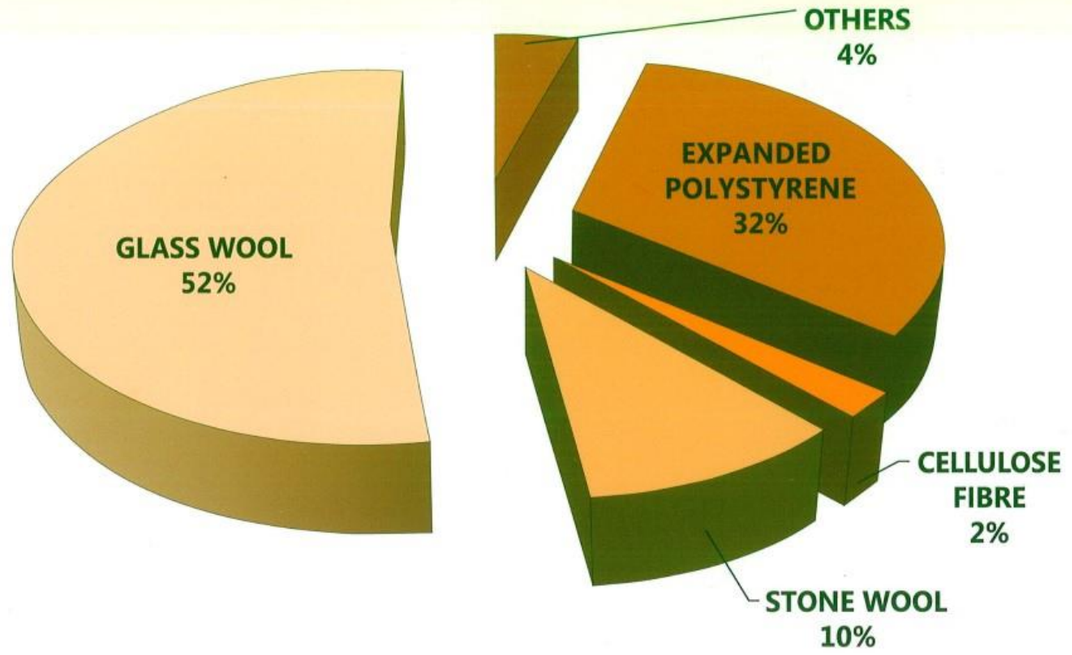
WHY GLASS WOOL IS WELL RECOGNISED IN THE MARKET COMPARED TO STONE WOOL EVEN THOUGH BOTH ARE UNDER SIMILAR FIBRE TYPE THERMAL INSULATION MATERIAL?

In general, there are two main types of thermal insulation material adopted in the residential market. They are expanded polystyrene and fibre insulation types. However, expanded polystyrene uses blowing agents such as CFC or alternative CFC (i.e. HCFC) in order to increase the heat insulating efficiency. This would have an adverse impact on our environment. Therefore, fibre insulation system is popular internationally and glass wool is always the No. 1 choice among the fibre materials.

RATIO OF THERMAL INSULATION MATERIALS USED IN JAPAN RESIDENTIAL MARKET

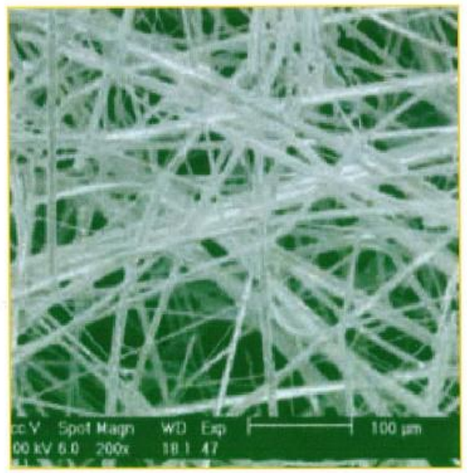


Comparison of fibre .....

