20-20 Fibre Cement Floor

RESISTANT BUILDING PRODUCTS LTD

A1 Non-combustible T & G Structural Floor Boards

Technical Data, Design Info & Fitting Guidance

F·T·M·R·C

STA ASSUREGOLD

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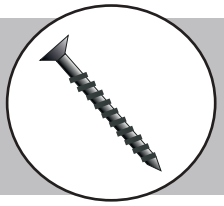
Feature & Benefits

High Performance Fire Protection A1 Non-Combustible

Resistant 20-20 FCB T & G Flooring has been developed to design in higher fire protection, shorten build time and improve the quality of build. As the UK & Ireland construction industry moves forward it is generally accepted that more buildings will be built from timber and light weight MMC. This expected increase in MMC comes at a time when the fire performance of all buildings is under more scrutiny than ever before. A1 Non-combustible structural drylining and sheathing boards are commonly used to improve the fire performance of walls and ceilings, both during construction and in-service, but there are very few fast fit, Non-combustible materials available that can be used to form a load bearing floor deck.
Selecting A1 Non-combustible building materials is a simple way to reduce the overall fire load and help minimise the potential severity and spread.

Weather Resistant During Construction Phase

Equally suitable for both the fast growing OSM sector and onsite installation our new T & G flooring board can be exposed to weather during the construction phase without fear of degrade or distortion to provide a safe working platform prior to wind and watertight stage and thereby shorten build programmes.



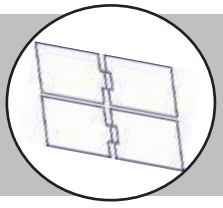
Screw Fix to Joist

Available in 19 & 22mm thickness our boards come in full size 2400 x 600mm sheets for less jointing and faster fitting time. Screws don't require pre-drilling and because we haven't used any additional adhesive anywhere in our BS EN 1195:1998 point load capacity stiffness testing then you don't have to either unless you decide your project would benefit from the inclusion of same. (see pages 8 & 9 for more detailed fitting information).

Higher Strength

Underfoot the 20-20 FCB T & G Flooring feels far superior to other commonly used materials such as chipboard or OSB which are prone to squeaking and completely lack the high build quality impression experienced from a walk across our floor.

Don't think our boards are for floors only - they are equally at home higher up the building as a component of roof decks. (See pages 6 & 7 for more information).



Ready to Tile

As a structural floor ready to receive any further decorative floor covering it eliminates the need for timely and costly additional overboarding and provides a suitable base for most underfloor heating systems.

