hand Protection: Wear suitable gloves.

Eye Protection: Wear safety goggles when melting Lead or Lead welding.

Skin Protection: Wear gloves and protective clothing. Follow standard personal hygiene procedures.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Bluish grey soft metal
Melting Temperature: 327°c
Fuming Temperature: 500°c
Density: 11.34g/cm^3
Odour: None
Flash Point: N/A
Solubility in Water: Insoluble

10. STABILITY AND REACTIVITY

Stability: Stable under normal conditions at low temperature.
Conditions to Avoid: N/A
Materials to Avoid: Ammonium nitrate, chloride trifluoride, hydrogen peroxide, potassium, sodium azide, sodium carbide and zirconium.

Hazardous Decomposition Products: Lead is a toxic metal and may produce hazardous fumes when melted.

11. TOXICOLOGICAL INFORMATION

The details below are unlikely to be relevant whilst Lead is in its solid metallic state. However they are relevant when exposed to fumes from melting Lead and Lead compounds on the surface caused by oxidation and from Lead dust.

Inhalation: Prolonged unprotected exposure could lead to various symptoms typical of Lead poisoning although this is extremely rare.

Ingestion: Could cause nausea or abdominal pain. Prolonged exposure could lead to various symptoms typical of Lead poisoning although this is extremely rare.

Skin Contact: Prolonged unprotected contact with Lead could lead to absorption of Lead particles into the blood stream, eventually leading to various symptoms typical of Lead poisoning although this is extremely rare.

Eye Contact: Possible irritation.

12. ECOLOGICAL INFORMATION

Mobility: Not considered mobile whilst Lead is in its solid metallic state. Particles can be dispersed through the air or in water courses .

Degradation: Not biodegradable.

Accumulation: Lead compounds have bioaccumulation potential.

Other Adverse Effects: Lead compounds are toxic to aquatic organisms.

13. DISPOSAL CONSIDERATIONS

Waste from Residues: Surplus metal may be returned to British Lead for recycling. Disposal of compounds must be to a licensed waste collection point, observe any local and national regulations.

Contaminated Packaging: N/A

14. TRANSPORT INFORMATION:

No restrictions on transportation.

15. REGULATORY INFORMATION

Label for Supply: N/A
Text of Risk Phrases Used in Section 2: N/A
Text of Safety Phrases Used in Section 2: N/A
Statutory Instrument: Chemicals (Hazards Information and Packaging) Regulations 2009 SI 716. Control of Substances Hazardous to Health 2002; SI 1000/437. Control of Lead at Work Regulations 2002; SI 2002/2676.
Approved Codes of Practice: Classification and Labelling of Substances and Preparations Dangerous for Supply. The Compilation of Safety Data Sheets (3rd Edition).
Guidance: Occupational Exposure Limits EH40 COSHH Essentials: Easy steps to control chemicals. Control of Substances Hazardous to Health Regulations; HSG193 CHIP for Everyone HSG108.

16. OTHER INFORMATION

The application of the soft metal presents negligible risks providing standard sensible workplace cleanliness is adopted. Working with molten Lead or Lead alloys requires the use of approved eye protection and other recognized personal protection such as approved protective face masks. The appropriate health and safety requirements are defined in the Control of Lead at Work Regulations 2009. It is recommended that a simple work place risk assessment is made in accordance with the point stated on pages 1, 2 & 5 of the regulations. In general, working with the metal in the open air presents negligible risk providing adequate washing facilities are available at the workplace for hand cleaning.

The data contained in this Safety Data Sheet has been supplied as required by the Chemical (Hazard Identification and Packaging) Regulations 2009, as amended, for the purpose of protecting the health and safety of industrial and commercial users who are deemed capable of understanding and acting on the information provided. Please ensure that it is passed to the appropriate person(s) in your company, who are capable of acting on the information. This information is given in good faith, being based on the latest knowledge available to British Lead. No known relevant information has been omitted from this Material Safety Data Sheet and the information provided is designed to enable the user to use the product safely. The user should not assume on the basis of the information provided in this sheet that the product is suitable for any abnormal use. The company can not accept liability to any customer, their employees or any other person whatsoever for any loss, injury or damage, whether direct or consequential, which may be caused by any error or omission from this sheet, whether such error or omission is negligent or otherwise. If the information provided is insufficient to ensure safety in any particular application, contact British Lead for further advice before the proposed application is undertaken.

02/11

British Lead, Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UB
Tel: 01707 324 595 Fax: 01707 328 941 email: sales@britishlead.co.uk

Product datasheet
2019-01-09
Item no: 2131

Kebony Norge AS
+47 06125
www.kebony.com
info@kebony.com

Kebony Clear

Kebony Clear RAP terrace smooth w/side slits 22 x 142 mm

Product description

Kebony Clear Radiata products are produced from FSC® certified Radiata Pine modified with a bio-based liquid.

