

TRADE OF
Industrial Insulation

PHASE 2

Module 4

Insulation – Materials, Science and Application

UNIT: 5

Gass Mineral Fibre & Rockwool

Produced by

S O L A S

An tSeirbhís Oideachais Leanúnaigh agus Scileanna
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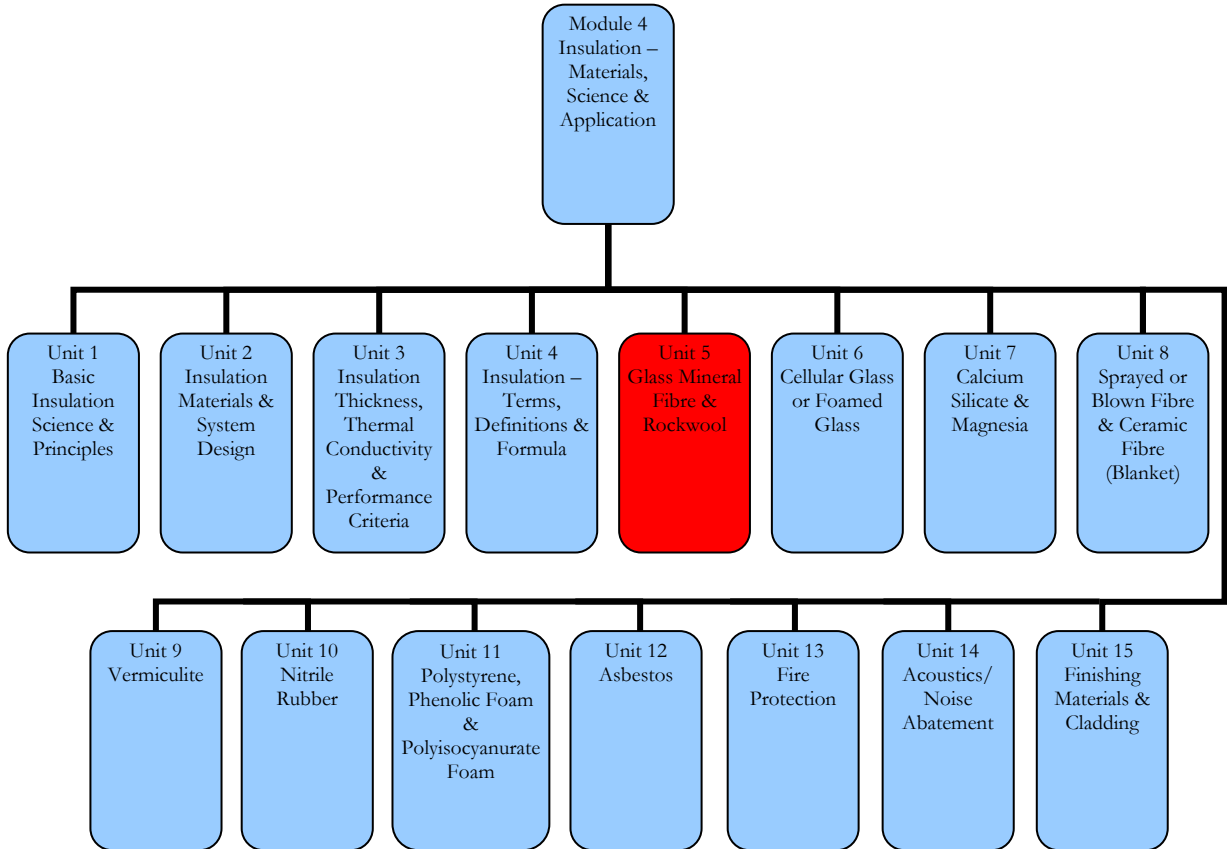
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Introduction

Glass mineral fibre and rockwool insulation is widely used in the industrial insulation industry. It is available in many forms from rolls to pre-formed pipe sections. In this unit we will look at the many forms of glass mineral wool and rockwool insulation, their applications within the industry and the advantages and disadvantages of using these products.



Unit Objective

By the end of this unit *each apprentice* will be able to:

- List and describe the properties, uses and applications of glass mineral fibre and rockwool insulating materials.
- Identify glass mineral fibre and rockwool from a selection of samples provided.
- Demonstrate the safe handling of materials.