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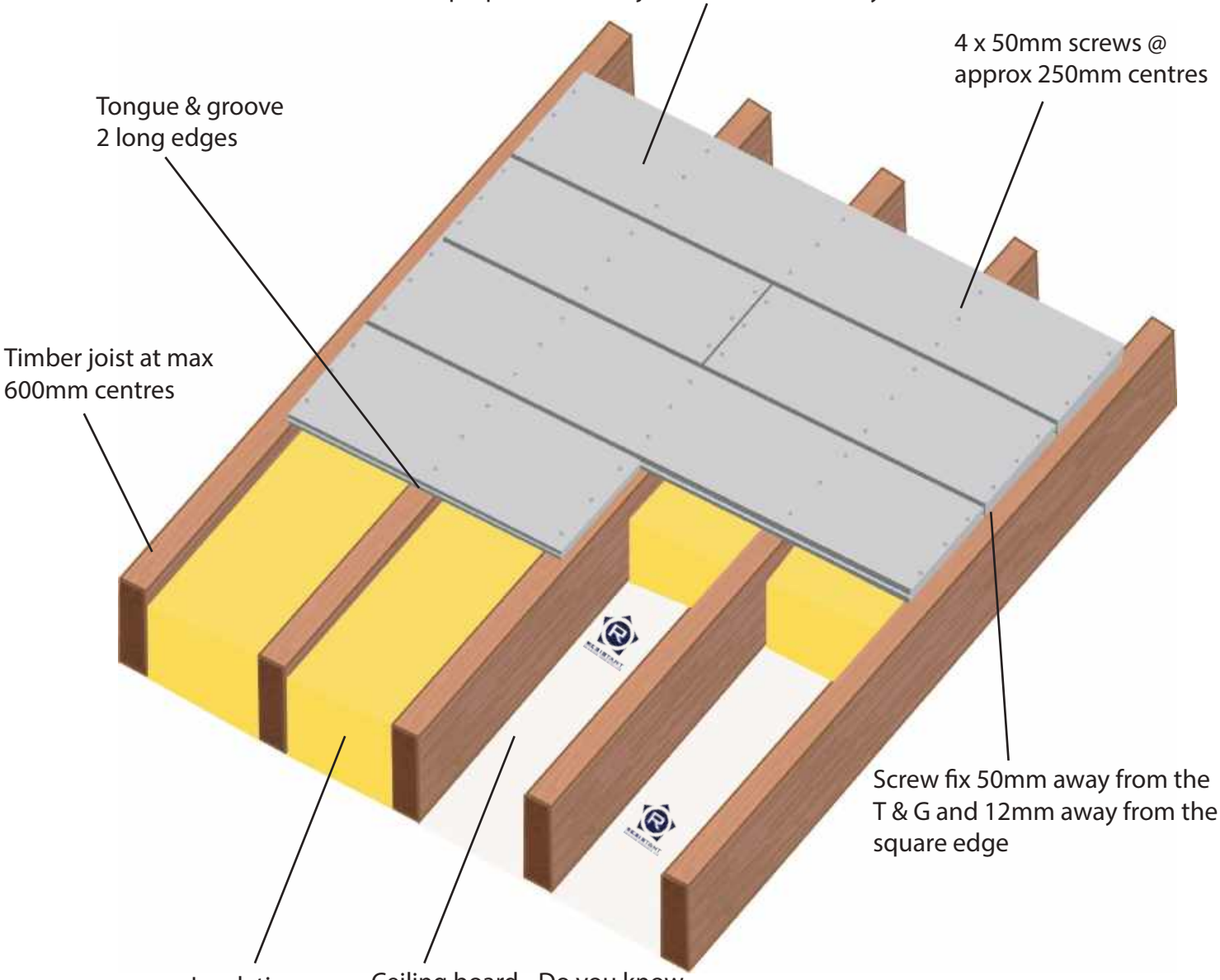
Boards can be fitted either way up. In this diagram the boards are shown fitted with Resistant logo face down / T & G expansion profile gap face up. Brochure cover picture shows boards fitted Resistant logo face up / T & G expansion profile gap face down. Read page 8 before deciding which orientation best suits your project.



