Thermal Insulation

Insulation

Is any material used to reduce or “slow down” or “resist” the flow of energy.

There are several different types of insulators:

Thermal insulators **-** reduce the flow of heat.

Electrical insulators **-** reduce the flow of electricity.

Acoustical insulators - reduce the flow of sound.

Benefits of Commercial and Industrial Insulation

Conserves Energy by Reducing Heat Loss or Gain

Properly designed and installed insulation systems immediately reduce the need for energy, a costly ingredient of every product made.

Controls Surface Temperatures for Personnel Protection and Comfort
Insulation reduces the surface temperature of piping or equipment to a safer level, resulting in increased worker safety and the avoidance of worker downtime due to injury.

Facilitates Process Temperature Control

By reducing heat loss or gain, insulation can help maintain the process temperature to a pre-determined value. Insulation thickness must be sufficient to limit the heat loss in a dynamic system or limit the temperature drop, with time, in a static system.

Prevents Condensation on Cold Surfaces

Specifying sufficient insulation thickness with a good vapour retarder is the most effective means of controlling condensation and limiting corrosion on cold piping, ducts, chillers and roof drains.

Prevents or Reduces Damage to Equipment From Exposure to Fire or Corrosive Atmospheres

When used in combination with other materials, fibreglass and rockwool insulation help provide fire protection in firestop systems; grease- and air-duct fireproofing; and electrical and communications conduit and cable protection.

Controls Noise

Special or standard insulation materials can be used to encase or enclose a noise generating source, forming a sound barrier between the source and the surrounding area.
Insulation installed in walls and ceilings can provide a barrier to the entry of sound from the outside or other rooms.

In summary Thermal insulation serves the following primary purposes in industry.

(1) on high temperature piping, it prevents burning and reduces ambient temperatures in work areas.

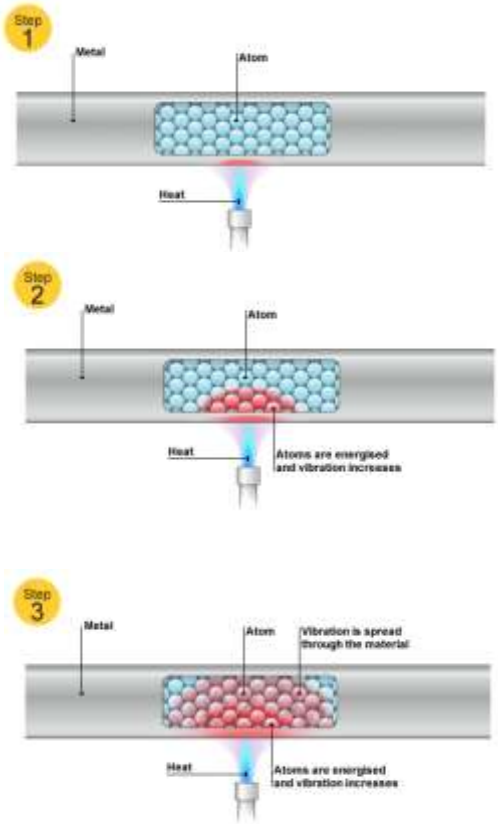
(2) on cold piping, it prevents condensation and freezing of water vapour.

(3) it makes heating, cooling and other industrial processes more efficient and less costly by reducing the leaking of heat in or out of systems.

(4) may slow down the spread of fire, reduce noise levels, and absorb vibration.

There are three mechanisms by which thermal energy is transported.

1. Convection
2. Conduction
3. Radiation



There are two basic categories of thermal insulation:

(1) *mass type* insulation

Mass-type insulation reduces the amount of heat transfer by enclosing air cells within a solid material that is a relatively poor conductor of heat.

(2) *reflective* insulation.

Reflective insulation helps to prevent radiant heat transfer by reflecting the heat waves like a mirror reflects light. The insulation is typically made of bright metal.

A wide variety of substances can serve as insulators. For example, an insulator can be organic, inorganic, fibrous, cellular, reflective, rigid, soft, or granular.

Most insulation materials are primarily effective because they have low thermal conductivity; some are primarily effective at blocking convection or radiation.

