TOMBO™ BRAND

MAKIBEE™

Fire resistant covering material

NICHIAS

Opens up the possibility of fire resistant construction with advanced performance and environmental consciousness.

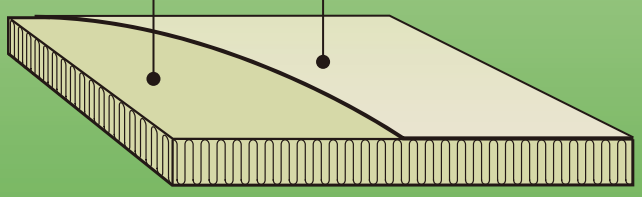
These days, corporate activities are closely scrutinized for environmental awareness.
In the field of building materials, there is also a need for selection of more environmentally friendly and clean products as well as reliable quality and performance to support construction.
MAKIBEE™ is a fire resistant covering material comprised of colored non-woven fabric applied to the surface of blanket made of rook wool* manufactured by NICHIAS.
This lightweight, thin workable structure makes it possible for this material to support applications that are difficult with conventional methods, while at the same time maintaining an eco-friendly concept all the way through the process, from the energy required for manufacturing to the amount of dust produced during and after construction.
This proposal from NICHIAS expands the possibility of fire-resistant construction to the next generation.

* Inorganic materials made into matted fibre used especially for insulation or soundproofing

● Structure diagram

Rock wool
(with fire-resistant and thermal insulating properties)

Colored non-woven fabric
[polypropylene based]
(for design and dust resistance)



Produced using unique NICHIAS technology, this eco-friendly fire resistant covering material is highly flexible and can be used in a variety of construction situations.

MAKIBEE™ is a blanket formed fire resistance material created by fiberizing and collecting molten natural ore and slag melted at high temperatures by centrifugal force and adhering colored non-woven fabric to it. The advanced thermal insulation performance of this soft, light and thin material delivers performance that exceeds conventional fire resistant covering material, leading to its excellent reputation as a sophisticated material that can be used in wide variety of applications.

Features

SUSTAINABLE

It has been awarded the rating of “VERY GOOD” as GREEN BUILDING PRODUCT in Singapore.

CLEAN

The reduced dust emissions during construction shorten construction time by allowing other construction work to proceed in parallel.

ECOLOGY

This thin, lightweight material reduces manufacturing energy per square meter, and more than half of the material is comprised of slag, a waste material produced during steel manufacturing. By cutting a dedicated fixing pin, it can be separated from the steel frame easily, which makes possible to recycle the steel frame.