The patented Kebony technology permanently alters the wood cell structure to give a unique wood product with outstanding durability and no maintenance needs beyond normal cleaning.

Kebony Clear Radiata products have a primarily clear front surface and are treated through the board.

Note: As of the 2019 season, the side slits are made narrower and shallower. Some traditional fixing clips maybe no longer be suitable. Kebony H-clip can still be used.

Quality and appearance upon delivery

Profile	Rectangular with smooth surface
Dimension	22 x 142 mm
Length	For available lengths, please consult the 'Overview of available lengths' on www.kebony.com
Knots/Pitch pockets	Maybe visible and are a natural occurrence in wood
Cupping	Max 1 % of width
Crook	3-3,6 m: max 10 mm; 4,2-4,8 m: max 13 mm
Moisture	4-8 %
Cracks	Surface cracks and checks maybe visible
Wane	May occur on the back
NOTE	There may be defects on the back side. These will not affect the technical quality of the product.

The Kebony technology gives the wood a deep rich brown colour. After exposure to sun and rain the wood will develop a natural silver gray patina. Natural colour and grain variations will be visible both upon delivery and after installation. This will not influence the performance and durability of the wood.

Technical data (average values)

	Kebony	Untreated	Unit
Density (12 % mc)	670	480	Kg/m^3
Hardness (EN 1534)	4,2	2,5	Brinell
Characteristic bending strength (MOR - EN 408 / EN 384)	36,1	N/A	MPa
Stiffness (MOE - EN 408 / EN 384)	12,4	8,1	GPa
Max swelling (dry to wet, tangential direction)	4	8	%
Decay resistance (EN 350)	1	5	Durability class 1-5
Use class (EN 335)	3*	1**	

* Suitable for outdoor applications above ground
** Not suitable for outdoor applications

Documents / Certificates / Compliance

Kebony installation guide for decking - www.kebony.com
FSC CU-COC-813689 - www.fsc.org
Nordic Ecolabel 2086 0001 - www.nordic-ecolabel.org
EPD: NEPD-407-287-EN – www.epd-norge.no
Complies with EU Timber Regulation (EUTR)
AbZ: Z-9.1-863 - www.dibt.de

Environment

Kebony products are exempted from the EU's biocide directive (76/769/EEC).
Waste handling as ordinary wood.

Disclaimer

Kebony products will change in appearance when exposed to rain and sun. Colour changes and surface cracks will occur due to natural weathering. The manufacturer cannot be held liable for any such variations in colour and surface appearance. This will not influence durability and overall performance of the product.

This data sheet applies for the original profile – any alterations may influence the technical performance of the product.

Kebony is continuously working on product development. Information in this datasheet may be changed without further notice.

Product Data Sheet

AkzoNobel Powder Coatings

Interpon D1036 Matt (30)

Product Description	**Interpon D1036 Matt (30)** is a range of powder coatings intended for use on architectural aluminium and galvanized steel. **Interpon D1036 Matt (30)** has been specifically formulated without the use of TGIC. As part of the **Interpon D 1036** series of architectural powders, **Interpon D1036 Matt (30)** gives excellent exterior durability and colour retention and conforms to the requirements of all the major European architectural finishing standards. All **Interpon D1036 Matt (30)** powders are lead-free and meet the requirements of GSB Standard, Qualicoat Class 1, EN12206, and EN13438 (formerly BS6496 &BS6497), and AAMA 2603. **Qualicoat License Number:** P-0235 (P/P extension) (France), P-0735 (P/P extension) (Italy), P-0739 (Germany), P-0350 (UK), P-0530 (P/P extension) (Spain), P-0886 (Czech Rep.), P-1126 (Turkey) **GSB License Number:** 164b (gloss 30)		
Powder Properties	**Chemical type**	Polyester	
	Appearance	Smooth Matt	
	Gloss level (EN ISO 2813 (60°))	25-35 gloss units	
	Specific gravity	1.2 – 1.9 g/cm^3 depending on colour	
	Particle Size	Suitable for electrostatic spray	
	Storage	Dry cool conditions below 30°C *(open boxes must be resealed)*	
	Shelf life	24 months below 30°C 12 months below 35°C	
	Curing schedule (at object temperature)	15-30 minutes at 180°C 12-25 minutes at 190°C 10-20 minutes at 200°C **Powder on Powder application:** **1st phase**: Melting and partial curing of the base coat suggested 110-120°C for 15-20 min. (object temp) otherwise refer to the instruction of the spraying equipment supplier **2nd phase**: Application of the wood decorative powder according to the instruction of the spraying equipment supplier **3rd phase**: Complete curing of the full package for 12-25 minutes at 190°C (object temperature)	