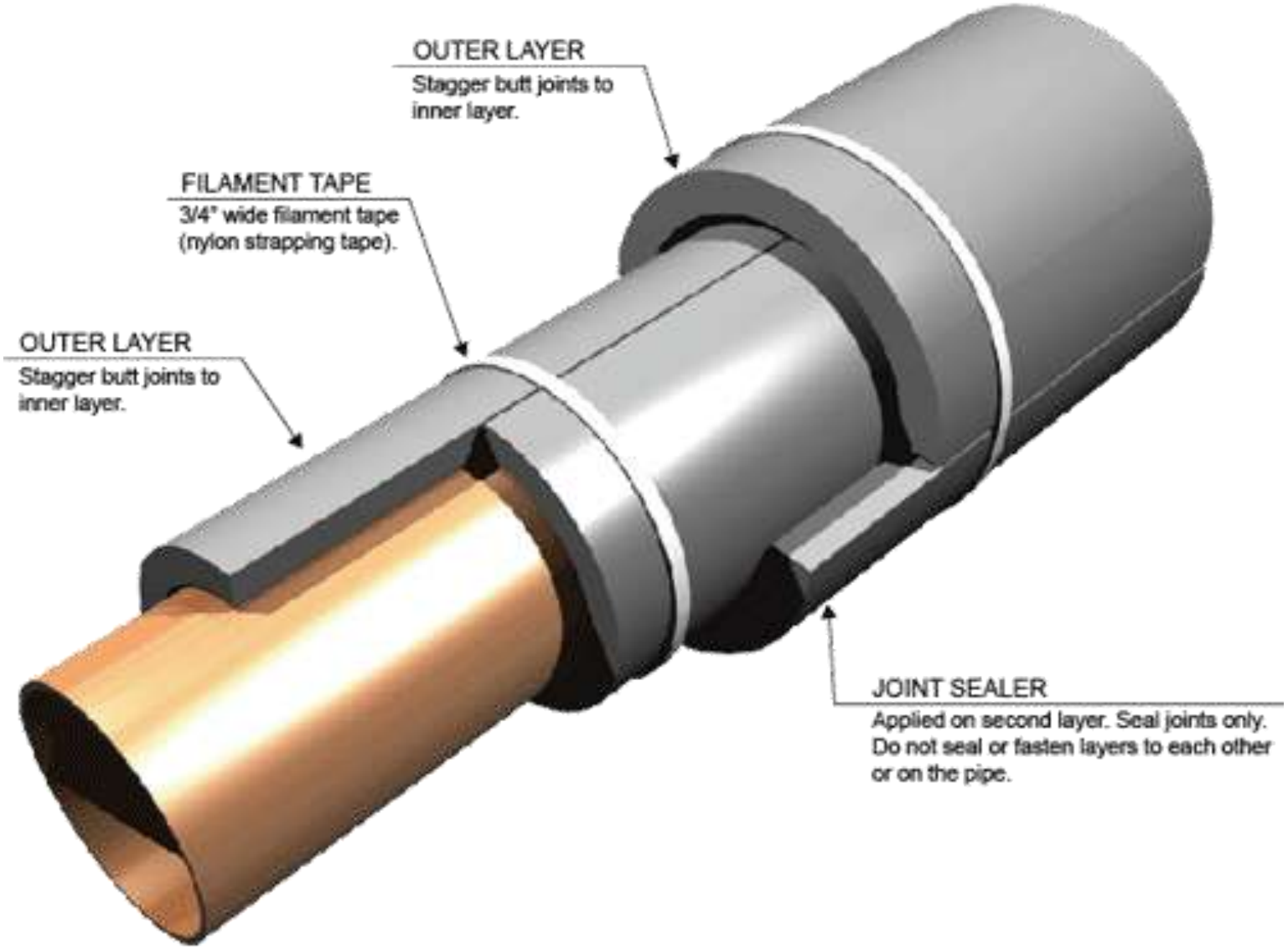
Commonly-used insulation materials can be obtained in the form of batts and blankets, loose-fill, spray foam, rigid panels, and radiant barriers.