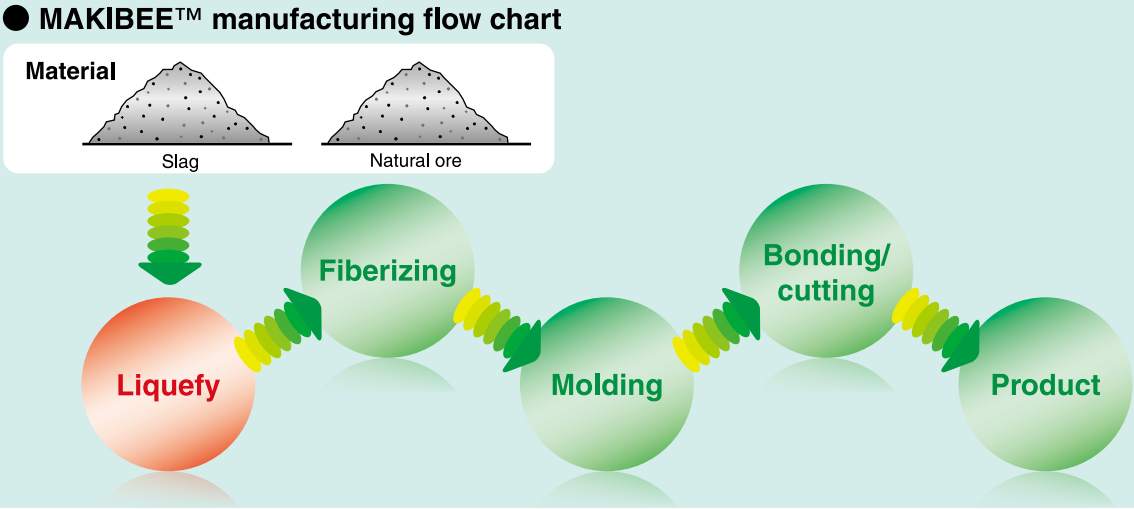
SAFETY

It can be securely fixed to steel frames by using electric welding (stud welding) to install dedicated fixing pins and also reduces risk of falling off or damage due to displacement and vibration in situations such as earthquakes.

● TREMENDOUS BENEFITS OF MAKIBEE™

1) Faster and shorten installation time
   - No preparation needed.
   - No cleaning job required.
2) Improvement on productivity for installation work
   - About 30%
3) Parallel work can be carried out together with other M&E works
4) Less wastage on material usage
   - Precut in factory.
   - Save cost & time.
5) High impact and finished quality work
6) Good and healthy working environment
   - Due to the product cleanliness.

● MAKIBEE™ manufacturing flow chart



Construction process

Drawing confirmation

Settling Arrangements, setting confirmation

MAKIBEE™ is a build-to-order product. Please confirm the quantity and delivery time beforehand.

Material loading

Material storing

Confirm scaffolding, installation of welding machine

Material cutting

Covering

Processing of interface part etc.

Self-inspection

Clean up

①Setting of welding machine

Preparation
Confirm the size of steel beam, necessary thickness of MAKIBEE™ by the drawing.
Power on the special pin welding machine.

Provided by TILEMENT

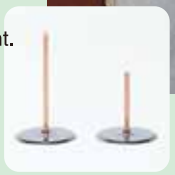
②Dimensioning and cutting of material

Cut MAKIBEE™ blanket
Use cutting knife or scissors.
The length shall be decided by measuring tape.
Pre-cutting at factory also be available by request.

③Fixing the material

Install MAKIBEE™ blanket
Locate MAKIBEE™ blanket based on the drawing and fix welded by pin at the side on beam flange.
Welding distance interval shall be less than 300mm.

Finish joint area
MAKIBEE™ blanket has shiplap joint.
Minimize the gap of each blanket.
If gap generated, fill the MAKIBEE™ into gaps.



Example of Self-inspection checklist

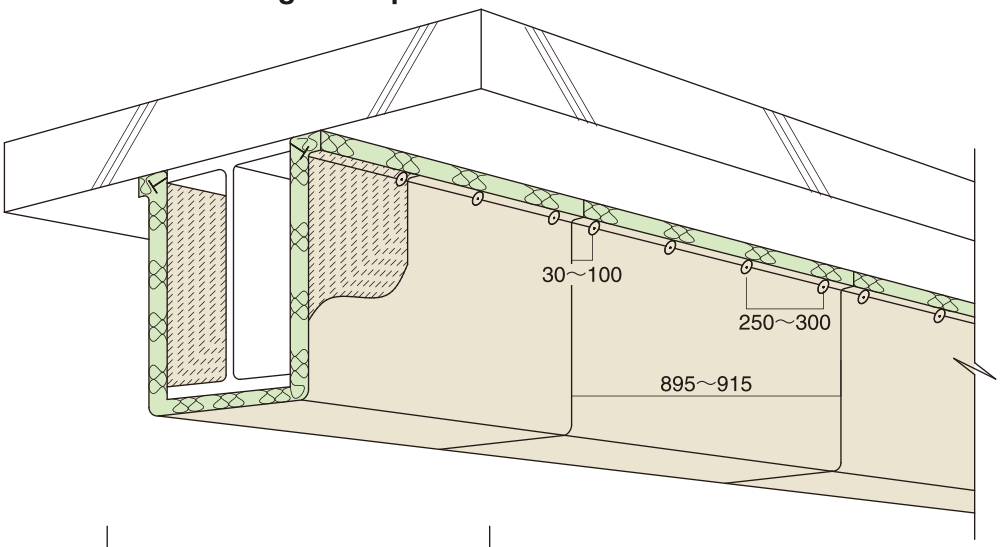
	Is the pitch of the fixed pins appropriate?		Did any of the fixed pins fall?
	Are there gaps in the joint section?		Are there gaps in the interface section?
	Are there any damaged parts?		Is the construction thickness correct?