1.0 Glass Mineral Fibre and Rockwool

Key Learning Points

- Product composition and characteristics.
- Advantages and disadvantages of glass mineral fibre and rockwool.
- Typical uses and applications.
- Identification of glass mineral fibre and rockwool from a selection of samples provided.

1.1 Product Composition and Characteristics

Glass Mineral Wool

Glass mineral wool is made from sand and recycled glass, limestone and soda ash. These are the same ingredients that are used to make familiar glass products such as window panes or glass bottles. The glass is spun to form millions of glass fibres. A resin is used to bind the fibres to form a mat of material. The density of the product determines whether the insulation is a light weight quilt supplied in rolls, a flexible slab or a rigid slab, and its thermal insulation value.

Advantages

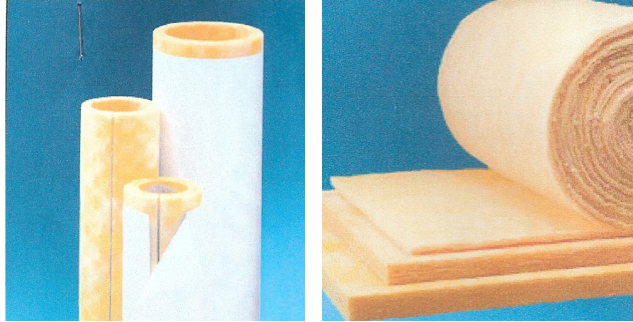
- Long fibre, giving good tear strength.
- Suitable for temperatures up to 230° C.
- Non-combustible.
- Lightweight.
- Available in rolls and slabs.
- Corrosion resistant.

Disadvantages

- Can cause skin irritation.
- Dust and fibres are a health risk.
- Low deformation resistance unless properly supported.
- Uneven surface – difficult to metal clad without supports.
- Loses effectiveness if the insulation becomes wet or damp.

Main Uses

- Loft or attic insulation.
- Cavity wall insulation.
- Sound insulation (absorption) within floors and partitions.
- Thermal and acoustic insulation of pipe work in heating and ventilation, air-conditioning and industrial applications.



1.2 Rock Mineral Wool

Rock mineral wool is made mainly from volcanic rock, typically basalt and/or dolomite. An increasing proportion is now recycled material from slag, a waste product from blast furnaces. The materials are melted and then spun into fine fibres. A resin is used to bind the fibres together to form a mat of insulation.

Advantages

- Short fibre- compressive strength.
- Non-combustible suitable for temperatures up to 850° C
- Denser than glass mineral wool.
- Available in the form of slabs, rolls mattresses and pipe sections.
- High compressive strength.

Disadvantages

- Dust and fibres are a health risk.
- Loses effectiveness if the insulation becomes wet or damp.
- Low deformation resistance unless properly supported.
- Uneven surface – difficult to metal clad without supports.

Main Uses

- Thermal insulation of flat roofs and external wall insulation.
- Fire protection, including smoke and fire barriers.
- High temperature applications.
- Sound insulation for floors and walls.
- Thermal and acoustic insulation of pipe work in heating and ventilation, air-conditioning and industrial applications.



2.0 Glass Mineral Wool

Key Learning Points

- Compressive strength of cellular glass mineral fibre and rockwool.
- Use of manufacturers' data and instructions.
- Definition of density, density of insulation materials. Service temperature range.
- Reaction to fire characteristics.
- Thickness and density range.
- Forms and supply available.

2.1 Glass Mineral Wool Products for Industrial Insulation

Glass mineral wool is manufactured in various products for the industrial insulation industry. Some of these products include:

- Duct wraps and rigid slabs.
- Pre-formed snap-on pipe sections.
- Mattress.
- Acoustic duct liner.

2.2 Requirements of Pipe and Duct Insulation – Uses and Applications

Heat conservation

Minimising the loss of heat from the working fluid to the surrounding will save energy and money. Returning unused energy to the heat source for re-circulation will reduce fuel demand on the boiler/heater, with associated energy cost savings. Heat loss because of poor insulation cannot usually be recovered, thus wasting the fuel energy used to produce it.

