

**TRADE OF**  
**Industrial Insulation**

**PHASE 2**

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**Module 6**

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**Insulation & Cladding the Training Rig**

**UNIT: 2**

**Selection & Cutting of Insulation  
Materials**

*Produced by*

**SOLAS**

**An tSeirbhís Oideachais Leanúnaigh agus Scileanna**  
Further Education and Training Authority

*In cooperation with subject matter expert:*

Michael Kelly

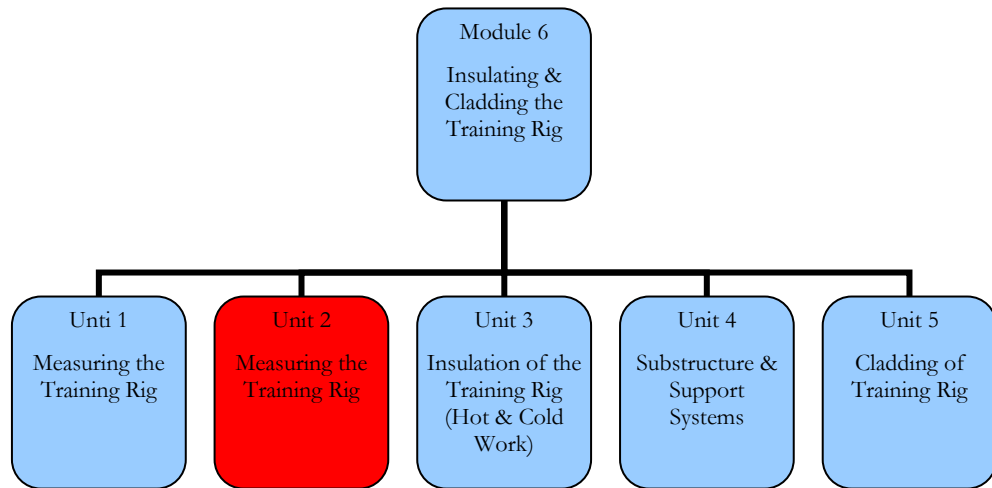
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## Introduction

Selecting the correct insulation material for a particular project requires skill and knowledge. Information on all insulation products is readily available through manufacturers' catalogues, project specifications and the internet. There are a number of factors to be taken into account when selecting the correct product including temperature, location, safety, corrosion and cost of materials.



## Unit Objective

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

- Select the appropriate insulation material.
- Calculate material requirements.
- Accurately cut a selection of insulation materials.

# 1.0 Material Selection

## Key Learning Points

- Interpretation of the supplier works specification
- Use of data sheets and manufacturers' catalogues
- Correct selection of material type and form
- Application of independent selection criteria
- Accurate estimation of materials

## 1.1 Interpretation of the Supplier Works Specification

Properly engineered specifications are vital to the overall success to any thermal insulation project. If a specification is poorly written, it can have a negative effect on the overall efficiency and operation of an insulation system. This can lead to improper selection of materials and systems as well as leaving the contractor unsure of what the specification really requires. It is important that the specification is written in clear and concise language. This is to ensure that there is no confusion and ambiguity and that the contract is carried out to the highest standards. A properly engineered insulation specification will optimise the capital expenditure and give a good return on the investment, as well as ensure the intended service life of the project is maintained.

Most specifications are composed of general conditions, project requirements, drawings, standards, a scope of works and technical information such as insulation thickness etc. Insulation thickness is the primary means of energy conservation through the reduction of heat loss, but ignoring other factors can cause an excessive loss of energy. So it is very important to adhere to the specification to ensure that the contract is carried out properly.

The selection of insulating materials must be precise. The criteria for selecting insulating materials should at minimum, be influenced by the following questions:

Is the insulation system designed to reduce energy loss from a hot surface or to reduce the absorption of heat and provide anti-sweat protection for cold surfaces?

- Will the insulation system be indoors or outdoors?
- Will the insulation system be above or below ground?
- Must the insulation system be protected from mechanical abuse?
- What is the probable incidence of fire?

A wide variety of insulation materials and methods of application are employed to facilitate the application of insulation, thereby reducing the overall cost of the insulation contract.

## 1.2 Use of Data Sheets and Manufacturers' Catalogues

Up-to date manufacturers' literature should be reviewed prior to specifying an insulation material to ensure that the material will perform as expected. Manufacturers' data sheets and catalogues generally outline the following:

- A description of the product including benefits of the product, density, thermal conductivity and overall performance.
- Structure – open cell or closed cell structure, high density.
- Temperature range – minimum and maximum temperature range.
- Thermal performance – Thermal conductivity values and performance.
- Moisture resistance – details and general information.
- Chemical resistance and compatibility – its resistance to oils, solvents, chemicals and adhesives etc.
- Fire performance – Resistance to burning and spread of flame.

## 1.3 Correct Selection of Material Type and Form

In selecting the correct type of material and supply form for a project, it is important to refer to the design data sheet and specification. This will indicate the pipe diameter, temperature range, insulation thickness and the method of installation i.e. multi-layers. The specification will indicate the insulation thickness for the first and second layers and the preferred method of installation.