⚠ Precautions for product handling

● Use manual tools such as a box cutter for cutting. ● Wear a dust mask when handling. ● Wear long-sleeved work clothes and protective gloves. Also, use protective glasses as needed. ● Store so that it will stay dry and avoid exposure to water. ● When disposing of the product, comply with your local legislation. ● Do not place near computing devices. The stud welding work could adversely affect computing devices, such as causing noise on the CRT display.

[Beams – Example of installed figure]

● **Example of installation of general part**



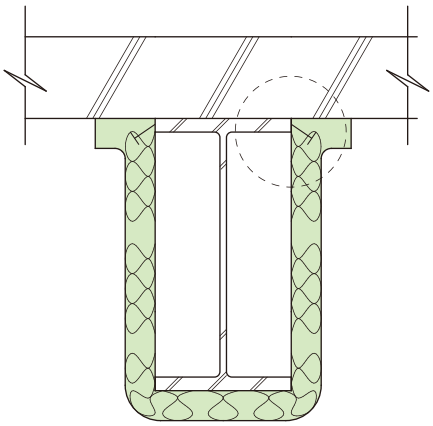


fig. 1

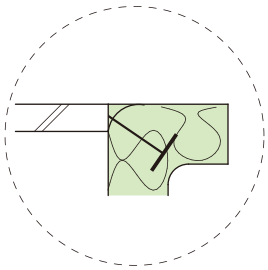


fig. 1 Expansion

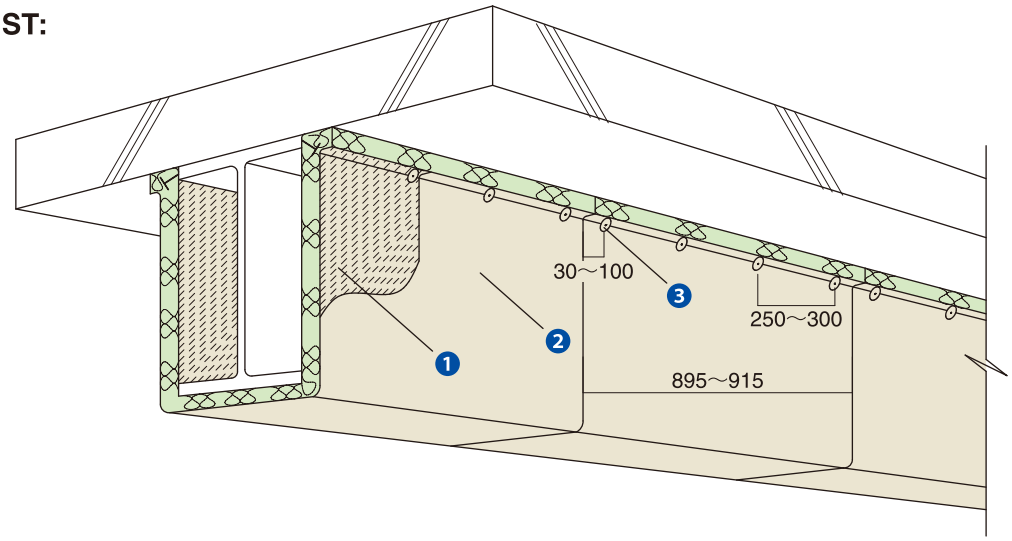
CHECK LIST:

1. MAKIBEE™ rock wool blanket (Factory laminated with tissue)
   Density: 100kg±20kg/m^3 (80-120kg/m^3)
   Size: 900-940mm Width X 20-65mm THK
   Length: Upon request
2. Fix method
   Washer hot dip zinc coated steel
   Size: 30mm DIA X 0.3 or 0.4mm THK
   Welding pins copper-coated steel
   Length: 15mm to 55mm
3. Welding spacing must be less than 300mm interval
4. Knife or scissors for cutting
5. Welding machine

* Please read the work procedures before installing.