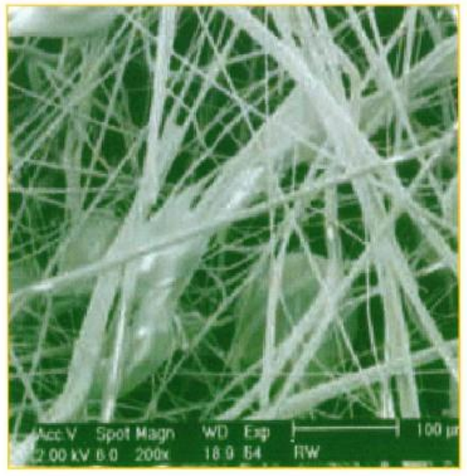
GLASS WOOL FIBRES

Glass wool is made of molten glass spun into soft cotton type fibre. The cotton form fibres contain more air chambers which contribute to the high elasticity and compressibility properties, making the insulation material a heat insulator with excellent recovery.

If you look at the microscope image on your right, you can see the long and fine fibre intertwined with each other and it has formed air chambers between the fibres. These make the fibre malleable and strong. Therefore, it will not lose its shape even after using it for a long time.



..... differences



STONE WOOL FIBRES

Stone wool is made from molten basalt and spun into fibre. In Japan, the raw material for stone wool is usually slag produced by steel production. In the western countries, it is known as slag wool instead of stone wool. Due to the raw material being iron ores, it is very difficult to uniformly produce the fibres and there will be variation in fibre diameter as well as mixture of shots.

The picture on the left shows the mixture of fibres and unfinished fiberised material. This nature makes the stone wool to have very coarse surface. If slight pressure is applied or squeezed, it is difficult for the material to return to its original form. Also, it tears off easily and has uneven surface. As the material and fibres are different, the characteristics of the end product will also be different.

PART 1 **COMPARISON OF PERFORMANCE**

SECTION 1 **STORAGE AND HANDLING**

FOR THE SAME PERFORMANCE, THERE IS A DIFFERENCE OF 3.2 TIMES IN WEIGHT, AND 2.7 TIMES IN VOLUMETRIC CAPACITY.

Due the high level of compressibility, glass wool can be easily compacted. Therefore, it can avoid excessive storage place and cut down the transportation cost.

Due to its lightweight, glass wool facilitates easy handling, transportation and lifting during installation.

GLASS WOOL CAN BE COMPRESSED UP TO 10 TIMES.

COMPARISON: VOLUMETRIC CAPACITY

INSULATION/STRUCTURE	SLAB	CEILING	WALL	TOTAL
GLASS WOOL	0.69m³	1.41m³	2.35m³	4.45m³
STONE WOOL	2.68m³	3.76m³	5.64m³	12.08m³

Experimental data from Glass Fiber Association

COMPARISON :
The amount of insulation required for building a house
(Japan Region IV new standards)

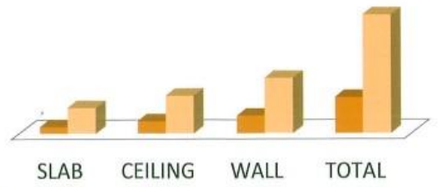
19 ROLLS OF GLASS WOOL

45 ROLLS OF STONE WOOL

LIGHTER THAN STONE WOOL PER PACK, EASY TO CARRY.

The difference in total weight is explained in the graph below.

COMPARISON: GROSS WEIGHT



INSULATION/STRUCTURE	SLAB	CEILING	WALL	TOTAL
GLASS WOOL	47.7kg	95.4kg	141.0kg	284.1kg
STONE WOOL	203.0kg	291.2kg	426.3kg	920.5kg

Experimental data from Glass Fiber Association

Comparison Method

The table on the right shows the amount of glass wool and stone wool applied at different structural component (ceiling, wall and floor) as per new Japan standard for region IV.
The comparison table is developed based on Japan Wooden House construction approach (a construction method called 2 x 4 built in accordance to the Standard: Common Specification of Wooden Housing Construction and Government Housing Loan Corporation) with a total Gross Floor Area of 140.058m², comparing floor area of 82.810m² on the 1st floor and 66.248m² on the 2nd floor.