Another method of selecting the correct material and forms of supply is to use the manufacturers' catalogues as mentioned in **section 1.2**. These will recommend for example:

- The use of glass/rock wool rigid pre-formed process pipe sections for steam and process pipe-work.
- Rock mineral wool rigid, semi-rigid and flexible slabs for thermal, acoustic and fire insulation.
- The use of rock mineral wool lamella mat for the insulation of heating and ventilation pie-work and ductwork.
- The use of rock mineral wool wired mattress for the insulation of high temperature ducts, process pipe-work, tanks, vessels and boilers.
- The use of nitrile foamed rubber (Armaflex) for hot and cold pipe-work, ductwork and vessels.
- The use of phenolic foam insulation pipe sections bends and slabs for pipe-work, vessels and ductwork.

## 1.4 Accurate Estimation of Materials

*In module 6 – unit 1 – section 2.1*, is an isometric drawing of the training rig. For this exercise we will consider leg 1 of the rig.

When measuring the pipe-work for estimating the amount of thermal insulation required for the job it is usual to measure on the centre line of the pipe-work through all the fittings to arrive at a total length required. Add 10% to the total length of material for waste and cutting allowances. Consult with the manufacturers' catalogues for the lengths of pipe sections available, usually 1 metre or 1.2 metre lengths, and simply divide the total length of the job by the available section lengths and this will give you the total lengths of pipe sections required.

### Example

To find the amount of insulation material required to cover a vessel similar to the one on the training rig, firstly the measurements of the vessel must be taken.

Diameter of vessel: 600mm

Height of vessel: 2500mm

Thickness of insulation to be used: 50mm

### Solution

Diameter of vessel: 600mm

Diameter of vessel plus insulation: 600mm + 50mm + 50mm = 700mm or 0.7m

Circumference of vessel:  $0.7 \times 3.14 = 2.198$  metres.

Area of vessel:  $2.198 \text{ m} \times 2.5 \text{ m high} = 5.495 \text{ m}^2$

Area of ends of vessel by 2 =  $\pi r^2 \times 2 = 3.14 \times 0.35^2 \times 2 = 0.7693 \text{ m}^2$

Total area of insulation required =  $5.495 \text{ m}^2 + 0.7693 \text{ m}^2 = 6.2643 \text{ m}^2$

For estimating purposes it is advised to add 10% to this figure to allow for waste and cutting allowances.

Check manufacturers' catalogues for information and advice on the types of insulation available for covering vessels, including the forms and densities available, typical construction methods and information on banding, circumferential support rings, securing methods etc. It is also advised to consult with BS: 5970: 2001



## 2.0 Marking Out and Cutting

### Key Learning Points

- Accurate marking out
- Neat layout of workspace and tools
- Safe use of tools and equipment
- Accurate cutting of material for fit and to minimise wastage
- Storage of cut materials in an orderly fashion for fitting
- Safe disposal of waste materials

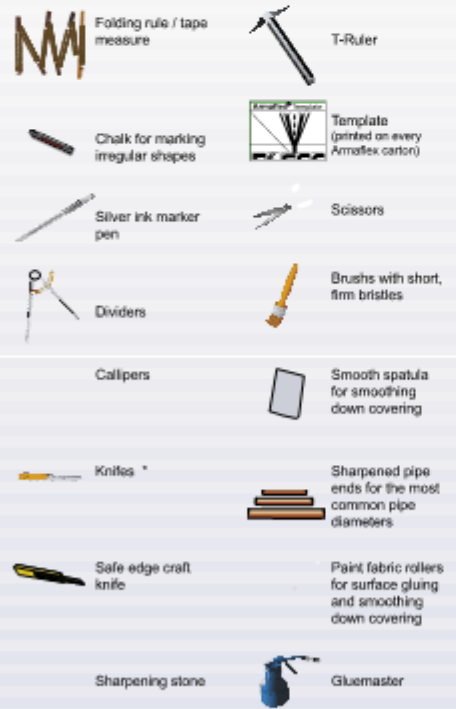
### 2.1 *Accurate Marking out of Insulation Materials*

For this example Armaflex insulation will be used for demonstration purposes. We have taken a large excerpt from the manufacturers' catalogue to demonstrate the level of information available and the correct application methods. It is worth noting that the application methods used in this example can also be used for other rigid and semi-rigid products, however it is important that you refer to the relevant manufacturers' catalogues for installation instructions.

**WORKING WITH ARMAFLEX**

- Use good quality tools, in particular a sharp knife, fresh Armaflex adhesive and a good brush.
- Oval tubes should always be split on the flat side.
- Use clean Armaflex material – with no dust, dirt, oil or water on the surface, if present clean with Armaflex cleaner.
- Use the right dimensions! Never pull glued joints when sealing them, always push them together.
- Never insulate plants and systems that are in operation! Only start insulated plants after 36 hours - after this time the adhesive is fully cured.
- **Armafinish FR paint** can be applied immediately after the insulation has been installed, with a second coat of paint applied within 3 days, to provide UV protection (see page 5).

**TOOLS FOR INSTALLING ARMAFLEX**



\* A three knife set plus sharpening stone are available together as a tool kit

**THE CORRECT USE OF ARMAFLEX ADHESIVE**

**Armaflex Adhesive 520**

Armaflex Adhesive 520 has been specially developed to bond Armaflex. It joins the surfaces reliably and safely at medium temperatures of up to +105°C. The bond is resistant to weathering and aging.