Specifications

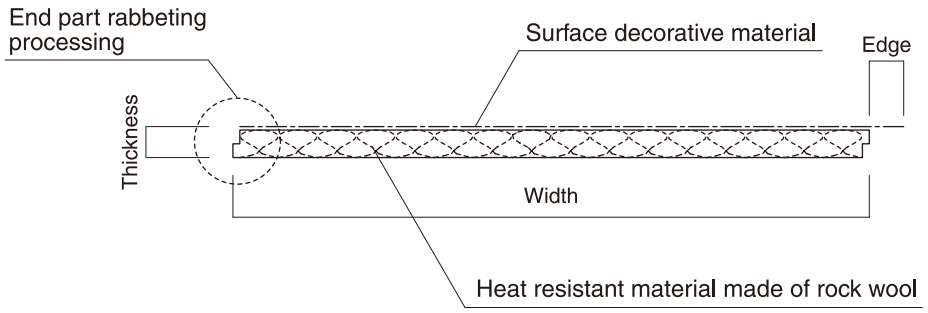
PART LIST:



(MAKIBEE™ is a build-to-order product. Please confirm the quantity and delivery time beforehand.)

❶ Base material: MAKIBEE™

❷ Surface material: PP tissue (Already applied at factory)



Product Specifications

Unit: mm

Product density	Thickness	Width (working width)
80～120kg/m³	20～40	925 (915)
	45～65	925 (895)

❸ Fix method: Welding Pin (fig.1)

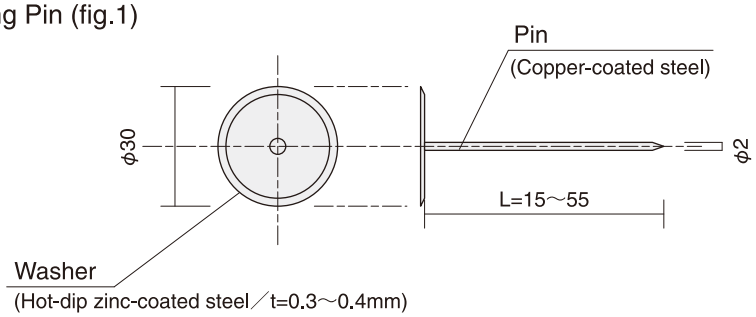


fig. 1 Welding Pin

Physical properties

Thermal conductivity

Measured the thermal conductivity (λ) according to ASTM C518: 2010, "Standard test method for steady-state thermal transmission properties by means of the heat flow meter".

λ = 0.0323 [W/mK] At an average temperature of 20°C
(0.0278 [kcal/m h K])

Measurement agency: TÜV SÜD PSD Singapore Pte Ltd. (April 2013)

Moisture permeability

Measured the moisture permeability of a 20mm MAKIBEE™ product per the flat cup method, as prescribed in JIS A 1324 (moisture permeability measurement method of building material).

Moisture permeation coefficient	2842ng/ (m^2 · s · Pa)
Vapor resistance	0.352×10^{-3} (m^2 · s · Pa) /ng

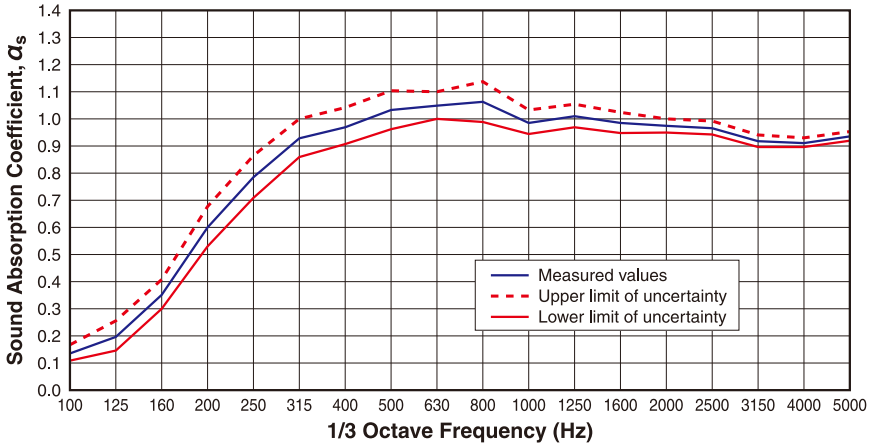
Measurement agency: Japan Testing Center for Construction Materials (April 2010)