INSULATION/ STRUCTURE	GLASS WOOL		STONE WOOL	
	PRODUCT TYPE	PACKAGING	PRODUCT TYPE	PACKAGING
CEILING	10kg/m³ 100mm	27 pcs	75mm thick	12 pcs
WALL	10kg/m³ 75mm	32 pcs	55mm thick	16 pcs
SLAB	10kg/m³ 50mm	54 pcs	55mm thick	16 pcs

When calculated according to the Next-Generation Energy Saving Standards under the same conditions as above, about twice the amount of stone wool is required compared to glass wool.

	NUMBER OF PACKS REQUIRED	GROSS WEIGHT
GLASS WOOL	45 PACKS	668.3kg
STONE WOOL	85 PACKS	1,588.5kg

Experimental data from Glass Fiber Association

PART 1 **COMPARISON OF PERFORMANCE**

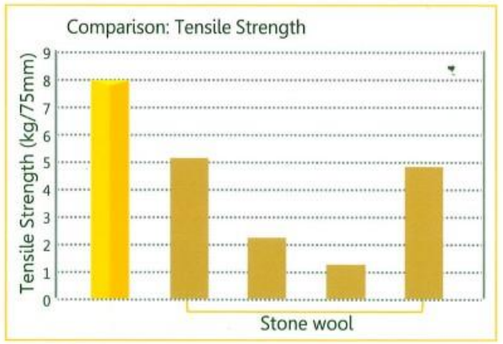
SECTION 2 **CONSTRUCTION WORKABILITY**

EVEN IF YOU BEND, PULL AND COMPRESS GLASS WOOL, IT WILL NOT CRACK, TEAR OR DISTORT.

Fine, longer and evenly distributed fibre network helps in creating better tensile strength allowing glass wool to demonstrate superior durability and flexibility. Therefore, minor damage by mishandling does not affect its performance.

COMPARISON: Tear resistance during construction

Glass wool is more durable – better tensile strength compared to stone wool.



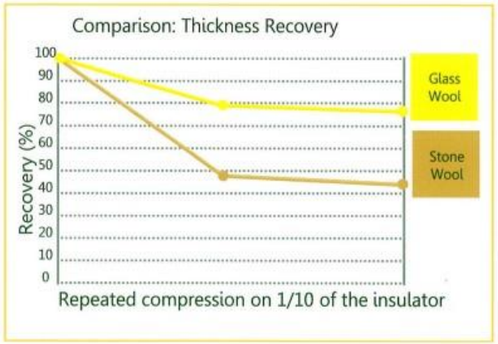
Comparison Method

The specimen, glass wool 16kg/m³ - 100mm and stone wool 90mm are used which specified by the energy saving standards.

1. The specimen size, 75mm width x 300mm length x thickness of the product which shown in the figure on the right.
2. Speed of tensioning is set as 50mm/min
3. Clamp both side of the insulator (width 75mm portion), when it tears off, check the reading of the of the tensioning strength. (number of test = 3 times each)

COMPARISON: Dimension stability

Glass wool has excellent compression strength. It recovers to its original form even after repeatedly being compressed.



Comparison Method

The specimen, glass wool 16kg/m³ - 100mm and stone wool 90mm are used which specified by the energy saving standards.

1. The steel plate, 300 width x 300mm length is placed in tension and compression testing machine which shown as the figure on the right.
2. The specimen size, 150mm width x 150mm length x thickness of the product is used.
3. Compression speed 500mm/min. Compress the specimen 1/10 of its thickness for 25 times and repeat the same until 50 times.
4. The specimen size, 150mm width x 150mm length x thickness of the product is used.