**Armaflex Adhesive HT625**

Armaflex Adhesive HT625 has been specially developed to bond HT Armaflex insulation for medium temperatures of up to +150°C\*. When using HT Armaflex only Armaflex Adhesive HT625 should be used.

\* For temperatures below -50°C or above +150°C, please consult our Customer Services Department.

**PREPARING FOR WORK**

Check condition of Armaflex Adhesive. Cans of Armaflex Adhesive should have been stored in a cool environment wherever possible. Cans must also have been kept free from frost.

Damage due to frost can be reversed by storing in warm conditions, or for immediate use by placing the can into a bucket of hot water. Shelf life approx. 1 year.

1. Where installation surfaces are soiled with dust, dirt, oil or water all of these contaminants must be removed and, where applicable, cleaned with Armaflex cleaner before starting work. In addition all surfaces to be joined must be dry before gluing begins.
2. Pay close attention to the installation instructions on the adhesive can. Use small cans during work so that the adhesive does not thicken too quickly. Refill from larger cans when necessary and keep closed when not in use to avoid thickening
3. Plants must not be in operation during the installation process!
4. Do not use adhesive under 0°C. If the adhesive is too cold it can be warmed in a bucket of hot water. At temperatures below 5°C, condensation can appear on the surfaces to be glued or the adhesive film. If this occurs the materials can be glued only with difficulty.  
Check whether this has happened by applying absorbent paper. When working in areas with a high atmospheric humidity and high temperatures see "Hot Climates" page 33 of this manual.
5. Stir adhesive well after opening. If left to stand, heavier components in the adhesive may settle in the bottom of the can. These must be mixed thoroughly before use in order to effectively activate the adhesive.

### STEEL PIPES

Check that the adhesive will adhere to any rust-inhibiting primer that has been used to protect steel pipes. Armaflex adhesive may not adhere to asphalt, bitumen, red-lead or cement surfaces.

### APPLICATION

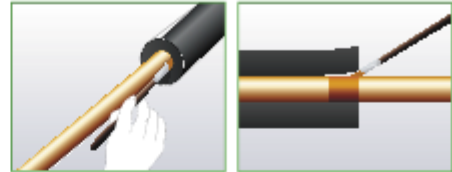
1. Use a brush with short, stiff bristles and keep clean. For larger areas a spatula or (non foam type) paint roller or the Armaflex Gluemaster may be used to speed up application.
2. Apply Armaflex adhesive thinly and evenly onto both surfaces to be glued.
3. When adhering Armaflex to other materials (e.g. metal), first apply the adhesive to the Armaflex and then to the other clean surface.
4. The tack time for Armaflex adhesives ranges between 3 and 10 min.<sup>(1)</sup> The time will vary according to the grade, ambient temperature and relative humidity. Avoid 'open times'<sup>(2)</sup> in excess of 20 min.
 

(1) Tack time for NH/Armaflex varies - please see special application advice for NH/Armaflex - available from [www.armacell.com/uk](http://www.armacell.com/uk).

(2) The 'open time' is defined as the period between - first applying adhesive and finally closing together the joint, seams or surfaces.
5. Allow the adhesive to 'lack-dry'. The correct initial drying time may be determined by the 'fingernail-test': touch the surface with a fingernail, if the fingernail does not adhere to the surface and the surface itself does not feel tacky the joint may be closed. The maximum adhesive force will be obtained when two tack dry surfaces are brought together.
6. The glued surfaces should be pressed together, do not stretch. Do not leave glued seams on the top of the insulation in external locations. When working outdoors, always turn the glued seams away from the sun.
7. When gluing joints under compression, with no gaps present, the wet adhesive method should be applied. Pull the seam apart slightly and apply Armaflex adhesive thinly and evenly with the brush to both surfaces and press together. No open time is needed in this case.
8. Use Armaflex cleaner to clean your tools, contaminated metal surfaces and surfaces which have had talc applied.
9. Curing time for Adhesive 520 / 625: 36 hours.

**Note:** Do not mix Armaflex cleaner with Armaflex adhesive to thin it out - warm it.

### WET SEALING OF BUTT JOINTS



1. On all cold lines and all piping equipment in a external location, fix and secure down to the piping surface, Armaflex tube/sheet ends with Armaflex adhesive.
2. The adhesive bonding will equal the insulation thickness as a minimum.



3. For the final wet sealing of the tube/sheet, pull the compressed butt joint apart with the finger and apply a thin even film of adhesive to the two butt joint edges with a small brush.
4. Apply firm and even pressure to the glued joint using the fingers and thumbs to finish.

**Note:** In addition all other types of Hot piping lines located externally, it is highly recommended to follow the same procedures as with cold lines.

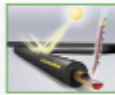
**OUTDOOR USE OF AMRAFLEX**

Whenever used externally Armaflex (with the exception of HT Armaflex) must be either painted, covered or clad.