Phenol foam with steel segment cladding


Polyurethane foam with aluminium foil coating


Mineral fibre with aluminium foil coating

DOUBLE LAYERED INSULATION SYSTEM




STEAM
Fulton

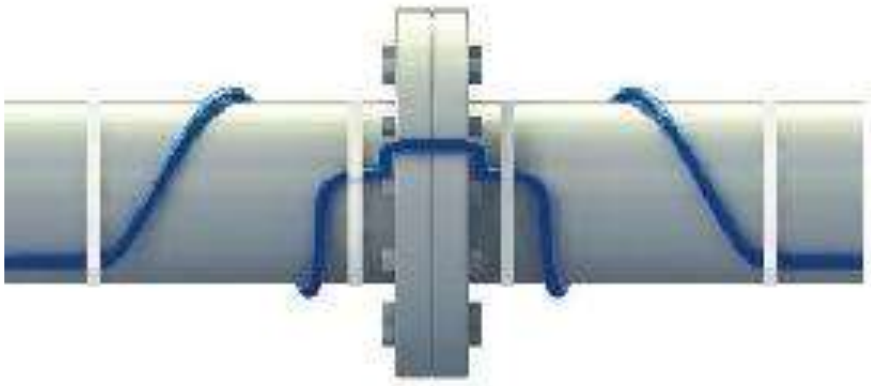

spirax sarco

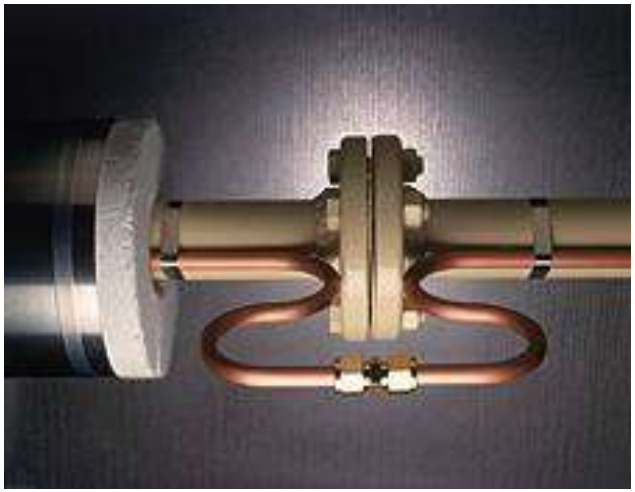

STEAM

Missing and damaged insulation and jacketing on a valve and connecting piping.

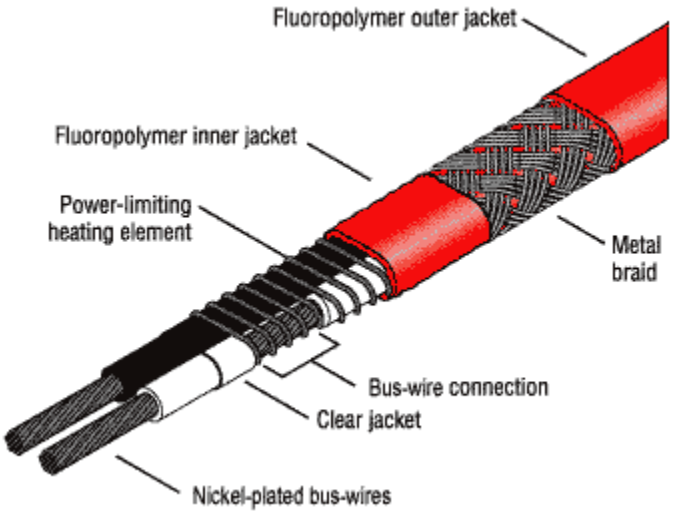
Trace Heating

Typical applications:-
Frost protection of water pipes.
Heating oil lines.
Maintaining temperatures in chemical and food product tanks





Frost protection to water or chemical pipework in cold climates. Insulation alone however thick, will not afford complete protection against freezing under all atmospheric conditions.



Electrical Trace heating systems are based on a flexible, cable-like, heating element which is positioned near or next to the pipe or engineering area which needs to be kept at a constant temperature.

This technology supplements the insulation normally included with such systems where the temperature fluctuation may still drop below minimum tolerances.

Thermal insulation will reduce the rate of heat loss, however trace heating is often essential to maintain the desired temperature, particularly in no flow conditions.

The most common applications are Freeze Protection, Hot Water Service temperature maintenance and Process temperature maintenance in a wide variety of applications: Fuel Oil, Caustic soda, Liquid Sugar, Fats and soaps, Bitumen, Paints and Lacquers, Polymers, Acids and Esters.