Safety

The possibility of human contact with heated or chilled pipe work introduces a risk of injury. A suitably finished cover will reduce this risk. Ducts and pipes can also create obstruction hazards, but the resilience of glass mineral wool insulation is an effective cushion.

Fire Protection

Fire risk must be minimised by using non-combustible materials wherever possible. Fire is prevented from spreading from one area to another by sealing with a suitable fire barrier.

Acoustic Protection

Noise transmission into occupied areas from mechanical services can be a serious nuisance. Air movement in ducts and liquid movement in pipes can also generate noise from turbulence. Noise does not have to be loud to cause problem, low level noise can be stressful and disruptive. The damping effect from insulation can reduce the vibration noise from a pipe or duct, which might otherwise be transmitted from one area to another.

Frost Protection

If aqueous solutions are left static, there is a risk of freezing in below ambient temperatures. The risk is increased by the effects of draughts causing a chilling effect to exposed surfaces. If the surfaces are damp or wet then the chilling effect is further increased by evaporation.

Condensation Protection

The moisture carrying capacity of the air is related to its temperature. When moist warm air comes into contact with cold surfaces such as pipes and ducts, the air is cooled and will produce precipitation on the cold surface. Condensation can be hazardous if it drips onto floors, creating dangerously slippery surfaces under foot. Condensation can also corrode steel pipes, ducts, and their supports. Continual moisture contact or dripping can result in cosmetic water damage to surfaces, fungal infestation, or even rotting of susceptible materials.

2.3 Temperature Ranges

Glass and rock mineral wool both withstand high temperatures. These materials are suitable for temperatures up to 230° C which is ideal for high pressure hot water pipes and steam pipes. Specially designed rockwool products like wired mats are suitable for temperatures up to 600° C and rockwool pipe sections are suitable for temperatures up to 700°C.

2.4 Fire Protection

Glass and rock mineral wool are non-combustible when tested to BS476: Part 4 1984, 'non-combustibility test for materials'. Additionally, when mineral wool is covered with a factory-applied aluminium foil facing it should achieve the highest standard required by BS476: Part 6, 'Fire Propagation' and BS476: Part 7, 'Surface Spread of Flame'. If the product has the above certifications, it is rated as 'Class O' to the Building regulations.

2.5 Manufacturer's Data Sheets

Suppliers of insulating products will provide a manufacturer's data sheet for the products they have available. It is an important part of the installation process that time is given to checking the manufacturer's data sheets to ensure that the products being installed conform to the specification of the job. These data sheets will contain the following information:

- Description of the product.
- Quality standard of the product.
- Benefits.

- Fire classification.
- Service temperature.
- Density of the product.
- Acoustic performance.
- Thermal performance.
- The correct installation procedures.

2.6 Compressive Strength of Insulating Materials

Compressive strength is a measure of the stress at which a material fails under a load. Deformation of a material is structural distortion of the material, with or without actual failure. For fibrous and calcium silicate insulations, compressive strength is typically measured when deformation reaches 5% to 25% of the thickness (dependent on the test method used).

Compressive Strengths of Various Materials.		
Insulation Material	Compressive Strength	
	<i>Psi</i>	<i>kPa</i>
Foamglas® Insulation.	100	689
Polyisocyanurate	15-30@ 10% def.	207
Polystyrene	10-45@5-10% def.	310
Phenolic	22@10% def.	152
Fibrous glass	2.3@ 10% def.	16
Mineral fibre	10@ 10% def.	69
Calcium silicate	100@ 5% def.	689
Perlite	90@ 5% def	620

Density

Density is defined as the mass of a substance to its volume, expressed, for example, in units of grams per cubic centimetre. The density of a pure substance varies very little from sample to sample and it is often considered a characteristic of the substance. Most substances undergo expansion when heated and therefore have lower densities at higher temperatures.

Density often is taken as an indication of how “heavy” a substance is. Iron is denser than cork, since a given volume of iron is more massive (and weighs more) than the same volume of cork.