A1 FIRE RATED

WEATHER RESISTANT

DIRECT FIX TO JOIST

HIGH STRENGTH

READY TO TILE

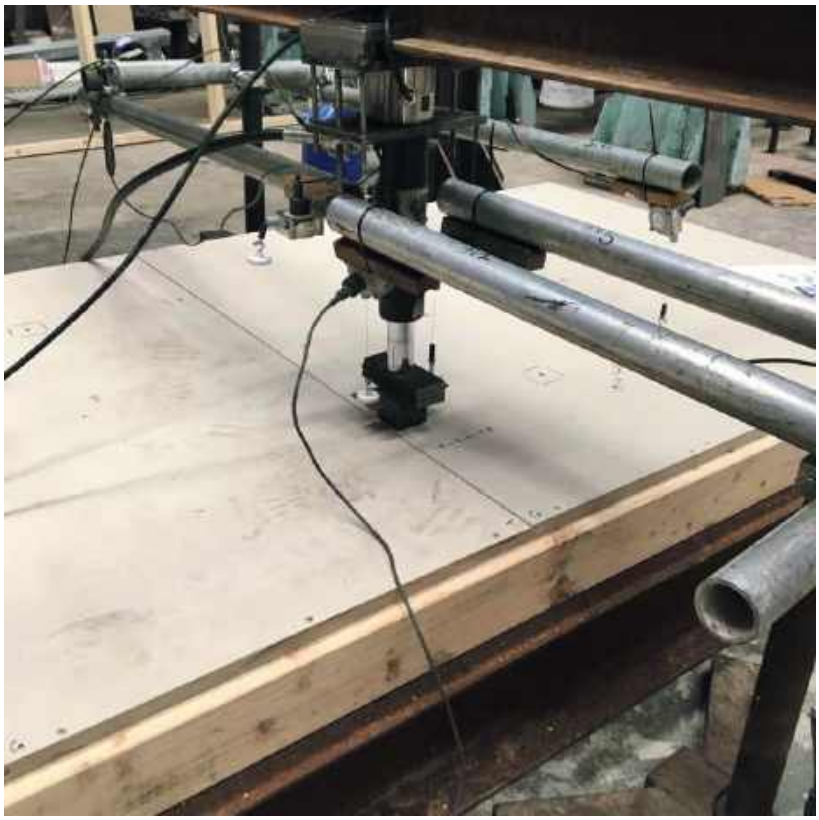
Design

The point load capacity of Resistant's 20-20 Fibre Cement Board T & G Flooring was determined by testing at Lucideon to BS EN 1195:1998 and associated guidance within Annex A of BS EN 12871:2013. Milner Associates, Chartered Consulting Engineers of Bristol were contracted to oversee testing, review and issue a report on results.

The strength and stiffness properties presented in the table on following page 6 of this brochure were achieved from tests which used the worst case board orientation and load position and are therefore valid for any board orientation, as long as the tongue and groove joint is tightly butted. The strength and stiffness properties were achieved without any adhesive in the tongue and groove joint or between the fibre cement boards and the top of the timber joists. Adhesive is therefore not required for the installation of the floor boards, when used as a floor or roof deck, to achieve the point load characteristics. The addition of any adhesive, particularly in the tongue and groove joint, would be expected to enhance the strength and stiffness values provided.

To determine the design strength of a floor or roof deck, the designer must modify the values provided by appropriate factors of safety in accordance with the recommendations of BS EN 12871:2013 and its associated national annex.
The recommended modification factors for our board for floor and roof applications are also provided in a table on page 6.

All testing was carried out with the board bearing on to 44mm wide timber joists. However, it is reasonable to assume that the point load resistance of the board would be equivalent for other joist materials as long as the bearing width is greater or equal to 44mm and the centre to centre span between joists is not greater than the values stated.



Do you know that Resistant 20-20 Fibre Cement T & G Flooring can help comply with The Structural Timber Association Design Guide to Separating Distances During Construction? Simply swapping wood based flooring for our A1 Non-combustible boards can achieve a 2 point floor assembly without the need for any fire retardant treated timber joists. These 2 points for the floor element are essential for achieving an overall Catergory C solution which enables timber frame to be built hard up against an existing building. Please see STA Product Paper 4 of the Design Guide available from your timber manufacturer or www.structuraltimber.co.uk

Here we provide calculation examples to demonstrate how the characteristic point load strength and stiffness values together with recommended modification factors for our Resistant Fibre Cement T & G Floor, derived from testing, can be used to calculate the design point load resistance of a floor deck used in different, common applications.

Example calculations are provided for information and guidance only. All design responsibility remains with the project engineer. Additional background information on the derivation of suitable strength properties can be found in Milner Associates report: "21046-MA-S-RP-01 Point Load Capacity of Fibre Cement Floor Deck to BS EN1195". This report is available in full to design professionals upon request from Resistant Building Products Ltd.

Example calculations for 3 common applications are provided.

1. Residential Floor (Category A1 to NA to BS EN 1991-1-1:2002)
2. Office Floor (Catergory B1 to NA to BS EN 1991-1-1:2002)
3. Roof (Catergory H to NA to BS EN 1991-1-1:2002)

The characteristic strength and stiffness properties of Resistant Fibre Cement T & G Floor under point loads were derived from the test results in accordance with BS EN 12871:2013 and BS EN 1990:2002 as follows:

Essential Characteristic	19mm thick 400mm centres	19mm thick 600mm centres	22mm thick 400mm centres	22mm thick 600mm centres
$F_{max,k}$ (kN)	4.7	4.0	6.9	5.3
$F_{ser,k}$ (kN)	3.3	2.8	4.8	3.7
R_{mean} (N/mm)	1280	539	1700	916

Where ,

$F_{max,k}$ Characteristic strength under a 50x50mm square point load (21046-MA-S-RP-01);

$F_{ser,k}$ Characteristic serviceability strength under a 50x50mm aquare point load (21046-MA-S-RP-01);

R_{mean} Characteristic mean stiffness under a 50x50mm square point load (21046-MA-S-RP-01).