Trace heating installation prior to fitting pipe insulation

Insulation Materials and Temperature Ranges

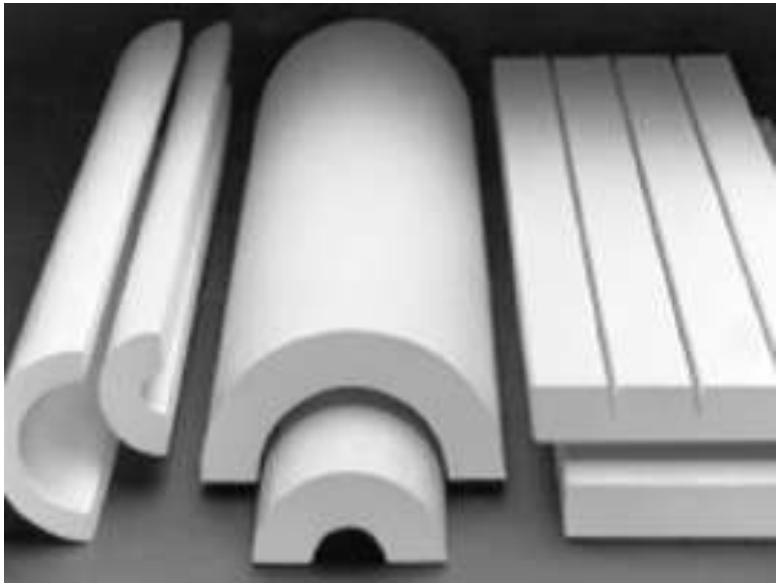
Temperature limits of some common insulation materials

Temperature limits of some common insulation materials are indicated in the table below:

Insulation Material	Low Temperature Range		High Temperature Range	
	°C	°F	°C	°F
Calcium Silicate	-18	0	650	1200
Fibre glass	-30	-20	540	1000
Mineral Wool	0	32	1040	1900
Polyurethane	-210	-350	120	250
Polystyrene	-210	-350	120	250
Cellular Glass	-260	-450	450	850

Calcium Silicate Insulation

Non-asbestos Calcium Silicate insulation board and pipe insulation feature with light weight, low thermal conductivity, high temperature and chemical resistance.



Cellular Glass Insulation

Cellular glass insulation is composed of crushed glass combined with a cellulating agent.

These components are mixed, placed in a mold, and then heated to a temperature of approximately 950oF.
During the heating process, the crushed glass turns to a liquid.
Decomposition of the cellulating agent will cause the mixture to expand and fill the mold.
The mixture creates millions of connected, uniform, closed-cells and form at the end a rigid insulating material.

Fibreglass Insulation

Fibreglass is the most common type of insulation. It's made from molten glass spun into microfibres.

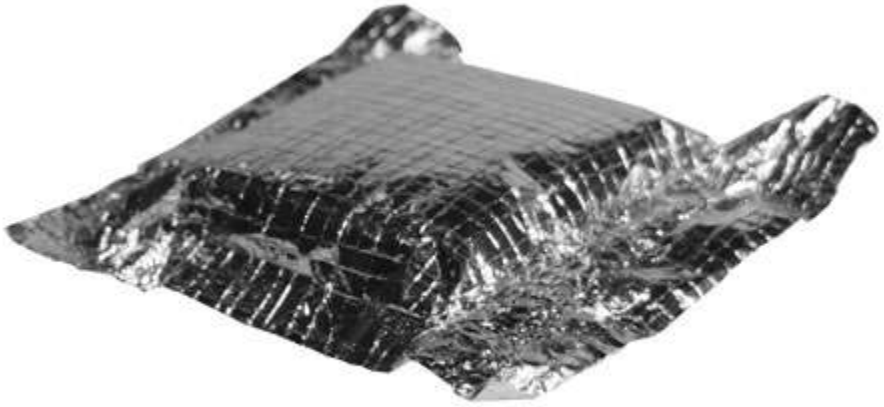
Mineral Wool Insulation

Mineral wool is made from molten glass, stone or slag that is spun into a fibre-like structure. Inorganic rock or slag are the main components (typically 98%) of stone wool. The remaining 2% organic content is generally a thermosetting resin binder (an adhesive) and a little oil.

Polyurethane insulation

Polyurethanes are flexible foams used in chemical-resistant coatings, adhesives and sealants, insulation for buildings and technical applications like heat exchangers, cooling pipes and much more.

Reflective insulation



Cellulose Insulation

Cellulose is made from shredded recycled paper, such as newsprint or cardboard. It's treated with chemicals to make it fire- and insect-resistant, and is applied as loose-fill or wet-sprayed through a machine.