2.7 Insulation Forms

Duct Wrap



Duct wrap is manufactured in a 1200mm wide roll in a variety of lengths, depending upon thickness. The product is compression wrapped and is fully enclosed in strong, colour-coded, polythene wrapping. Duct wrap is available as a high performance mattress which is suitable for large ductwork and vessels providing an extra strong substrate for subsequent coverings or as a multipurpose mattress suitable for all shapes or ductwork.

Thickness	Roll Length	m ² /Pack
25mm	20.0m	24
40mm	12.5m	15
50mm	10.0m	12

Multi-purpose duct wrap.

Thickness	Roll Length	m ² /Pack
25mm	15.0m	18
40mm	10.0m	12
50mm	9.0m	10.8

High Performance duct wrap

Duct Slabs

Duct slabs are available in a high performance slab and a multi-purpose slab. The high performance slab insulation can be used both internally and externally where the applied product is additionally required to provide an extra firm substrate for subsequent coverings and waterproofing. The multi-purpose duct slab is suitable for use with all types of rectangular ductwork, and with an inherent robustness for installation under typical rigorous site conditions associated with heating, ventilation and air-conditioning projects.



Thickness	Slabs/Pack	m ² /Pack
25mm	16	11.52
40mm	10	7.20
50mm	8	5.76

High performance duct slab.

Thickness	Slabs/Pack	m ² /Pack
25mm	18	12.96
40mm	12	8.64
50mm	10	7.20

Multi-purpose duct slab.

Pipe Sections

Pre-formed mineral wool snap-on pipe sections are designed to provide thermal and acoustic insulation of pipe work in heating, ventilation, air-conditioning and industrial applications. Pre-formed pipe sections are available with a factory applied foil outer coating or plain sections.



Standard Sizes of Pre-Formed Pipe Sections

Inner Diameter (mm)	Outer diameter of Pipe Section (mm)							
	Nominal Insulation Thickness (mm)							
	20	25	30	40	50	60	80	100
12	52	62	72	92	-	-	-	-
15	52	65	72	92	115	141		
18	62	68	72	102	115	141		
22	62	72	82	102	128	141		
28	72	78	88	102	128	154		
35	72	85	92	115	141	154		
42	82	92	102	128	141	167		
48	92	98	108	128	154	167		
54	92	104	115	128	154	180		
60	102	110	120	141	154	180	219	
70	-	120	128	154	167	193	232	
76	-	126	141	154	180	193	232	
83	-	133	141	167	180	206	245	
89	-	139	154	167	193	206	245	
102	-	152	167	180	206	219	258	297
108	-	158	167	193	206	232	271	310
114	-	164	180	193	219	232	271	310
133	-	183	-	219	232	258	297	336
140	-	190	206	219	245	258	297	336
159	-	209	-	245	258	284	323	362
168	-	218	232	245	271	284	323	362
194	-	244		271	297	310	349	388
219	-	269	284	297	323	336	375	414
273	-	323	-	349	375	388	427	479
324	-	374	-	401	427	440	479	-

3.0 Rockwool

Key Learning Points

- Forms of supply available.
- Thickness and density range.
- Reaction to fire characteristics.
- Service temperature range.

3.1 Products

Rockwool products are available to suit many different applications. Some standard products would include:

- Duct slab and duct wrap.
- Pre-formed pipe sections.
- Pipe section mattress.
- Pipe bend segments.
- Wired mattress.
- Lamella mattress.

Duct Slab and Duct Wrap

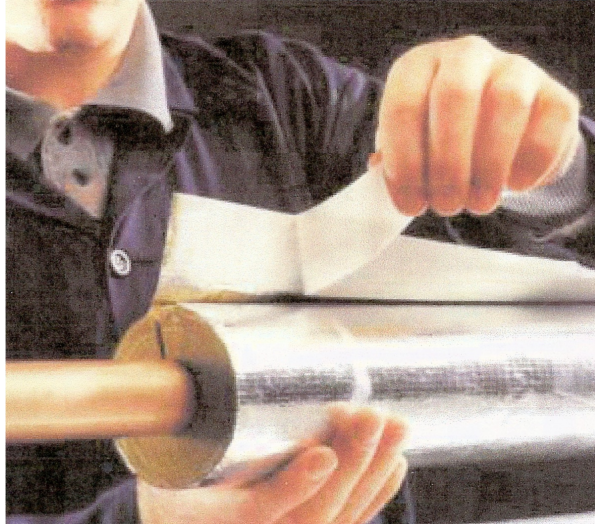
Duct wrap and duct slab provide thermal insulation for air-conditioning, warm air and extract ducts used in the internal and external environment generally within plant rooms and boiler houses. It is also used for the thermal insulation of cold water storage, feed and expansion tanks. The products are recommended for service temperatures of up to 230°C.