COMPARISON :
Ductility

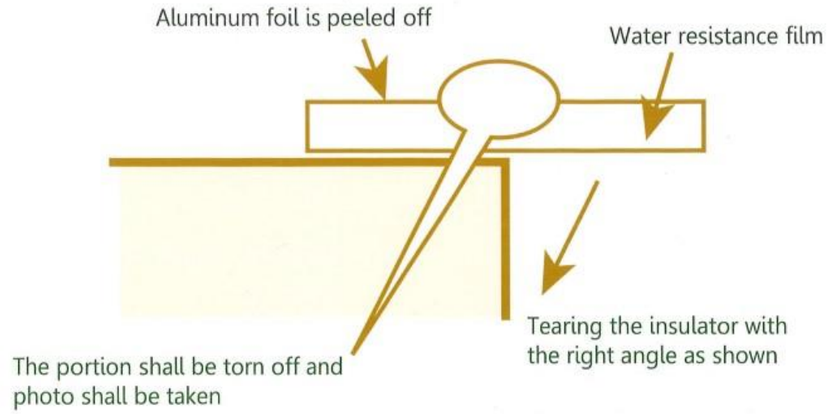
GLASS WOOL IS DURABLE AND FLEXIBLE. IT WILL WITHSTAND REPEATED FLEXING WITHOUT ANY DAMAGE

STONE WOOL TEARS OFF EASILY AND THE BENT PORTION WILL BECOME THINNER AND FINALLY IT WILL DAMAGE

Comparison Method

The specimen, wooden wall insulator, glass wool 16kg/m³ - 100mm and stone wool with the thickness of 90mm is used (as specified by the energy saving standards).

1. Aluminum foil is peeled off as shown in the figure above.
2. Stone wool tears off and damaged in the bent portion. Meanwhile, glass wool remains in good condition without any damage.
3. The pictures above show the results of the experiment.



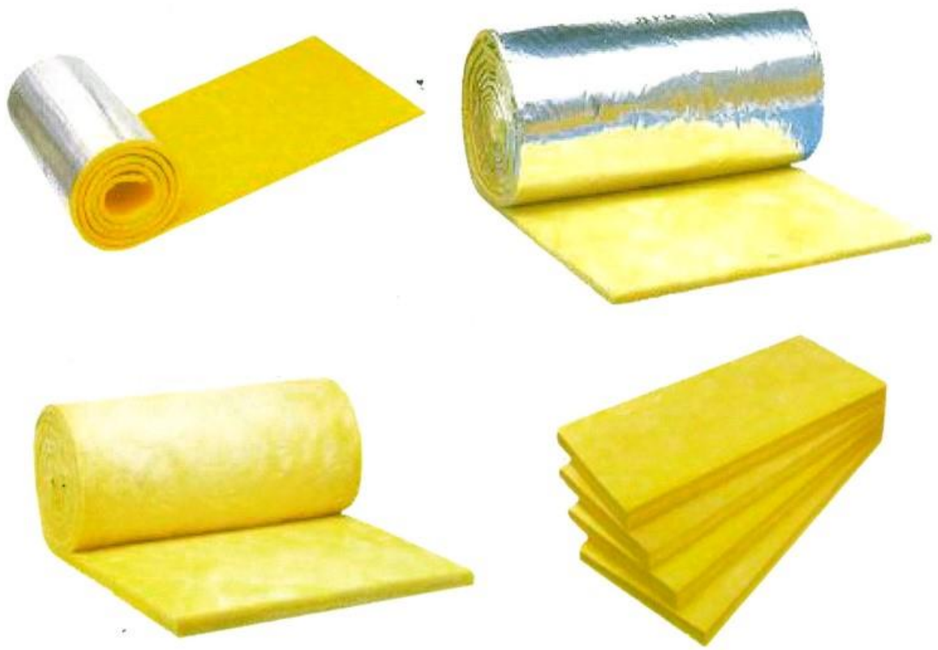
Experimental data from Glass Fiber Association