The recommended modification factors for Resistant Fibre Cement T & G floor and roof applications are provided in the table below.

Service Class	k_{mod} (medium-term)	k_{mod} (short-term)	k_{def}	γ_m	γ_Q	k_{red}
1	0.65	0.85	2.25	1.25[1]	1.35[2]	0.89
2	0.45	0.60	3.00	1.25[1]	1.35[2]	0.89

Note 1: Only to be used for the determination of the point load resistance of Resistant Fibre Cement T & G board product.
Note 2: Utilising k_{FL} of 0.9 given in Annex B of BS EN 1990 for reliability Class RC1

Where ,

k_{mod} Modification factor, dependent on the duration of load and service class (21046-MA-S-RP-01);

k_{def} Deformation factor, dependent on the service class (21046-MA-S-RP-01);

γ_m Partial factor to account for the variability in material properties (21046-MA-S-RP-01);

γ_Q Partial factor to account for the variability in the variable action (NA to BS EN 12871);

k_{red} Reduction factor for local types of failure (NA to BS EN 12871);

The basic variables of the three applications are listed below.

	Load Category	Service Class	Duration of Load	Q_k (kN)	ψ_2
Residential Floor	A1	SC1	Medium	2.0	0.3
Office Floor	B1	SC1	Medium	2.7	0.3
Roof	H	SC2	Short	0.9	0.0

Where ,

Q_k Characteristic concentrated load for the relevant load catergory (NA to BS EN 1991-1.1).

ψ_2 Load combination factor (NA to BS EN 1990).

1. Using 19mm Resistant's Fibre Cement T & G Floor for residental floor joists @400mm centres

Serviceability Limit State Deflection Check:

$$w_{fin} = \frac{Q_k}{R_{mean}}\left(1 + \psi_2 \cdot k_{def}\right) \leq min\begin{cases} 6mm \\ L/100 \end{cases}$$ (BS EN 12871:2013)

$$w_{fin} = \frac{2000}{1280}(1 + 0.3 \times 2.25) = 2.62mm$$

$$min\begin{cases} 6mm \\ 600/100 \end{cases} = 6mm > w_{fin} \ \therefore OK$$

Serviceability Limit State Load Check:

$$F_{ser,k} \geq k_{dis} \cdot Q_k$$ (BS EN 12871:2013)

$$= 1.0 \times 2.0 = 2kN < F_{ser,k} = 3.3kN \ \therefore OK$$

Ultimate Limit State Check:

$$F_{max,k} \geq k_{dis} \cdot k_{red} \cdot \gamma_M \cdot \gamma_Q \cdot \frac{Q_k}{k_{mod}}$$ (BS EN 12871:2013)

$$= 1.0 \times 0.89 \times 1.25 \times 1.35 \times \frac{2.0}{0.65} = 4.62kN < F_{max,k} = 4.7kN \ \therefore OK$$

2. Using 22mm Resistant's Fibre Cement T & G Floor for office floor joists @400mm centres

Serviceability Limit State Deflection Check:

$$w_{fin} = \frac{Q_k}{R_{mean}}\left(1 + \psi_2 \cdot k_{def}\right) \leq min\begin{cases} 6mm \\ L/100 \end{cases}$$ (BS EN 12871:2013)

$$w_{fin} = \frac{2700}{1700}(1 + 0.3 \times 2.25) = 2.66mm$$

$$min\begin{cases} 6mm \\ 600/100 \end{cases} = 6mm > w_{fin} \ \therefore OK$$

Serviceability Limit State Load Check:

$$F_{ser,k} \geq k_{dis} \cdot Q_k$$ (BS EN 12871:2013)

$$= 1.0 \times 2.7 = 2.7kN < F_{ser,k} = 4.8kN \ \therefore OK$$

Ultimate Limit State Check:

$$F_{max,k} \geq k_{dis} \cdot k_{red} \cdot \gamma_M \cdot \gamma_Q \cdot \frac{Q_k}{k_{mod}}$$ (BS EN 12871:2013)

$$= 1.0 \times 0.89 \times 1.25 \times 1.35 \times \frac{2.7}{0.65} = 6.24kN < F_{max,k} = 6.9kN \ \therefore OK$$