Rockwool duct wrap used to thermally and acoustically insulate ducting.

Pre-Formed Pipe Sections

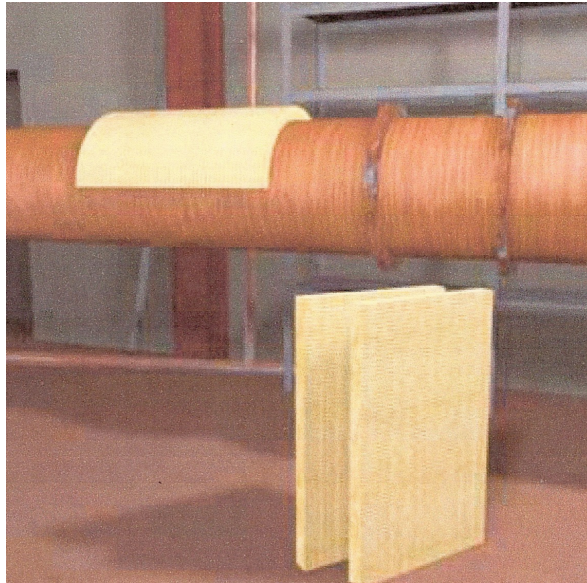
Rockwool pre-formed pipe sections are strong lengths of pre-formed insulation with a one-piece, factory applied foil facing with integral self-adhesive lap. The integral lap ensures fast and easy installation just snap the sections onto the pipe, peel off the backing tape and smooth down the adhesive tape for a completely sealed joint. The sections are designed for thermal and acoustic insulation of heating, ventilation and air-conditioning pipe work operating in the temperature range 0°C to 700°C.



Nominal pipe OD (mm)	Insulation thickness (mm)							
	20	25	30	35	40	45	50	60
17	*	*	*	*	*			
21	*	*	*	*	*	*	*	*
27	*	*	*	*	*	*	*	*
34	*	*	*	*	*	*	*	*
42	*	*	*	*	*	*	*	*
48	*	*	*	*	*	*	*	*
54	*	*	*	*	*	*	*	*
60	*	*	*	*	*	*	*	*
67		*	*	*	*	*	*	*
76		*	*	*	*	*	*	*
80		*	*	*	*	*	*	*
89		*	*	*	*	*	*	*
108		*	*	*	*	*	*	*
114		*	*	*	*	*	*	*
140		*	*	*	*	*	*	*
169		*	*	*	*	*	*	*
194		*	*	*	*	*	*	*
219		*	*	*	*	*	*	*
230		*	*	*	*	*	*	*
245		*	*	*	*	*	*	*
273		*	*	*	*	*	*	*

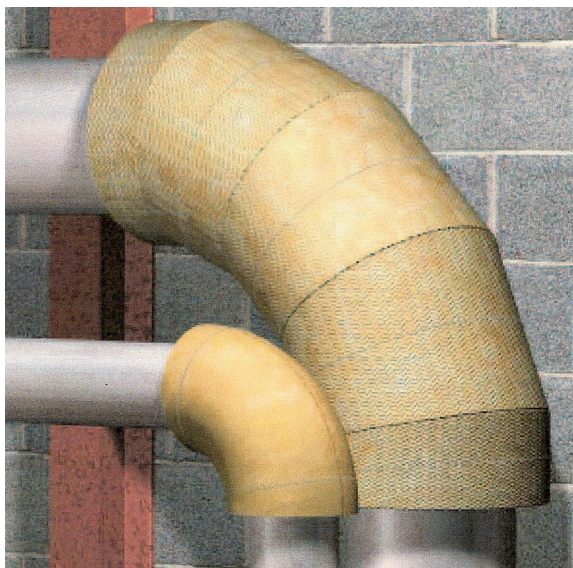
Pipe section mattress.