PART 1 **COMPARISON OF PERFORMANCE**

SECTION 3 **THERMAL INSULATION**

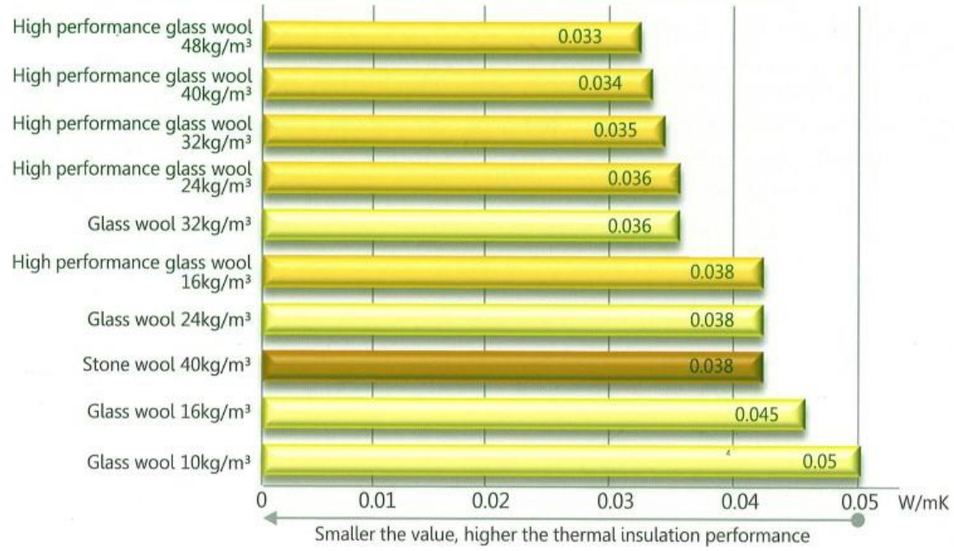
WIDE VARIETIES OF GLASS WOOL INSULATION PRODUCTS WITH WIDE FUNCTIONALITIES WHICH CAN FULLFILL EVERY CUSTOMER NEEDS.

Wide combination of thickness, density, width and length makes glass wool an insulation material with excellent design flexibility and workability. Furthermore, high performance glass wool can be achieved by producing glass wool with fine fibres.



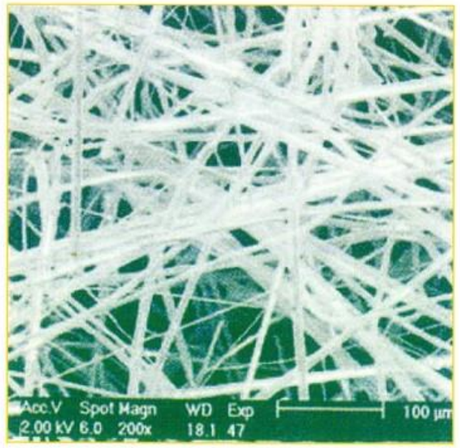
COMPARISON :
Thermal Conductivity

Different types of glass wool have different thermal performance which is determined by the thickness and thermal conductivity value of the insulation. The comparison below is only valid for thermal conductivity.

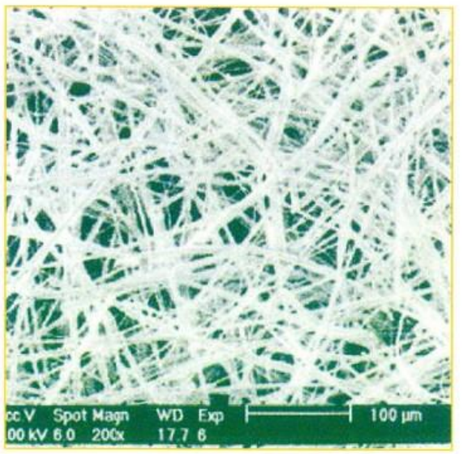


WHAT IS HIGH PERFORMANCE GLASS WOOL ?

Smaller fibre diameter ranging from 4-5 microns (compared to traditional glass wool which is 7-8 micron) produces more air chambers which enable the insulation to provide better and enhanced thermal and acoustic performance. The high performance glass wool has 4 times more fibres compared to the traditional glass wool with the same density resulting in the chambers to be 4 times smaller than the traditional one. Therefore, glass wool with a density of 16kg/m^3 will have equivalent insulation performance of a traditional insulation with a density of 24kg/m^3. The high performance glass wool will be less dusty and itchy. It creates a pleasant work experience by reducing the tingling feeling during installation.