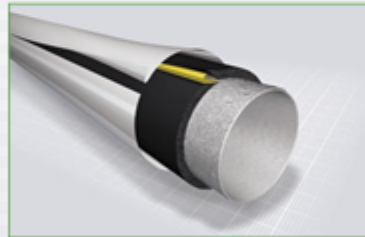
**Armafinish FR** paint will provide UV protection and can be applied immediately after the insulation has been installed, with a second coat of paint applied within 3 days.

	Normal consumption			
	l / m <sup>2</sup>	m <sup>2</sup> / l	wet film mm	dry film mm
1st coat	0.275	3.6	0.275	0.13
2nd coat	0.275	3.6	0.275	0.13
Total	0.550	1.8	0.550	0.26



The UV-resistant **HT/Armaflex** can be used for outdoor applications without any additional UV-protection

If additional mechanical protection or protection against severe weather conditions is required **Arma-Chek covering systems** offer a non-metallic cladding option. For installation details please see the Arma-Chek installation manual.



**ADVICE FOR INSULATING REFRIGERATION AND A/C EQUIPMENT**

- Attach each end of the Armaflex tube to the pipe with Armaflex adhesive, and make sure the adhesive joints are firm at critical points such as flanges, T-sections, elbows, supports, etc.
- All connected items of equipment shall be insulated with equal thickness where practical.
- Never insulate chilled water lines or refrigeration equipment if the sections to be insulated are too close together. An air gap of at least 25mm should be present between the chilled water line insulated surfaces to prevent sweating.



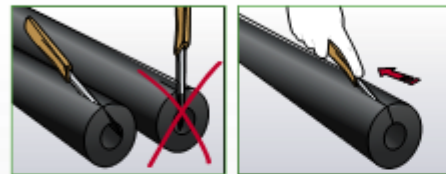
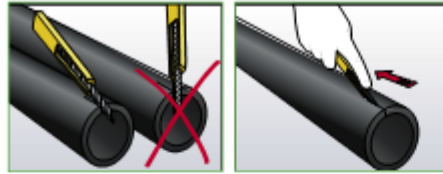
- Provide effective protection against corrosion on surface of steel pipes and vessels. Armaflex should not contribute to corrosion however, due to the presence of chloride ions in the normal building environment, it remains best practice to pre-coat the steel surface to be insulated using either aluminium foil or special paints before applying the Armaflex.

**INSULATING STAINLESS STEEL PIPES**

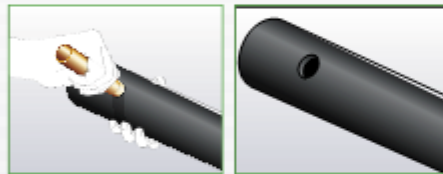
BS 5970 gives a number of specific recommendations when insulating stainless steel pipes. These installation practices greatly reduce the risk of stress corrosion cracking. All Armacell recommendations for installation on stainless steel pipework are intended to be in compliance with the procedure laid out in BS 5970.

For further information relating to the insulation of stainless steel pipes using Armaflex please see the Keytec detailed in the other references section of this application manual.

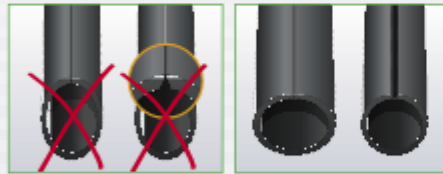
**CUTTING ARMAFLEX TUBES**



Use a sharp knife. Keep knife at a low angle when slitting tube



Use sharpened off-cuts of pipes to make holes.



Always cut on the flat sides of tubes.

**INSULATING NEW PIPEWORK WITH SLEEVE-ON-TECHNIQUE**

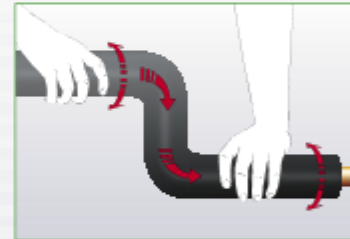
In principle, tube material can simply be slid round bends.

However, with tight bends (such as those likely to be encountered on small bore pipes) there is a risk that the insulation will kink in the throat of the bend, reducing insulation thickness.

In the refrigeration/air-conditioning sector the calculated insulation thickness is then no longer achieved and condensation can occur on the surface of the insulation. When installing tubes with a self-adhesive seal there is the additional risk of compression of the adhesive lining in the bend area, which can lead to seams coming apart.

The following should be taken into account in these cases:

If the insulation kinks and the adhesive seam is compressed the bends should be cut into segments to fit (see page 11).



**Note:** Do not attempt to pull the Armaflex tube along the pipe as this may cause the insulation to tear.



Always push the Armaflex tube over the pipe as shown.

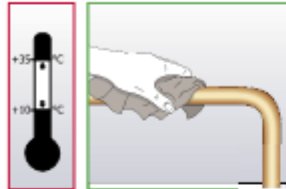
**INSULATING EXISTING PIPEWORK WITH  
SNAP-ON-TECHNIQUE**


1. With a sharp knife, slit the flat part of the unslit tube along the entire length.
2. Place the slit tube onto the clean pipe; apply Armaflex adhesive to the two cut edges with a thin even film of adhesive using a short bristle brush. Apply the adhesive at 200mm intervals, along the tube length.