Sound absorption coefficients

Measured the sound absorption coefficients according to ASTM C423-09, "Standard test method for sound absorption and sound absorption coefficients by the reverberation room method".

1/3 Octave Frequency (Hz)	"MAKIBEE™" F.R. blankets (Type A mounting)		
	Sound Absorption Coefficient, α_s		Uncertainty
100	0.14	(0.23)	± 0.03
125	0.20		± 0.05
160	0.36		± 0.05
200	0.61	(0.78)	± 0.08
250	0.79		± 0.06
315	0.93		± 0.07
400	0.97	(1.02)	± 0.07
500	1.03		± 0.07
630	1.05		± 0.05
800	1.06	(1.02)	± 0.07
1000	0.99		± 0.05
1250	1.01		± 0.04
1600	0.99	(0.98)	± 0.04
2000	0.97		± 0.03
2500	0.97		± 0.03
3150	0.92	(0.92)	± 0.02
4000	0.91		± 0.02
5000	0.93		± 0.02
Noise Reduction Coefficient, NRC	**0.95**		
Sound Absorption Average, SAA (200Hz- 2500Hz)	**0.95**		

Remark : Values in bracket ( ) denotes the values of sound absorption coefficient, α_s of 1/1 Octave Frequency Bands



Measurement agency: TÜV SÜD PSD Singapore Pte Ltd. (May 2013)

Fire resistance capability

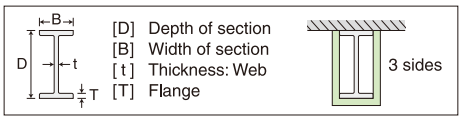
As a result of carrying the heating of three sides of the beam based on a BS476: Part21: 1987 test, the thickness required for the each shape coefficient of the steel frame (Hp/A) and fire-resistance time of MAKIBEE™ is as shown in the following table.

Shape coefficient (m^{-1})	Thickness required per indicated fire-resistance time (mm)				
	30min	60min	90min	120min	150min
50	20	20	20	35	50
55					55
60				40	
65					60
70			25		
75				45	65
80					
85					
90					
95					
100				50	
105					
110					
115					
120			30		
125					
130					
135				55	
140					
145					
150					
155					
160					
165					
170					
175					
180					
185				60	
190					
195					
200					
205					
210					
215			35		
220					
225					
230					
235					
240					
245					
250					
255					
260					

* The thickness indicates a single or laminated layer. The table is for three-side fire-resistant protection of I-shaped steel beams on a concrete floor slab.

What is the shape coefficient (Hp/A)?

The shape coefficient is a variable which greatly affect fire-resistance performance. It is calculated by dividing the heating perimeter by the cross section of the steel frame.
Table 2 indicates the common size of steel frame and quick chart of Hp/A. Only three-side heating on Table 2 applies to MAKIBEE™.



