

# TOMBO™ BRAND

## MAKIBEE™

Fire resistant covering material





## **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.

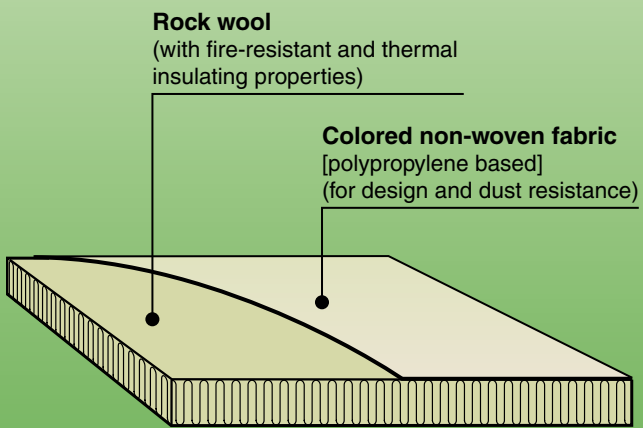
This lightweight, thin workable structure makes it possible for this material to support applications that are difficult with conventional methods, while at the same time maintaining an eco-friendly concept all the way through the process, from the energy required for manufacturing to the amount of dust 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**



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## **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 "EXCELLENT" 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**

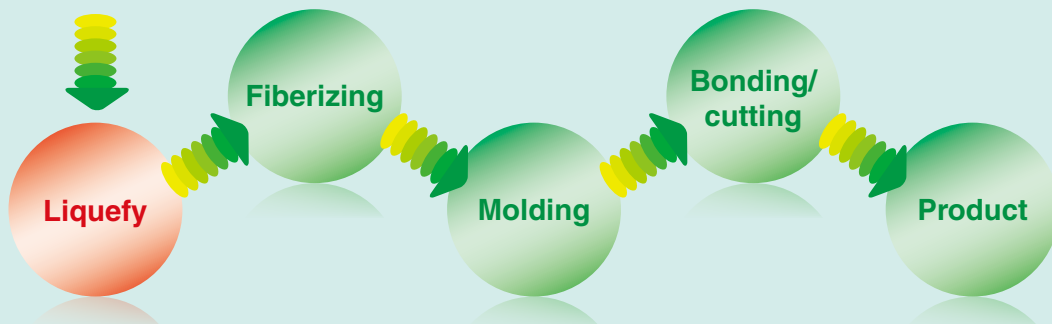
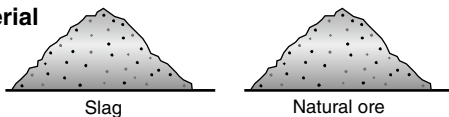
It can be securely fixed to steel frames by using electric welding (stud welding) to install dedicated fixing pins and also reduces risk of falling off or damage due to displacement and vibration in situations such as earthquakes.

### ● TREMENDOUS BENEFITS OF MAKIBEE™

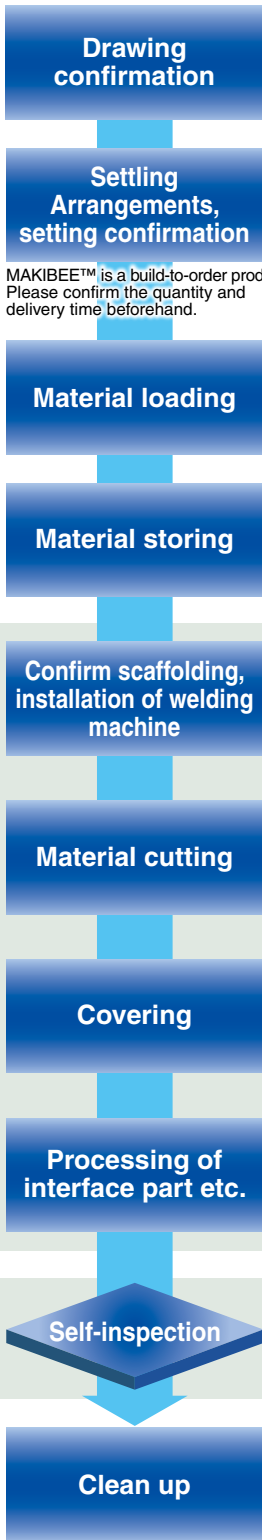
- 1) Faster and shorten installation time
  - No preparation needed.
  - No cleaning job required.
- 2) Improvement on productivity for installation work
  - About 30%
- 3) Parallel work can be carried out together with other M&E works
- 4) Less wastage on material usage
  - Precut in factory.
  - Save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