Synthetic Insulation

Synthetic insulation usually polystyrene or polyurethane foam, is commonly used in rigid boards for insulating basements, roofs, ceilings or sidewalls.

Polystyrene Insulation

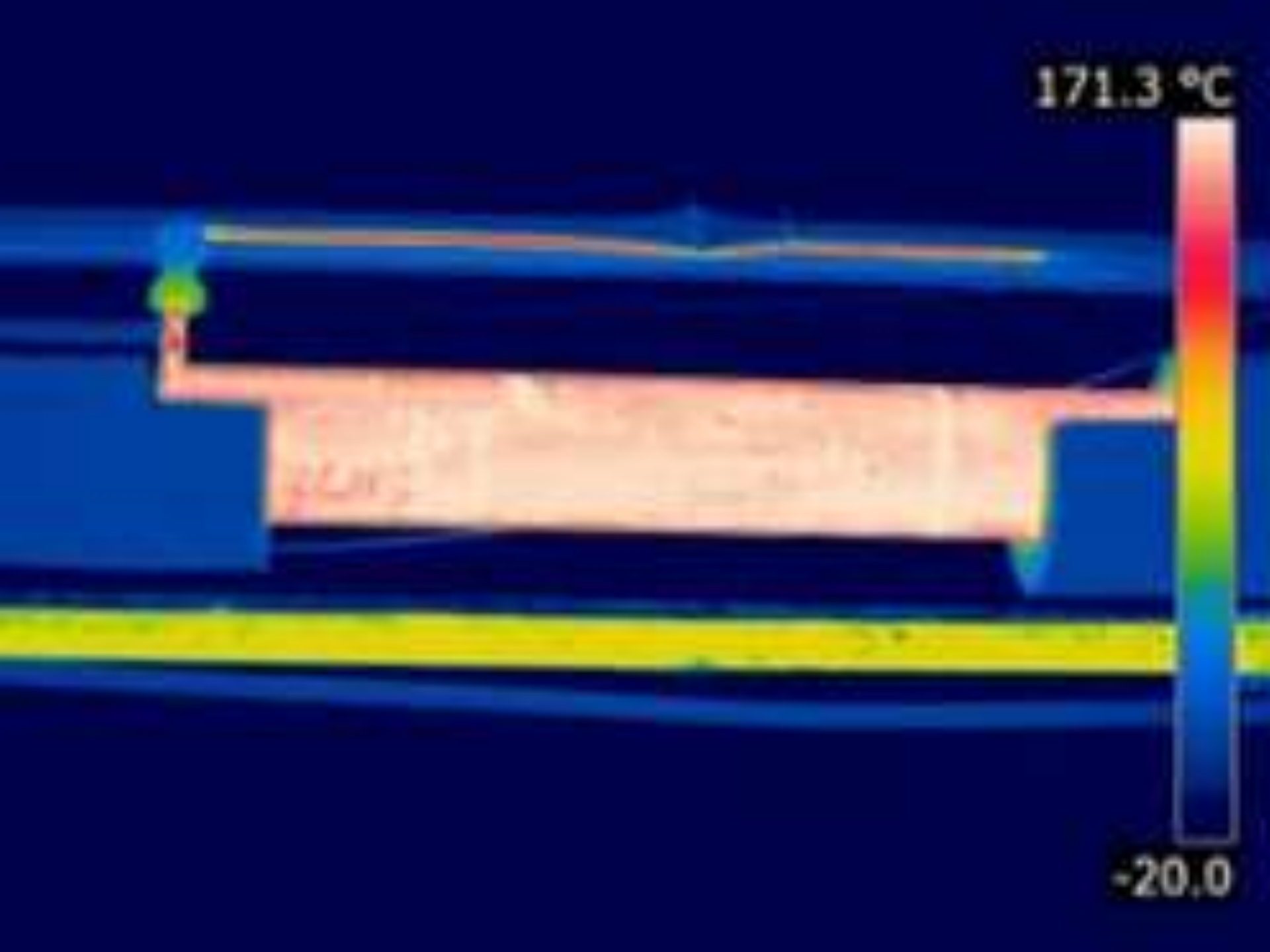
Polystyrene is an excellent insulator. It is manufactured in two ways:

Extrusion - which results in fine, closed cells, containing a mixture of air and refrigerant gas

Molded or expanded - which produces coarse, closed cells containing air


FAIRMONT TONGS

Insulation Hazards


171.3 °C
-20.0

Health and safety

Precautions need to be made when handling a fibre product as it can be absorbed into the body by inhalation. It can also irritate the eyes, skin and respiratory tract.