TRADITIONAL GLASS WOOL



HIGH PERFORMANCE GLASS WOOL

PART 2 **AN UNTRUE STATEMENT**

1ST VERIFICATION **AGING**

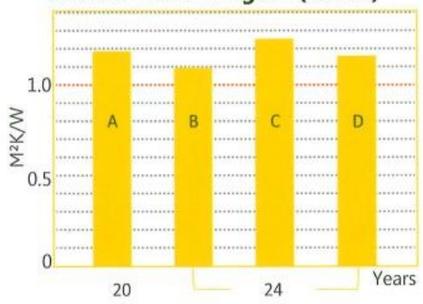
GLASS WOOL IS NOT DURABLE. IT IS A LIE.

Glass wool is an insulation material which does not age that much. Glass wool is usually installed either into the wall, on the ceiling or roof top. Any changes to the original form and its performance cannot be seen from outside. Therefore, we collected the glass wool from inside the building and aging test was performed.

INVESTIGATION

Samples of glass wool were collected from wooden residential houses built 20 years ago and aging test was performed.

Chart 1 - Warm region (Kanto)

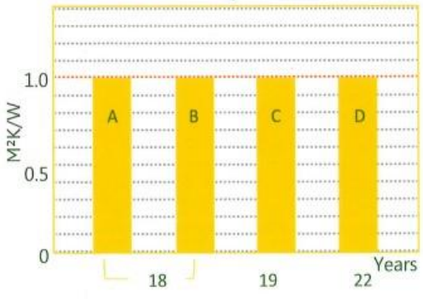


Duration	Nominal Thickness (mm)	Measured Thickness (mm)	Density (kg/m³)	K-value (W/mK)	R-value (m²/K/W)
A - 20	50	50	10.4	0.043	1.2
B - 24	50	53.5	9.9	0.043	1.1
C - 24	50	53.5	10.9	0.041	1.2
D - 24	50	50.8	10.9	0.047	1.2

Date taken from Glass Fiber Association of Japan

- Thermal resistance value will only pass if the value is above 1.0m³ k/w
- Thermal conductivity value will only pass if the value is below 0.05 W/mK

Chart 2 - Cold region (Hokkaido)



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Date taken from Glass Fiber Association of Japan

- Thermal resistance value will only pass if the value is above 1.0m³ k/w
- Thermal conductivity value will only pass if the value is below 0.05 W/mK

Experimental data from Glass Fiber Association

Both maintain their performance exceeding the standards. It is UNTRUE that the thickness and form of glass wool degrades over time.

PART 2 **AN UNTRUE STATEMENT**

2ND VERIFICATION **INFLAMMABLE RESISTANCE**

GLASS WOOL IS NOT FIREPROOF IF YOUR NEIGHBOUR'S HOME IS ON FIRE, THE EXTERIOR WALL OF YOUR HOUSE WILL REACH UP TO 840°C WITHIN 30 MINUTES. IT'S A LIE.

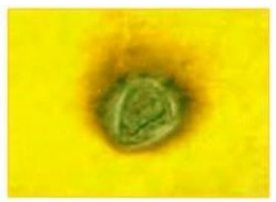
How would you prevent the fire from spreading ?

It will be meaningless if we are comparing the insulation inside the exterior wall of your house unless it has a heat resistance property of at least 700°C. However, the major issue is whether the insulation material is combustible or not and will it hinder the fire from spreading. It is essential that the insulation material be fire-resistant.

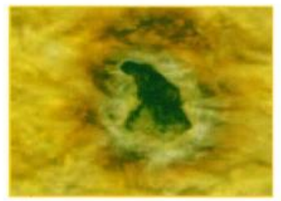
INVESTIGATION

Tested at 700°C. (When comparing the status of photography in 10 seconds after the start of the fire test.)

Glass Wool



Stone Wool



Comparison Method

Assuming a fire next door and the insulation material has a heat resistance property of at least 700°C is used in the exterior wall of the house. What happens if we compare both the insulation materials at the above temperature?