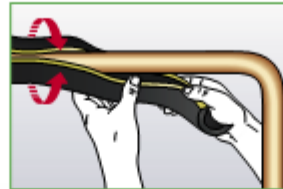


3. Allow the adhesive to touch dry, test with the fingernail.
4. Free the seams from the pipe where applicable, line the edges together and press the seam detail with firm even pressure to finish.

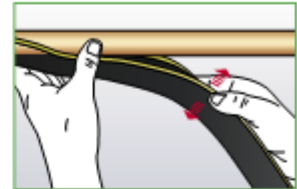
**INSULATING PIPES WITH ARMAFLEX SELFSEAL TUBES**



Clean all dust, dirt, oil and water from pipework using Armaflex cleaner where necessary. Install Armaflex when ambient temperature is between +10 and +35°C.



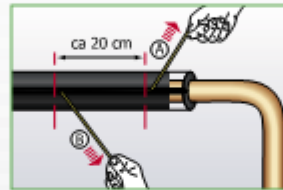
Open pre-slit Armaflex and snap onto pipe (the release paper is still protecting the self-adhesive strip)



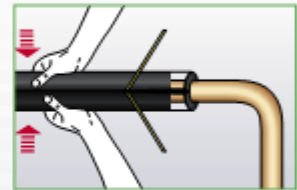
Adjust fitted Armaflex to ensure slit is easily accessible.



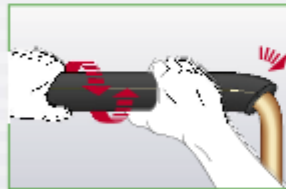
Locate the end of yellow release paper for the self-seal strip.



Remove the yellow protection paper strip on both sides, by drawing it away from the insulation. Please note: remove protective release paper strip from both sides!



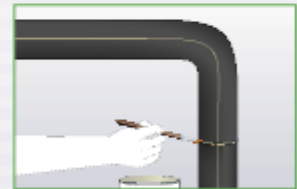
Close the slit seam and squeeze together with firm pressure, to ensure a permanent seal.



Push the Armaflex along the pipe using a circular motion. **Do not pull the insulation.**



Using a circular motion, push the Armaflex around bends. **Do not pull the insulation.**



Seal all joints with Armaflex Adhesive. **Do not stretch when sealing joints.**

**Note:** In principle, tube material can simply be slid over bends. However, with tight bends in pipes (small radius) there is a risk that the insulation will kink in the throat of the bend, reducing insulation thickness. In the refrigeration/air-conditioning sector the calculated insulation thickness is then no longer achieved and condensation can occur on the surface of the insulation. When installing Armaflex SelfSeal tubes there is the additional risk of compression of the adhesive lining in the bend area, which can lead to seams coming apart. The following should be taken into account in these cases: If the insulation kinks and the adhesive seam is compressed the bends should be cut into segments to fit (see page 11).

**MULTI-LAYER INSULATION OF PIPEWORK**

**Staggering on pipe-work: cross section view**



The inside diameter of the second oversize tube (where applicable) should be selected according to the maximum outside diameter of the first layer.

**Staggering on pipe-work: longitudinal view**



Yellow lines indicate glued seams

**Important:** Stagger all joints and seams

If the outer diameter of the first insulating layer is above 114mm, we recommend that the second layer be made with sheet, since this can be adapted exactly to the outside diameter of the first layer.

The ends of the tube or sheet of the second layer should be glued to the under layer of Armaflex.

**Note:** For pipework >500 mm O.D. please see page 15 "Armaflex Adhesive and its use on large bore pipework" of this manual.

**Multi-layer insulation for pipework > 500 mm O.D.**

- In the case of double-layer insulation the first and second layers should be glued over the entire surface. DO NOT apply only spots or strips of adhesive.
- The butt and longitudinal seams of the second layer must always be positioned offset to the first layer. The Armaflex surfaces of the first layer should be clean, dry and free from contamination. Armaflex cleaner can be used when oil or grease are present

**Caution:** Ensure that the underlying glued seams have cured for 36 hours, before using the Armaflex cleaner.



Yellow lines indicate glued seams

**Multi-layer insulation for flat surface**

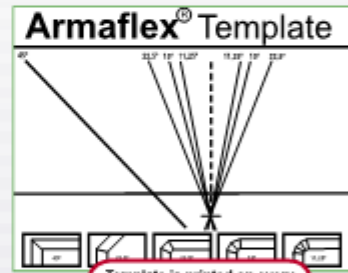
- In the case of single and multi-layering applications adhesive is applied with all-over adhesive coverage to all contacting surfaces. DO NOT apply only spots or strips of adhesive.

**USING THE ARMAFLEX TEMPLATE**

The fabrication of bends and tees using Armaflex tube requires tubes to be cut to different angles. In order to make this process easier and quicker, the Armaflex template is provided on every box of Armaflex.

1. Place a copy of the Armaflex template face up on a table or worktop.
2. Line a tube of Armaflex across the template parallel along the horizontal base line.
3. Select the required angle cut from the template and cut along this line.

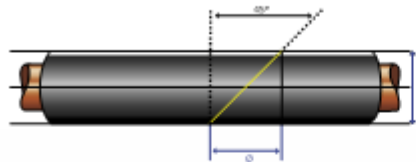
Additional copies of the Armaflex template on hard PVC sheet are available on request (contact your local Armacell representative for more information).