3. Using 19mm Resistant's Fibre Cement T & G Floor for roof joists @600mm centres

Serviceability Limit State Deflection Check:

$$w_{fin} = \frac{Q_k}{R_{mean}}\left(1 + \psi_2 \cdot k_{def}\right) \leq min\begin{cases} 12mm \\ L/50 \end{cases}$$ (BS EN 12871:2013)

$$w_{fin} = \frac{900}{539}(1 + 0 \times 3.0) = 1.67mm$$

$$min\begin{cases} 12mm \\ 600/50 \end{cases} = 12mm > w_{fin} \ \therefore OK$$

Serviceability Limit State Load Check:

$$F_{ser,k} \geq k_{dis} \cdot Q_k$$ (BS EN 12871:2013)

$$= 1.0 \times 0.9 = 0.9kN < F_{ser,k} = 2.8kN \ \therefore OK$$

Ultimate Limit State Check:

$$F_{max,k} \geq k_{dis} \cdot k_{red} \cdot \gamma_M \cdot \gamma_Q \cdot \frac{Q_k}{k_{mod}}$$ (BS EN 12871:2013)

$$= 1.0 \times 0.89 \times 1.25 \times 1.35 \times \frac{0.9}{0.60} = 2.25kN < F_{max,k} = 4.0kN \ \therefore OK$$

Strength, stiffness and soft body impact testing performed on Resistant 20-20 FCB T & G Flooring were all conducted with screw fixings only and with the T & G in weakest orientation to provide lowest case data. Whilst it is perfectly acceptable to only screw fix our boards, certain applications may benefit from addition of adhesive between board & joist and within the T & G. Flexible joint sealant such as Sikasil-670 may be selected to fill T & G expansion gap between boards (see below for more detailed info).

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Figure 1: flooring boards fitted logo face down and T & G expansion profile gap up

Figure 1 shows the boards fitted as per strength testing was conducted. In this orientation when boards are fitted with Resistant product logo face down to the joist (determined as weakest orientation) the profiled expansion joint is face up, leaving approx 2mm joint where 2 boards meet along the T & G. In this orientation the marginally smoother surface of the flooring boards will be facing upwards.

It may be preferable to decide on this orientation if fitting without D4 type adhesive and the intention is to apply tiles as the finished surface layer. A flexible waterproof joint sealant can then be used to fill the 2mm expansion gap, with excess scraped away, prior to laying the tile adhesive or tanking solution. Please refer to tile adhesive manufacturers instructions as to whether a primer is required.

JOINT SEALANT

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Figure 2 shows the boards fitted with the Resistant product logo face up (determined as stronger orientation) and the profiled expansion gap face down to the joist. When fitted in this orientation the boards butt tightly together along the T & G. In this orientation the slightly rougher surface of the flooring boards will be facing upwards. If boards are to be glued and screwed we recommend selecting this orientation.

It is also preferable to choose this board orientation if a soft finish material such as carpet or vinyl is to be selected. Check to ensure there are no raised edges at the board joints, smooth any such areas and remove all debris prior to applying adhesive to ensure no bumps or blemishes are visible in the surface layer.

ADHESIVE

Figure 2: flooring boards logo fitted face up with T & G expansion profile gap down

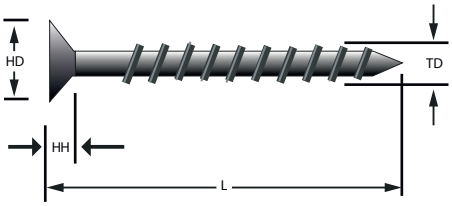
Cutting

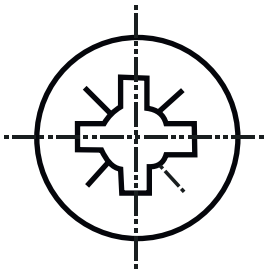
Boards can be cut with PCD or tungsten carbide tipped circular saw blades. Boards shoud be cut outside or in well ventilated spaces using appropriate dust extraction and personal protection. Fibre cement type building boards contain significant composition of quartz which can be released as respirable crystalline silica dust (RCS) when cut and machined. RCS is harmful to health and exposure should be avoided. More details can be found on our Material Safety Data Sheet.