Prolonged exposure could lead to long term effects and it is considered a possible carcinogen to humans.

SAFETY PRECAUTIONS

Calcium silicate insulation presents several hazards to those involved in its installation and removal.
Calcium silicate is *dusty* – especially when it is being cut or trimmed to fit.

Persons exposed to dust from any kind of insulating material must wear a filter mask, eye protection and appropraitte workwear

Certain types of older calcium silicate insulation present an additional hazard to insulation worker.

Calcium silicate insulation formerly contained asbestos fibres increased insulation value.

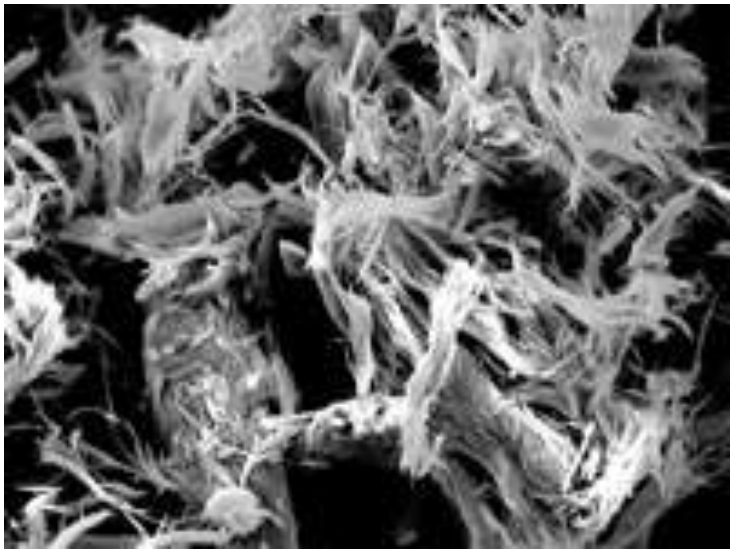
Asbestos has been found to cause cancer and contribute to other respiratory problems. For this reason, calcium silicate is no longer formulated with asbestos.

In older installations however, much of the insulation may contain asbestos.

ASBESTOS

White Asbestos – Chrysotile

Chrysotile, also known as white asbestos, is a member of the Serpentine group, so-named because the fibre is curly. Chrysotile fibres are the most flexible of all asbestos fibres. Chrysotile fibres can withstand the fiercest heat but are so soft and flexible that they can be spun and woven as easily as cotton. Resistance to alkaline attack makes chrysotile a useful reinforcing material in asbestos-cement building products. Chrysotile was banned in the UK in 1999.



Common Uses

Chrysotile is an extremely common used type of asbestos and is often present in a wide variety of products and materials, including:

Vinyl floor tiles, sheeting, commonly within the adhesives used beneath

Plaster and texture coatings

Roofing slates, tars and felts,

Acoustic ceilings

External Roofs i.e. Corrugated shed roofs

Flue Pipes, Soil and Vent Pipes & Rain Water Goods

Thermal pipe insulation

Fireproofing products
Stage curtains
Fire blankets
Interior fire doors

Brown Asbestos – Amosite

Amosite, also known as brown asbestos, is a member of the Amphibole group. Its harsh, spiky fibres have good tensile strength and resistance to heat. In buildings, amosite was used for anti-condensation and acoustic purposes. On structural steel, it was used for fire protection. Between the 1920s and the late 1960s amosite was used in preformed thermal insulation, pipes, slabs and moulded pipe fitting covers. In the UK amosite was also used widely in the manufacture of insulation boards. The import of amosite was banned as of 1 January 1986 by The Asbestos (Prohibitions) Regulations 1985.

Common Uses

Amosite is another very commonly used type of asbestos and is often present in a variety of products and materials, including:

General Insulating Boards

External Soffits & Fascias

Ceiling Panels

Toilet Cisterns

Boiler Cupboard Doors & linings

Bath Panels

Radiator Covers

Fire partitions
Fire Door headers
Lift Doors / linings







www.kentsurveys.com



a
WARNING
CONTAINS
ASBESTOS
Breathing asbestos dust is dangerous to health
Follow safety instructions


Blue Asbestos – Crocidolite

Crocidolite, also known as blue asbestos, is a member of the Amphibole group. The needle like fibres are the strongest of all asbestos fibres and have a high resistance to acids. Crocidolite was used in yarn and rope lagging from the 1880s until the mid 1960s and in preformed thermal insulation from the mid 1920s until 1950. The high bulk volume of crocidolite makes it suitable for use in sprayed insulation.