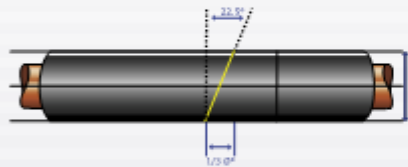
**BEND WITH 90° ANGLE USING ARMAFLEX TUBE**



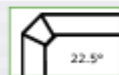
**Note:** Yellow lines indicate where cuts are to be made. For correct angle measurements please use the Armaflex template located on each tube box.



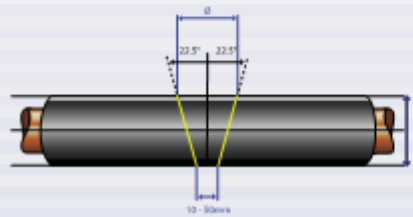
**BEND WITH 45° ANGLE USING ARMAFLEX TUBE**



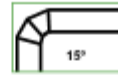
\* The Ø details to achieve the 45° angle are approximate values!  
**Note:** Yellow lines indicate where cuts are to be made. For correct angle measurements please use the Armaflex template located on each tube box.



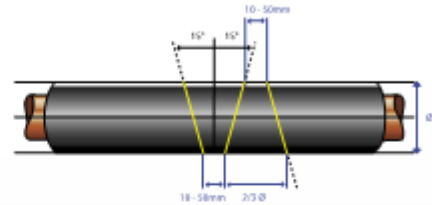
**SEGMENT BEND WITH 1 MIDDLE PART - 2+1 USING ARMAFLEX TUBE**



**Note:** Yellow lines indicate where cuts are to be made. For correct angle measurements please use the Armaflex template located on each tube box.



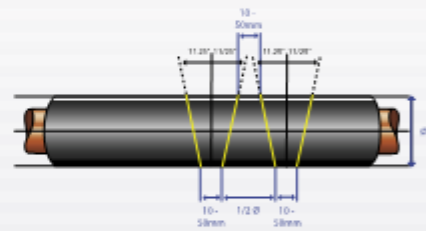
**SEGMENT BEND WITH 2 MIDDLE PARTS - 2+2 USING ARMAFLEX TUBE**



**Note:** Yellow lines indicate where cuts are to be made. For correct angle measurements please use the Armaflex template located on each tube box.



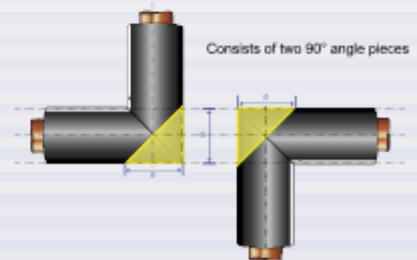
**SEGMENT BEND WITH 3 MIDDLE PARTS - 2+3 USING ARMAFLEX TUBE**



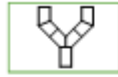
**Note:** Yellow lines indicate where cuts are to be made. For correct angle measurements please use the Armaflex template located on each tube box.



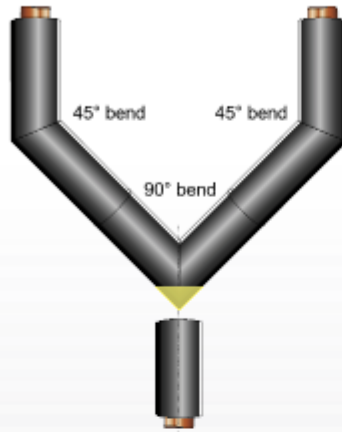
**CROSSPIECE JOINT USING ARMAFLEX TUBE**



**Note:** Yellow lines indicate where cuts are to be made. For correct angle measurements please use the Armaflex template located on each tube box.

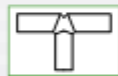


**Y-TUBE USING ARMAFLEX TUBE**

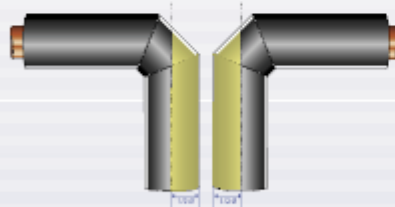


**Note:** Yellow lines indicate where cuts are to be made. For correct angle measurements please use the Armaflex template located on each tube box.

Further fabrication of the 45° bend (2 times) and the 90° bend (once).



**SWEPT T-PIECE USING ARMAFLEX TUBE**

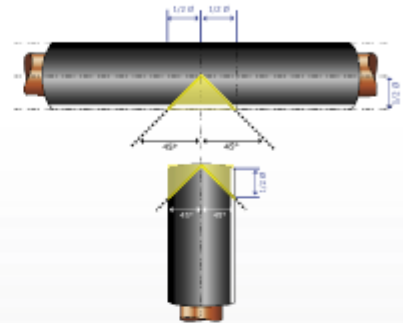


**Note:** Yellow lines indicate where cuts are to be made. For correct angle measurements please use the Armaflex template located on each tube box.