### ● MAKIBEE™ manufacturing flow chart

Material



# Construction process



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

## ① Setting 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

## ② Dimensioning 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.



## ③ Fixing the material

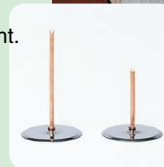
### Install MAKIBEE™ blanket

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 shi lap 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?

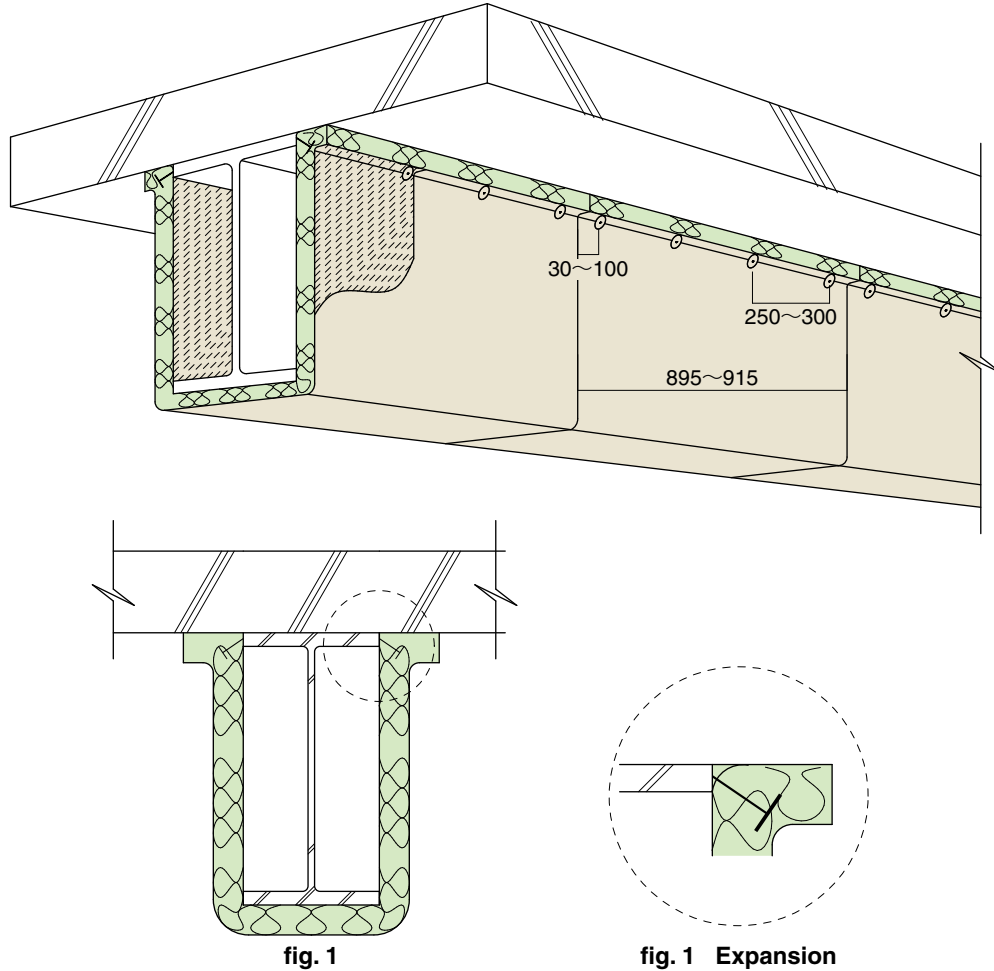


## Precautions for product handling

- 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



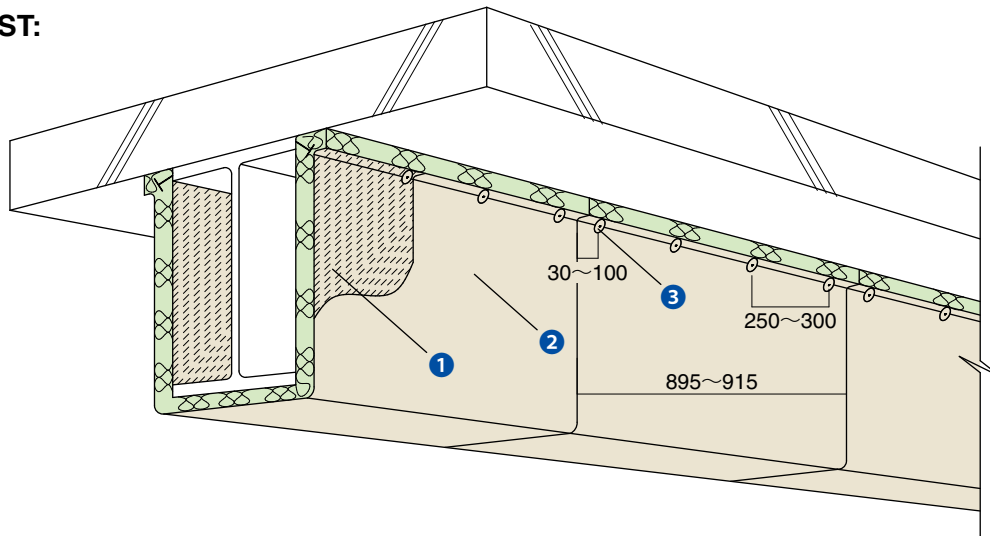
#### CHECK LIST:

1. MAKIBEE™ rock wool blanket (Factory laminated with tissue)  
Density:  $100\text{kg}\pm 20\text{kg}/\text{m}^3$  (80-120 $\text{kg}/\text{m}^3$ )  