Crocidolite is known to be the most lethal of all the asbestos types. The import of crocidolite peaked in 1950, fell by 25% in 1960 and by 88% in 1970. The “import, supply and use of crude, fibre, flake, powder or waste crocidolite or amosite” wasn’t actually banned until the Asbestos (Prohibitions) Regulations of 1985 came into force, although strict guidelines had regulated its use since 1969.

Common Uses

Crocidolite is most commonly used in insulation products due to high fibre strengths. This type of asbestos is found commonly in commercial buildings where larger heating installations require insulation and structural elements require fire protection. It is seldom used in residential property's, however its use to insulate pipework, loft spaces (in pure form) etc. has been known. Typical uses of the Crocidolite includes:

Sprayed asbestos (flock) to structural beams, soffits

Thermal Insulation to Pipework (lagging)

Hard-set insulation to pipes, cylinders, calorifiers and boilers

Asbestos rope (seals and gaskets)

Loft insulation – pure form (not mixed with other materials)

Asbestos Cement (this is not licensed or notifiable, as asbestos fibres are bonded into cement composition)









Workers involved in repair or replacement of insulation containing asbestos must take extra additional precautions.

Special equipment may be used to measure the concentration of asbestos particles in the air, and any used insulation containing asbestos must be disposed of by burying in sealed plastic bags labelled “ASBESTOS WASTE”.

Loose dust should be vacuumed off the floor and the worker’s clothing.

Special legislation governs the management and control of asbestos removal and disposal.

Heat stress

“Hot jobs” are an occupational hazard to insulation workers.

Sometimes it is not practical to shutdown a system for insulation maintenance, and personnel may have to work where surrounding air temperatures are higher than 100˚ Fahrenheit (40˚ Celsius).

When a person is in a hot environment, the body automatically acts to cool itself off: sweating and increased blood circulation are two of those responses.

With the additional stress caused by physical work, the body's cooling system may overload. The symptoms of heat stress are as follows:

- **Hot dry skin**
- **Pale, clammy skin or warm, flushed moist skin**
- **Weakness, dizziness, headache, blurred vision**
- **Nausea, vomiting, diarrhoea**
- **Rapid heartbeat**
- **Prickly, red skin**
- **Muscle cramps**
- **Irritability**

Heat stress is the reaction of the body when it is unable to cool itself adequately. Often, the reaction is related to the loss of water and salts through sweating.

When surrounding temperatures are high, workers should drink water frequently, with a small amount of salt, to replace perspiration losses.

A person who feels the symptoms of heat stress (dizziness, rapid heartbeat, cramps) should stop working, get to a cooler place and take frequent small drinks of water until they recover.

HEAT STROKE

Extreme cases of heat stress lead to a condition called heat stroke.

Heat stroke is a reaction of the body to severe water loss. Perspiration stops and internal temperatures rise to dangerous levels. The victim may have mottled red and blue skin, experience convulsions, or is delirious.