**T-PIECE USING ARMAFLEX TUBE**

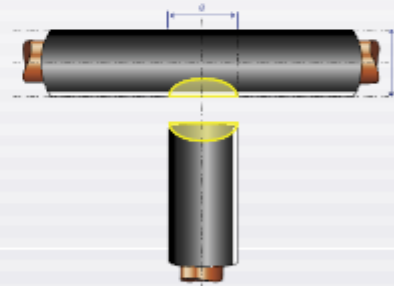
**Method 1 - The "Mitre Block" T Piece**



**Note:** Yellow lines indicate where cuts are to be made. For correct angle measurements please use the Armaflex template located on each tube box.

1. Join pre-cuts parts with adhesive to form a "T"
2. Slit open the "T", it can then be slid over the pipes

**Method 2 - The "Punched Hole" T Piece**



**Note:** Yellow lines indicate where cuts are to be made.

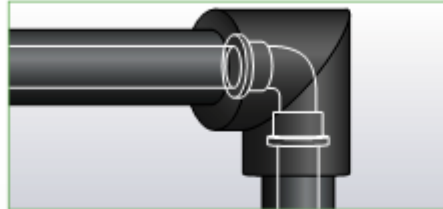
1. Punch a hole in the tube - with a sharpened section of a copper pipe of the right diameter - forming the crossbar of the "T"

**Note:** For larger hole cut-outs use a pair of dividers to "mark out" and cut using a small sharp knife.

2. Slit this section of the tube open (half through the hole) and slid it over the pipe
3. Cut a semi-circular recess in the end of the branch section of tube. It is better to have a cut which is a little to deep rather than to shallow.
4. Attach the branch section to the pipe and join the two halves of the "T". Adhere all seams with Armaflex adhesive

**INSULATING COUPLING PIPE JOINTS**

**Method 1: Oversized 90° bend**



The fitting cover is made from tube, the bore of which is the O.D. of the incoming tube. Provide a minimum 25 mm overlap at each side. The fitting may be made up using any of the methods described on page 11. Slit in the throat, apply adhesive to seams, fit when tack dry. Wet seal both over-lapping contact surfaces.

1. Push the Armaflex tube as far as the pipe fitting.  
For chilled water and refrigeration pipework secure the bore of the tube to the pipe with adhesive. The adhesive band to be the same width as the insulation thickness.
2. The fitting cover is made from tube the bore of which is the O.D. of the incoming tube. Provide a minimum 25 mm overlap at each side. The fitting may be made up using any of the methods described on pages 11. Slit in the throat, apply adhesive to seams, fit when tack dry. Wet seal both over-lapping contact surfaces

**Method 2: Smooth finish 90° bend**



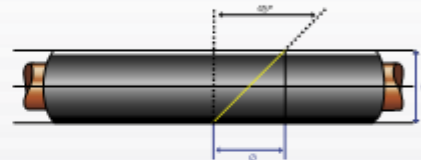
1. The fitting cover is made from tube material, the bore of which corresponds to the maximum outside diameter of the screwed fitting. Provide at least a 38mm overlap beyond the end of the fitting on each side.
2. For pipes up to 35mm, cut two wedge-shaped pieces at 180° to each other, from top and bottom centres, at each end of the fitting. For large bore

tubes cut four wedges, one at each 90° around the circumference.

The wedges should taper back to the points where the fitting would start and be sized so that the bore of the Armaflex reduces to the O.D. of the incoming pipe. Glue the seams on the reducing sections.

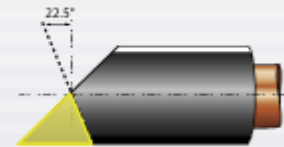
3. Slit in the throat, apply adhesive, allow to tack dry, then fit. To complete, wet seal butt joints with Armaflex adhesive.

**ANGLE T-PIECE (OFF-SET) USING ARMAFLEX TUBE**



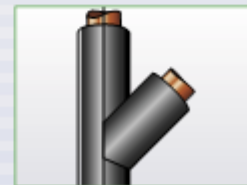
**Note:** Yellow lines indicate where cuts are to be made. For correct angle measurements please use the Armaflex template located on each tube box.

1. Make a 45° cut as shown above

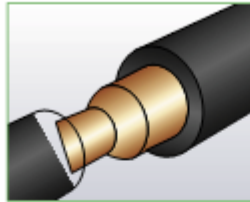


**Note:** Yellow lines indicate where cuts are to be made. For correct angle measurements please use the Armaflex template located on each tube box.

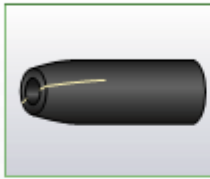
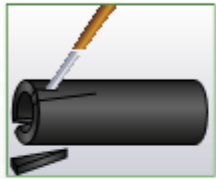
2. Use the piece of the tube with the 45° and mark a 22.5° angle and cut off as displayed above.
3. Chamfer the inside of the tube where it touches the insulation around the straight pipe
4. Wet seal all seams.



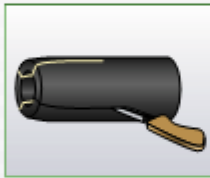
**PIPE REDUCER USING ARMAFLEX TUBE**



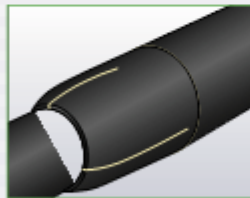
Pipe reducer to be insulated



Cut out segments and glue seams with Armaflex adhesive



Cut reducer to size - allow compression of 5mm at each end. Slit fitting on the flat side



Install and glue seam and butt joints

**INSULATING PIPES WITH ARMAFLEX SHEET**

Armaflex tubes are available for pipe with outer diameters up to 114mm. Larger pipes, ducts and tanks must be insulated using Armaflex sheet.