The rockwool pipe section mattress consists of rockwool rigid slab having grooves factory machined in one face to specifically suit large diameter pipes. The distance between the grooves are calculated to ensure the mat fits closely around the pipe or vessel. The pipe section mattress is designed for thermal and acoustic insulation of large diameter pipes, ducts, chimneys and small vessels and is ideal for use where space is limited. The mattress is supplied with a factory bonded glass fibre reinforcing mesh on the outer face.



Pipe Bend Segments

Insulating pipe bends using pieces cut on-site is difficult, time consuming, potentially inaccurate and results in material wastage. Gaps at joints reduce thermal efficiency and can lead to hot spots that may burn personnel or discolour cladding. Pipe bend segments can be installed quickly, simply and accurately. Two specially engineered products are available to insulate bends in mild steel pipes, the matched-half bends and the pipe bend segments.



Match-half bends are supplied in two curved half-shells that closely follow the radius line of the pipe bend.

Pipe bend segments comprise 1000mm long process pipe sections pre-cut into wedge-shaped segments, two 11.25° starter/finisher segments and three 22.5° full segments. The two starter/finisher segments and the three full segments are required to insulate each pipe bend. The number of segments in each 1000mm pack is shown in the chart below.

Pipe Bend Segments packing/ordering chart

Pipe OD (mm)	219	273	324	356	406	456	508 558 610
Full segments ¹	6	4	3	3	2	2	1
Part-cut full segments ²	1	1	1	1	1	1	1
Starter/finisher segments ('half segments') ³	-	1/2	1/2	-	1/2	-	1/2
Total number of segments per 1000 mm pack	7	5 1/2	4 1/2	4	3 1/2	3	2 1/2
Number of 1000 mm packs required per bend	0.57	0.73	0.89	1	1.15	1.34	1.60

Wired Mat

Wired mats are flexible rockwool mats with 25mm galvanised wire mesh stitched to one face. Two standard grades, industrial and heavy duty are available. Wired mats are particularly suitable for the insulation of high temperature ducts, process pipe work, tanks, vessels and boiler. The advantages of a wired mat are:

- Excellent thermal and acoustic insulation for irregular surfaces.
- Non-combustible.
- High temperature use.
- Strong and flexible
- Easy to handle and install.



Dimensions

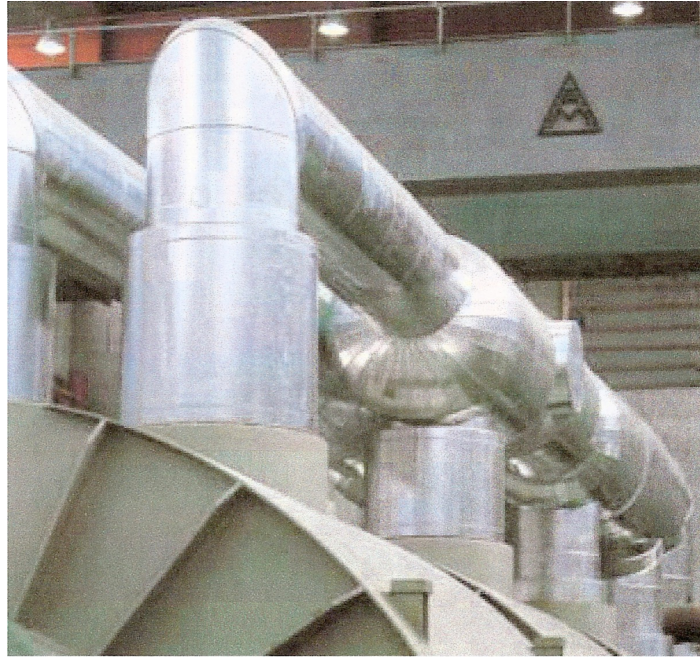
Standard width: 1000 mm

Thickness (mm)	Mat length	
	Industrial (m)	HD (m)
30	5.0	5.0
40	5.0	4.0
50	4.0	3.0
60	3.0	3.0
80	2.5	2.0
100	2.0	-

Note BS 5970 recommends that where total thickness exceeds 70 mm the application should be made in two or more layers arranged so that the joints are staggered.