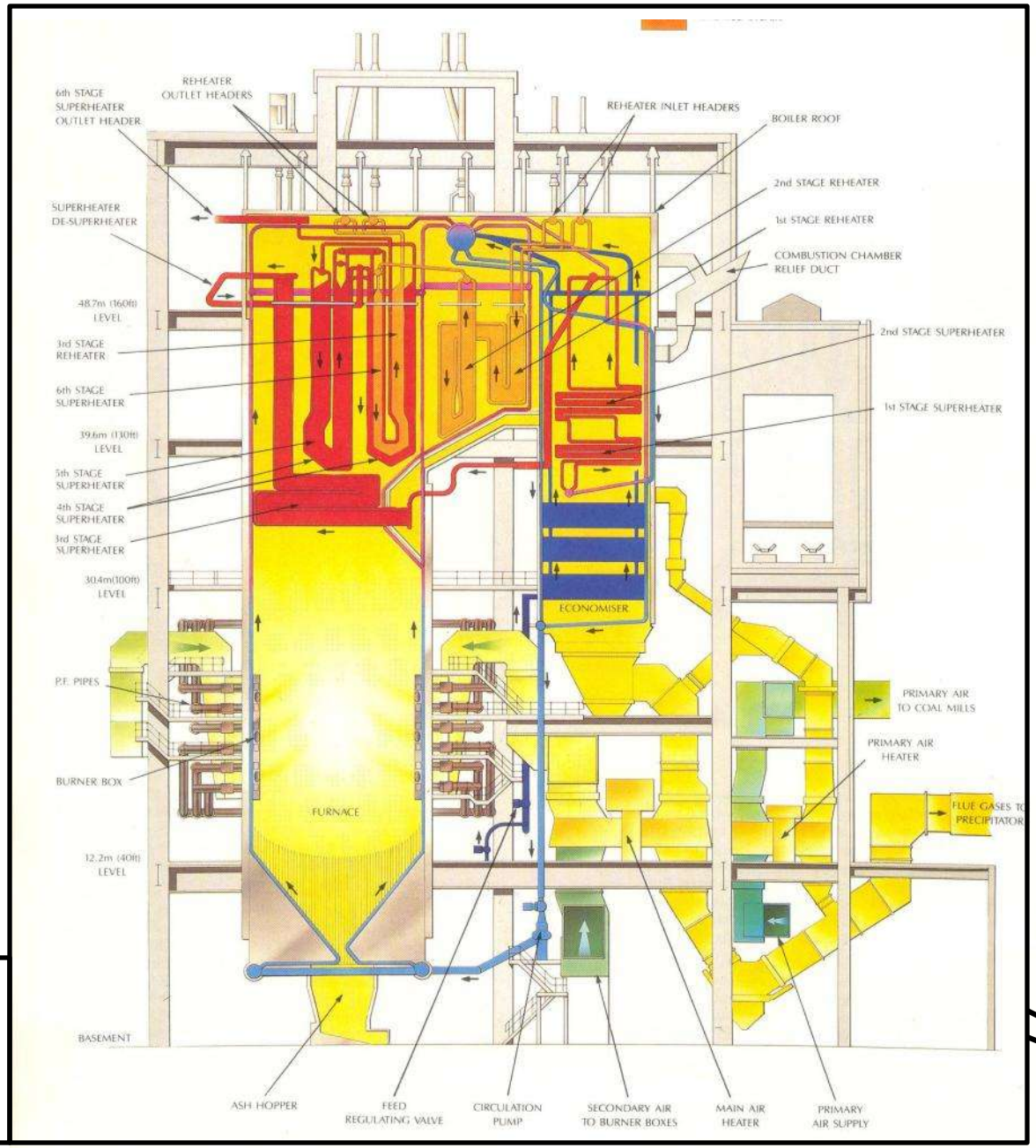
A victim of heat stroke should be taken to a cool place, wetted down, and fanned to lower his body temperature. Medical help should be called.

Other insulating hazards

Insulation workers are exposed to several types of hazards indirectly related to their jobs.

For example, insulation work often takes place above floor level from ladders or scaffolds. Ensure safe access and egress, wearing of harness etc

Other hazards involve
Cutting into or damaging heat tracing
Stress corrosion cracking of material
Ignition of oil-soaked insulation on exposure to air
Handling of sharp materials


6th STAGE SUPERHEATER OUTLET HEADER
REHEATER OUTLET HEADERS
REHEATER INLET HEADERS
BOILER ROOF
SUPERHEATER DE-SUPERHEATER
2nd STAGE REHEATER
1st STAGE REHEATER
COMBUSTION CHAMBER RELIEF DUCT
48.7m (160ft) LEVEL
3rd STAGE REHEATER
2nd STAGE SUPERHEATER
6th STAGE SUPERHEATER
1st STAGE SUPERHEATER
39.6m (130ft) LEVEL
5th STAGE SUPERHEATER
4th STAGE SUPERHEATER
3rd STAGE SUPERHEATER
30.4m(100ft) LEVEL
ECONOMISER
P.F. PIPES
PRIMARY AIR TO COAL MILLS
PRIMARY AIR HEATER
BURNER BOX
FURNACE
FLUE GASES TO PRECIPITATOR
12.2m (40ft) LEVEL
BASEMENT
ASH HOPPER
FEED REGULATING VALVE
CIRCULATION PUMP
SECONDARY AIR TO BURNER BOXES
MAIN AIR HEATER
PRIMARY AIR SUPPLY