Screw Type and Fixing Centres

Strength testing was performed with size 4.0 x 50mm Spax self tapping yellow zinc galvanised screws, fitting boards to solid timber with a 45mm wide bearing. Screws were located 50mm from corners and 12mm back from square edge of boards at approx 250mm centres. Screws do not require pre-drilling but this may not be the case for any different screw or fixing pattern selected. Whether pre-drilling of boards prior to screw fixing is necessary can be decided by simple site trial. Fixing 2400 x 600mm sheets with 3 screws along each joist requires minimum of 21 screws each board @ 400mm centres and minimum of 15 screws each board @ 600mm centres.

Boards can also be fixed to steel bearers rather than timber using appropriately selected wing tip or tek screws.





KEY

Head Diameter (HD): 7.7mm
Head Type (HT): Pozi No.2
Head Height (HH): 3mm
Length (L): 50mm
Thread Diqameter (TD): 4mm (No.8)
Finish: Yellow zinc plated
Thread Type: Self tapping
Material: Steel

Fitting prior to wind and watertight

20-20 FCB T & G Flooring boards are resistant to fast uptake of moisture and very dimensionally stable meaning they can be fitted prior to achieving wind and watertight. Boards can be left exposed to weather for up to 6 months without concern for distortion or degrade but obviously best building practise is to minimise full exposure time. It is further advised that if it is known boards are going to be exposed for a long period of time that a coat of waterproofing primer is applied to provide extra protection. Whilst our testing has demonstrated that adhesive between board and joint or within T & G is not necessary to obtain strength results stated, the practise of gluing and screwing is commonly chosen for floor decks and especially those which are to be exposed to the weather.

Perimeter spacing and expansion control joints

A minimum 10mm gap should be left at all floor perimeters. Sheet control joints should be introduced at maximum 9mtr centres in the direction of the T & G and maximum 5.4mtr centres in the direction of the butt joints. These are absolute maximums and best practise may decide that they should be introduced at lesser centres. Introduction of underfloor heating may dictate that more control joints are required. Additional control joints should be introduced at every doorway and any change in sheet direction. Control joints should always mirror any control joints in both the structure and the finished surface layer.

Technical Data

Parameter	Test / Standard	Results
Size		2400 x 600mm
Dimensional Tolerance (thickness)		+ / - 0.5mm
Dimensional Tolerance (length & width)		+ / - 2mm
Density		1100-1200kg/m3
Weight		**19mm** - 33kg each approx **22mm** - 38kg each approx
MC%		≤ 15%
Moisture Movement (after 24hr immersion)	BS EN 12467	≤ 0.15%
Bending Strength/ MOR (wet)	BS EN 12467	≥ 8MPa
Modulus of Elasticity	BS EN 12467	≥ 4000N/mm2
Point Load (mean)	BS EN 1195	**19mm** - 400mm centres 5.82kN 600mm centres 5.14kN **22mm** - 400mm centres 7.94kN 600mm centres 6.84kN
Thermal Conductivity	BS EN 12467	< 0.35W/m.K
Soft Body Impact	BS EN 12871	PASS
Reaction to Fire	BS EN 13501-1	fl A1 Non-combustible

PPE

Fibre cement type building boards contain quartz which can be released as respirable crystalline silica (RCS) dust when cut and machined. RCS is harmful to health and exposure should be avoided. Follow our cutting guidance on page 9 and visit www.resistant.co.uk to download product Material Safety Data Sheet.

RESISTANT
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Thank you for your interest in our 20-20 Fibre Cement Structural Floor Boards.

Please check out our range of:

Tile Backer Boards
Render Carrier Boards
A1 Non-combustible Structural Sheathing Boards
Passive Fire Protection Wall & Ceiling Linings (60-120mins)

Available from Resistant Stockists across UK & Ireland

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Fibre Cement Floor

Available from your local Resistant stockist

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