Hp/A table

Designation: Serial size	Mass per metre	Depth of section [D]	Width of section [B]	Thickness: Web [t]	Flange [T]	Area of section	3 sides shape coefficient
(mm)	(kg)	(mm)	(mm)	(mm)	(mm)	(cm^2)	(m^{-1})
914×419	388	921.0	420.5	21.5	36.6	494.5	45
	343	911.4	418.5	19.4	32.0	437.5	50
914×305	289	926.6	307.8	19.6	32.0	368.8	60
	253	918.5	305.5	17.3	27.9	322.8	65
	224	910.3	304.1	15.9	23.9	285.3	75
	201	903.0	303.0	15.2	20.2	256.4	80
838×292	226	850.9	293.8	16.1	26.8	288.7	70
	194	840.7	292.4	14.7	21.7	247.2	80
	176	834.9	291.6	14.0	18.8	224.1	90
762×267	197	769.6	268.0	15.6	25.4	250.8	70
	173	762.0	266.7	14.3	21.6	220.5	80
	147	753.9	265.3	12.9	17.5	188.1	95
686×254	170	692.9	255.8	14.5	23.7	216.6	75
	152	687.6	254.5	13.2	21.0	193.8	85
	140	683.5	253.7	12.4	19.0	178.6	90
	125	677.9	253.0	11.7	16.2	159.6	100
610×305	238	633.0	311.5	18.6	31.4	303.8	50
	179	617.5	307.0	14.1	23.6	227.9	70
	149	609.6	304.8	11.9	19.7	190.1	80
610×229	140	617.0	230.1	13.1	22.1	178.4	80
	124	611.9	229.0	11.9	19.6	159.6	90
	113	607.3	228.2	11.2	17.3	144.5	100
	101	602.2	227.6	10.6	14.8	129.2	110
533×210	122	544.6	211.9	12.8	21.3	155.8	85
	109	539.5	210.7	11.6	18.8	138.6	95
	101	536.7	210.1	10.9	17.4	129.3	100
	92	533.1	209.3	10.2	15.6	117.8	110
	82	528.3	208.7	9.6	13.2	104.4	120
457×191	98	467.4	192.8	11.4	19.6	125.3	90
	89	463.6	192.0	10.6	17.7	113.9	100
	82	460.2	191.3	9.9	16.0	104.4	105
	74	457.2	190.5	9.1	14.5	95.0	115
	67	453.6	189.9	8.5	12.7	85.4	130
457×152	82	465.1	153.5	10.7	18.9	104.5	105
	74	461.3	152.7	9.9	17.0	95.0	115
	67	457.2	151.9	9.1	15.0	85.4	125
	60	454.7	152.9	8.0	13.3	75.9	140
	52	449.8	152.4	7.6	10.9	66.5	160
406×178	74	412.8	179.7	9.7	16.0	95.0	105
	67	409.4	178.8	8.8	14.3	85.5	115
	60	406.4	177.8	7.8	12.8	76.0	130
	54	402.6	177.6	7.6	10.9	68.4	145
406×140	46	402.3	142.4	6.9	11.2	59.0	160
	39	397.3	141.8	6.3	8.6	49.4	190
356×171	67	364.0	173.2	9.1	15.7	85.4	105
	57	358.6	172.1	8.0	13.0	72.2	125
	51	355.6	171.5	7.3	11.5	64.6	135
	45	352.0	171.0	6.9	9.7	57.0	155
356×127	39	352.8	126.0	6.5	10.7	49.4	170
	33	348.5	125.4	5.9	8.5	41.8	195
305×165	54	310.9	166.8	7.7	13.7	68.4	115
	46	307.1	165.7	6.7	11.8	58.9	130
	40	303.8	165.1	6.1	10.2	51.5	150
305×127	48	310.4	125.2	8.9	14.0	60.8	125
	42	306.6	124.3	8.0	12.1	53.2	140
	37	303.8	123.5	7.2	10.7	47.5	155
305×102	33	312.7	102.4	6.6	10.8	41.8	175
	28	308.9	101.9	6.1	8.9	36.3	200
	25	304.8	101.6	5.8	6.8	31.4	225
254×146	43	259.6	147.3	7.3	12.7	55.1	120
	37	256.0	146.4	6.4	10.9	47.5	140
	31	251.5	146.1	6.1	8.6	40.0	160
254×102	28	260.4	102.1	6.4	10.0	36.2	170
	25	257.0	101.9	6.1	8.4	32.2	190
	22	254.0	101.6	5.8	6.8	28.4	215
203×133	30	206.8	133.8	6.3	9.6	38.0	145
	25	203.2	133.4	5.8	7.8	32.3	165

* Please refer to Yellow Book

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