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.

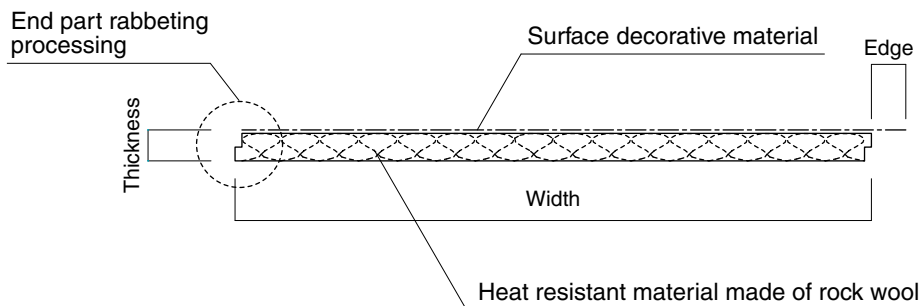
# Specifications

## PART LIST:



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

- ① Base material: MAKIBEE™
- ② Surface material: PP tissue (Already applied at factory)



### Product Specifications

Unit: mm

Product density	Thickness	Width (working width)
80~120kg/m <sup>3</sup>	20~40	925 (915)
	45~65	925 (895)

- ③ Fix method: Welding Pin (fig.1)

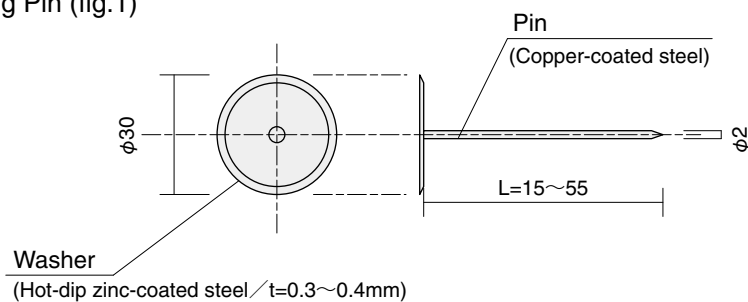


fig. 1 Welding Pin



## Physical properties

### Thermal conductivity

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

$$\lambda = 0.0323 \text{ [W/mK]} \quad \text{At an average temperature of } 20^\circ\text{C}$$

$$(0.0278 \text{ [kcal/m h K]})$$

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<sup>2</sup> · s · Pa)