Based on the Energy Conservation Standards set for wooden house wall structure, 16kg/m^3 high performance glass wool with a thickness of 100mm and stone wool with a thickness of 90mm will be used.

Install the burner nozzle to a gas cylinder cassette. Position at which the surface temperature is about 700°C and torch the insulation at a distance of 110mm.

Both the insulation materials did not burn. The investigation clearly shows that there are no differences between glass wool and stone wool in terms of fire safety.

Experimental data from Glass Fiber Association

3RD VERIFICATION HYGROSCOPIC, DRYING CHARACTERISTICS

"GLASS WOOL ABSORBS MOISTURE". IT IS A LIE.

Stone wool floats on water due to the effect of 'oil based additive' which is mixed during the manufacturing process. Neither glass wool nor stone wool is hygroscopic and inorganic.

As the fibre surface and the binder will absorb tiny moisture, both materials show that they are hygroscopic in the experiment. When they are dipped into water, the results of water content and drying speed are almost the same.

INVESTIGATION

Comparing the amount of moisture absorption under high humidity. Moisture content and drying speed are at the difference level.

0.006gsm

Glass wool moisture absorption

0.022gsm

Stone wool moisture absorption

Comparison Method

The specimen, glass wool 16kg/m³ - 100mm and stone wool 90mm is used (as specified by the future energy saving standards).
Both insulator's aluminum foils are peeled off. The test is conducted based on JIS A 9523 : 1990 hygroscopic testing.
Dried for 6 hours at temperature 50℃ (±2℃), relative humidity 50% (±5%) moisture for 24 hours then measure the mass.
Subsequently, temperature 50℃ (±2℃), relative humidity remains 90%(±55) up to 24 hours then measure the mass and calculate the amount of moisture.

Full-size dipping a piece of residential insulation products in the tank, the water content was then suspended vertically down, changing the water content was measured.
Product as a full-size specimens, the length is 1370mm × 430mm × 100mm thick glass wool, 90mm thick stone wool with a length of 1360mm × 420mm width.

Dip a piece of residential insulator fully inside the tank. After that, hang it vertically and measure the changes of water content. Use the suggested dimension for the specimen:

- Glass wool 430mm (W) x 1370mm (L) x 100mm thick.
- Stone wool 420mm (W) x 1360mm (L) x 90mm thick.

Experimental data from Glass Fiber Association

During the final drying up, high-density stone wool took 168 hours longer than the glass wool.

4TH VERIFICATION CONDENSATION

"GLASS WOOL CONDENSES EASILY INSIDE THE WALL". IT IS A LIE.

It is wrong to assume that the longer the insulation material floats on water, the less likely it is to cause condensation. This is because condensation is not caused by water. It is caused by moisture or water vapour.

Condensation which happens inside the wall is caused by the intrusion of indoor moisture that enters the building. In order to prevent this, ventilation system plays a vital role in providing an escape route for the water vapour and to allow proper ventilation.

No matter what type of thermal insulation we use, condensation will occur due to improper installation.

INVESTIGATION

Compare Content	Glass Wool	Stone Wool
Sample weight before test (gsm)	83.8	140.1
Sample weight after test (an hour after moisture absorption)	89.1	146.7
Weight increase (gsm)	5.3	6.6
24 hours after discharge wet weight (gsm)	83.8	140.1

Experimental data from Glass Fiber Association

Comparison Method

The specimen, glass wool 16kg/m³ - 100mm and stone wool 90mm is used (as specified by the future energy saving standards). Both insulator's aluminum foils are peeled off. Use the size of 310mmx310mm. Insert glass wool specimen and stone wool specimen respectively to the gap of the refrigerator door and closed the door. There is temperature different between inside and outside of the refrigerator. After 24 hours, check the portion of insulator which is inside the refrigerator and measure the water content. To prevent the vapour and condensed water to escape inside the fridge, Polyethylene film is pasted.

Experimental data from Glass Fiber Association

After 24 hours, both insulation materials have returned to dry condition.