AkzoNobel Powder Coatings

Mechanical Tests	**Flexibility**	ISO 1519 (cylindrical Mandrel)	Pass 5mm
	Adhesion	ISO 2409 (2mm crosshatch)	Gt0
	Erichsen cupping	ISO 1520	Pass >5mm
	Impact resistance	ISO 6272:1993	Pass 2,5 Joules (reverse & direct (20 in lb)
	Buchholz Hardness	ISO 2815	>80
Environmental and Durability Tests	**Acetic acid salt spray**	ISO 9227	<16 mm^2 corrosion/10cm, 1000 hours
	Constant humidity	ISO 6270	No blistering, creep <1mm (1000 hours)
	Sulphur Dioxide	ISO 3231	Pass 30 cycles – no blistering, gloss loss or discoloration
	Permeability	EN12206-5.10	Pressure Cooker – pass 1 hour no defects
	Chemical Resistance	Generally good resistance to acid, alkalis and oil at room temperatures	
	Mortar Resistance	EN12206-1	No effect after 24 hours
	Accelarated Weathering	ISO16474-2 (1000 hrs) ISO11507:1997 QUV B 313 (300 hrs)	Gloss retention ⩾50%
	Exterior durability	ISO2810 (1 year)	⩾50% gloss retention, Colour retention accords with GSB/Qualicoat Chalking – none in excess of minimum in ASTM D659:1980
Test Conditions	Testing has been determined under laboratory conditions using the following application properties and is for guidance only.		
	Substrate	Aluminium (0.5-0.8 mm Al Mg1)	
	Pretreatment	Chrome free Qualicoat/GSB approved pretreatment	
	Film thickness	60 – 80 microns	
	Cure schedule	18 minutes at 190°C (object temperature)	
	Actual film performance will depend on the individiual circumstances in which the product is used.		
Pre-treatment	For maximum protection it is essential to pretreat components prior to the application of **Interpon D1036 Matt (30).** Aluminium components should receive a full multi-stage chromate conversion coating or suitable chrome-free pre-treatment or suitable pre-anodising to clean and condition the substrate. Detailed advice should be sought from the pre-treatment supplier. Galvanised steel requires surface preparation by either multi-stage pretreatment using		

AkzoNobel Powder Coatings

	either zinc phosphate or chromate conversion or controlled sweep blasting. Depending on the type of galvanizing, degassing or use of anti-bubbling additives may be required – follow the procedural advice of the pretreatment supplier. **Interpon D1036 Matt (30)** products may also be used on cast or mild steel. For outdoor use, **Interpon PZ** anti-corrosive primer over a correctly prepared substrate is recommended.
Application	**Interpon D1036 Matt (30)** powders can be applied by manual or automatic electrostatic spray or tribo-charging equipment. For solid shades, unused powder can be reclaimed up to a maximum of 30% using suitable equipment and recycled through the system. Please consult AkzoNobel for further details as to the correct mixing ratio for virgin/reclaim powder. **Interpon D1036 Matt (30)** powders should be applied at minimum 60µm. All powders can show small colour differences from batch to batch, this is normal and unavoidable. While AkzoNobel take every precaution to minimize visible differences, this cannot be guaranteed. Applicators and fabricators are advised to use a single batch for parts that will be assembled together. Differences are more likely with special effect powders. Bonded products have better application properties than blended products (more stable) but attention should still be paid to line settings in order to avoid "marble effect" and changes in aspect after recycling. A constant ratio between virgin and recycled powders should be fixed by the coater in order to achieve a consistent effect. For more details it is suggested to read the ***"Metallic Application Guideline".*** Different substrates (aluminium, steel, galvanized steel…), use of primer, and big changes in film thickness may give a different aspect. Products with different codes should not be mixed even if same colour and gloss.
Post Application	For specific advice on the suitability of post coating processes such as bending or the use of sealants, adhesives, thermal break, cleaning etc, please consult AkzoNobel.
Maintenance	For specific advice on Cleaning and Maintenance please consult the Interpon D series *Cleaning and Maintenance Guidelines* available from AkzoNobel.
Safety Precautions	Please consult the Material Safety Datasheet (MSDS)
Disclaimer	**IMPORTANT NOTE:** The information in this data sheet is not intended to be exhaustive and is based on the present state of our knowledge and on current laws: any person using the product for any purpose other than that specifically recommended in the technical data sheet without first obtaining written confirmation from us as to the suitability of the product for the intended purpose does so at his own risk. It is always the responsibility of the user to take all necessary steps to fulfil the demands set out in the local rules and legislation. Always read the Material Data Sheet and the Technical Data Sheet for this product if available. All advice we give or any statement made about the product by us (whether in this data sheet or otherwise) is correct to the best of our knowledge but we have no control over the quality or the condition of the substrate or the many factors affecting the use and application of the product. Therefore, unless we specifically agree in writing otherwise, we do not accept any liability whatsoever for the performance of the product or for any loss or damage arising out of the use of the product. All products supplied and technical advices given are subject to our standard terms and conditions of sale. You should request a copy of this document and review it carefully. The information contained in this data sheet is subject to modification from time to time in the light of experience and our policy of continuous development. It is the user's responsibility to verify that this data sheet is current prior to using the product.