Vapor resistance 0.352×10<sup>-3</sup> (m<sup>2</sup> · s · Pa) /ng

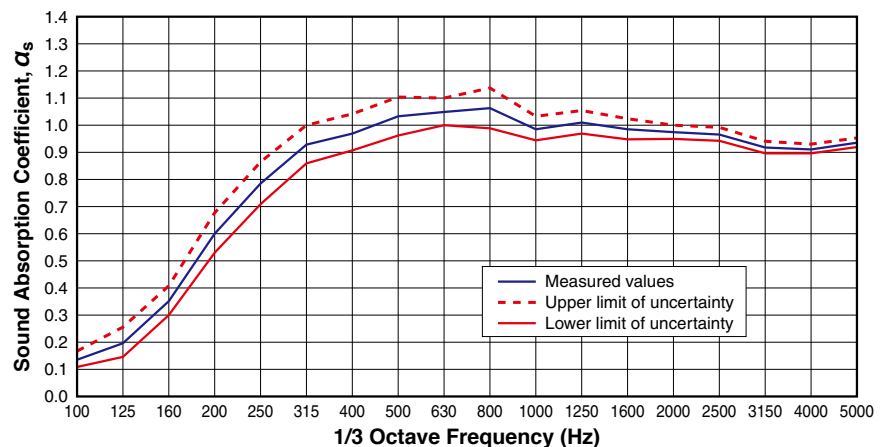
Measurement agency: Japan Testing Center for Construction Materials (April 2010)

### 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, $\alpha_s$	Uncertainty
100	0.14	(0.23)
125	0.20	
160	0.36	
200	0.61	(0.78)
250	0.79	
315	0.93	
400	0.97	(1.02)
500	1.03	
630	1.05	
800	1.06	(1.02)
1000	0.99	
1250	1.01	
1600	0.99	(0.98)
2000	0.97	
2500	0.97	
3150	0.92	(0.92)
4000	0.91	
5000	0.93	
<b>Noise Reduction Coefficient, NRC</b>	<b>0.95</b>	
<b>Sound Absorption Average, SAA (200Hz- 2500Hz)</b>	<b>0.95</b>	

Remark : Values in bracket ( ) denotes the values of sound absorption coefficient,  $\alpha_s$  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 ( $H_p/A$ ) and fire-resistance time of MAKIBEE™ is as shown in the following table.

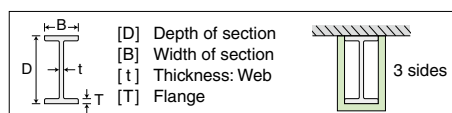
Shape coefficient ( $m^{-1}$ )	Thickness required per indicated fire-resistance time (mm)						
	30min	60min	90min	120min	150min		
50	20	20	20	35	50		
55				55			
60				40	25	45	60
65							65
70			50	30		60	
75							
80							
85							
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205							
210							
215							
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 ( $H_p/A$ )?

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  $H_p/A$ . Only three-side heating on Table 2 applies to MAKIBEE™.



## Hp/A table

Designation: Serial size (mm)	Mass per metre (kg)	Depth of section [D] (mm)	Width of section [B] (mm)	Thickness: Web [t] (mm)	Flange [T] (mm)	Area of section (cm <sup>2</sup> )	3 sides shape coefficient (m <sup>-1</sup> )
914x419	388	921.0	420.5	21.5	36.6	494.5	45
	343	911.4	418.5	19.4	32.0	437.5	50
914x305	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
838x292	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
762x267	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
686x254	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
610x305	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
610x229	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
533x210	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
457x191	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
457x152	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
406x178	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
406x140	46	402.3	142.4	6.9	11.2	59.0	160
	39	397.3	141.8	6.3	8.6	49.4	190
356x171	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
356x127	39	352.8	126.0	6.5	10.7	49.4	170
	33	348.5	125.4	5.9	8.5	41.8	195
305x165	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
305x127	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
305x102	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
254x146	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
254x102	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
203x133	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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