Lamella Mattress

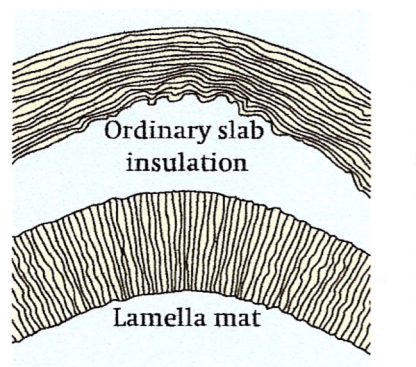
Lamella mattress is ideal for insulating and upgrading of pipe and ductwork installations. It is formed from strips of rockwool mineral wool bonded on edge to a flexible outer facing. The method of construction provides a strong and a resilient mattress which will resist flattening at bends and corners. Lamella mat is particularly suitable for the insulation of heating and ventilation ductwork and pipe work and as an overlay to upgrading existing insulation. It is recommended for service at temperatures up to 230°C.



Lamella Mat used to insulate ducting - thickness of insulation maintained under cladding load

The advantages of the lamella mat are:

- Maintains its thickness on bends.
- Flexible.
- Excellent thermal and acoustic insulation.
- Easy to handle.



- Compression resistant.

Lamella mat maintains its thickness on bends.

4.0 Health and Safety

Key Learning Points

- Health risks and safe handling techniques.
- Use of personnel protective equipment.
- Positive attitude to work place and safe disposal of waste.

Reference should be made at all times to the current requirements of health and safety legislation, and to codes of practice and guidelines notes. Always refer to the manufacturer's data sheets for the correct health and safety procedures when installing any insulation products.

4.1 Minimizing Dust Generation

- Keep the insulating material in its packaging as long as possible.
- Keep work areas clean and free from scrap insulating material.
- Do not use compressed air to clean off surfaces.
- Where repair or maintenance of equipment covered with insulation dust is necessary, clean the equipment first with a HEPA vacuum system.
- Avoid unnecessary handling of scrap materials by placing them in waste disposal containers and equipment kept as close as possible which prevents the release of fibres. Develop a positive attitude to the workplace and the safe disposal of waste material.

4.2 Ventilation

Unless other proper procedures and control measures have been implemented, dust collection systems should be used in manufacturing and fabrication settings where appropriate. Exhausted air containing insulation fibres and dust should be filtered prior to recirculation into interior work places. If ventilation systems are used to capture insulation dust or fibres, they should be regularly checked and maintained.

4.3 Wearing Appropriate Clothing

Loose fitting, long sleeved and long legged clothing is recommended to prevent irritation. A head cover is also recommended, especially when working with materials overhead. Gloves are also recommended. Skin irritation cannot occur if there is no contact with the skin. Do not tape sleeves or pants at the wrists or ankles. Remove insulation dust/fibres from work cloths before leaving work to reduce potential for skin irritation.

4.4 Wearing Appropriate Personnel Protective Equipment

To minimise upper respiratory tract irritation, measures should be taken to control the exposure to insulation dust and fibres. Such measures will be dictated by the work environment and may include appropriate respiratory equipment. When appropriate, eye protection should be worn whenever mineral fibre products are being handled. Personnel protective equipment should be properly fitted and worn when required.

4.5 Removal of Fibres from Skin and Eyes

If fibres accumulate on the skin, do not rub or scratch. Never remove fibres from the skin by blowing with compressed air. If fibres have penetrated the skin, they may be removed by applying and then removing adhesive tape so that the fibres adhere to the tape and are pulled out of the skin. Insulation fibres may be deposited in the eye. If this should happen, do not rub the eyes. Flush them with water or eyewash solution. Consult a doctor if the irritation persists.

Summary

Glass mineral fibre and rockwool insulation are one of the most efficient, flexible and environmentally friendly products available on the market. They are available in many forms including rolls, slabs, pre-formed sections and mattress. They have excellent sound absorption qualities and because they are manufactured from natural materials, they will not support combustion even in direct, prolonged contact with flames.

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