GLASS WOOL | STONE WOOL

INSULATION THICKNESS IS "LIFE".

Try stacking 10 pieces of 100mm thick insulation (as shown in the picture).

The picture shows that glass wool is higher in height. Stone wool is affected by the weight itself.

As you can see there is a difference in the thickness of the 1st piece of stone wool.

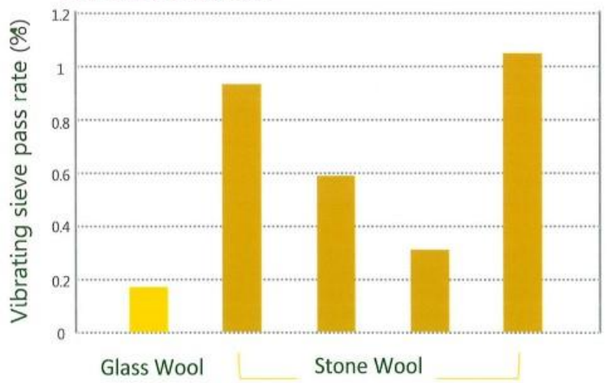
To determine the insulation performance, thermal conductivity is not the only important criteria but also the thickness. If the insulation material has the same thermal conductivity value, the thicker insulation material will give higher performance.

WHICH ONE PRODUCES MORE DUST ?

When we touch fibre type insulation material, it feels itchy.

Due to the short and brittle fibres of stone wool, the insulation generates a lot of dust during installation compared to glass wool. This may lead to performance degradation due to the discomfort while handling the insulation material.

COMPARISON: Dust



Method of Experiment

For this specimen, glass wool 16kg/m³ with the thickness of 100mm and stone wool 90mm is used.

- 100mm x 100mm x thickness specimen are placed into rotor (200rpm at 60 time/min) and vibrated for 10 minutes.
- Measure the mass pass through the sieving and vibrating sieve pass rate is calculated.

Experimental data taken from Glass Fiber Association

THE THEME OF THE 21ST CENTURY IS "COMFORTABLE" AND "ENVIRONMENTAL FRIENDLY". IT IS AN ESSENTIAL CONDITION FOR SEEKING RECONCILIATION BETWEEN BOTH OF THEM WHEN CHOOSING INSULATION FOR RESIDENTIAL HOUSES WITHOUT BURDENING THE ENVIRONMENT.

Energy consumption continues to grow as the usage of air conditioning so common nowadays. While we are having comfortable life, global warming and energy issues are being neglected.

Japan's world-class insulation standards which is known as "Next Generation Energy Efficiency Standards" was launched in March 1999. This standard strongly recommends that thermal insulation is the engine for global CO^2 emission while reducing energy consumption. In addition, CFCs are not used at all.

GLASS WOOL IS MANUFACTURED FROM 85% OF RECYCLED GLASS MATERIAL

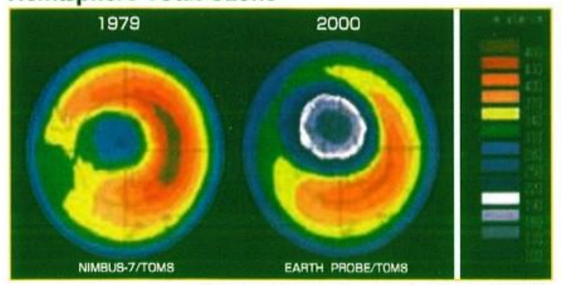
The insulation also helps to protect the environment and waste reduction. Glass wool is manufactured mainly from glass bottles which are collected from households. It is also produced mainly from industrial glass waste.

We continue with the destruction of the ozone layer by CFCs and CFC gases.

The ozone layer that protects the earth's ecosystems and absorb much of the harmful UV rays from the sun, has been severely destroyed in the last 20 years.

In order to boost higher thermal insulation quality for foam type insulation system, CFC has been widely used and it cause ozone depletion. However, CFC is totally being eliminated and alternatives for CFC is being seek after.

Distribution of 10 Months Average Southern Hemisphere Total Ozone



Created based on data from NASA