It is often advantageous to insulate smaller pipes using Armaflex sheet, even when correctly dimensioned tubes are available. Care should be taken to ensure that the stresses in the seams, caused by the bending in the sheet, do not become too great.

These stresses rise as the insulation thickness increases and as the pipe diameter decreases. Please consult the table below to gauge the applicability of different thicknesses of Armaflex sheet (recommendations may vary for HT/Armaflex and NH/Armaflex).

The ambient temperature during installation will also impact on the levels of stress likely to be encountered.

For advice on installation Armaflex sheet in ambient temperatures  $\geq 5^{\circ}\text{C}$  please see table below.

Sheet Thickness	Pipe Outer Diameter / mm			
	$\geq 88.9$	$\geq 114$	$\geq 139$	$\geq 406$
9 mm	•	•	•	•
13 mm	•	•	•	•
19 mm	•	•	•	•
25 mm		•	•	•
32 mm			•	•
50 mm				•

(Recommendations may vary for HT/Armaflex and NH/Armaflex, please see special application advice - available on [www.armacell.com/uk](http://www.armacell.com/uk))

**ARMAFLEX ADHESIVE AND ITS USE ON PIPEWORK > 88.9 MM O.D.**

Armaflex adhesive must be applied to all seams and joints on tube and sheet fabrications up to 500 mm O.D pipe size, at each tube and sheet end Armaflex shall be adhered to the pipe.

In addition

- when insulating horizontal pipework with an O.D. > 500 mm adhesive should also be applied to  $\frac{1}{4}$  of the pipe surface and the facing Armaflex sheet surface in order to prevent "bellowing". The picture below illustrates the area which should be covered using adhesive.

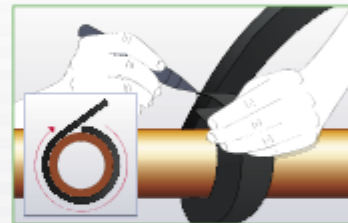


- When insulating vertical pipework, all-over adhesive coverage must be applied to both to the pipework and the facing Armaflex sheet regardless of pipe outer diameter.

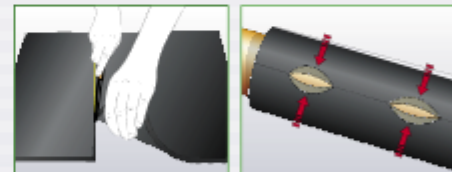


For temperatures lower than  $-50^{\circ}\text{C}$  please refer to special application advice "Insulating low temperature lines"

**INSULATING LARGE PIPES WITH ARMAFLEX SHEET**

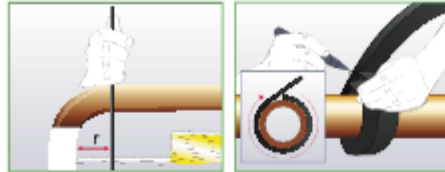


1. Determine the circumference of the pipe.  
**Important:** Always measure with a strip of Armaflex of the thickness to be used for the insulation.  
**Warning:** Do not stretch the strip.



2. Cut Armaflex sheet to the required size - apply Armaflex adhesive to the cut surfaces in a thin layer, allow to touch dry.
3. Press together at the ends and then in the middle. Close the entire seam starting from the middle.  
**Note:** In order to prevent the seam re-opening ensure the adhesive has been fully applied to the edges of the fixing seam and ensure the correct amount of adhesive has been applied.  
Check the open time of adhesive to ensure it is still fit for use.

**TWO-PART-BEND WITH ARMAFLEX SHEET**

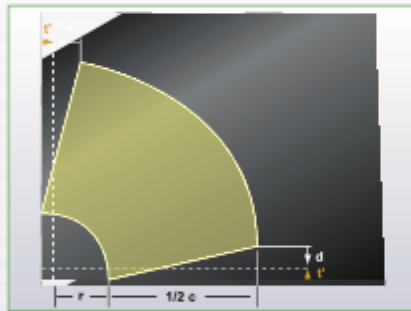


Establish the inside radius, *r*, by dropping a perpendicular line to meet a horizontal line from the outside of the two welds. The point where these two lines intersect gives the origin for the radius, *r*. This is the throat radius.

Measure in a trimming allowance equal to the thickness of insulation being used along both vertical and horizontal edges then transfer *r* to the sheet as indicated.

Determine the circumference of the pipe using a strip of Armaflex of the thickness to be installed.

**Note:** Do not stretch



Halve the pipe circumference and transfer this dimension to the Armaflex sheet.

Mark out the two arcs from the intersection of the trim lines.

- r* = inside radius of bend
- $\frac{1}{2} c$  = half of pipe circumference
- t* = insulation thickness (in mm)
- d* = 1/4 pipe diameter



Cut out the first half-section of the elbow.

Use the first half-section as a template to cut out the second half-section of the elbow.



Place the sections together with the rough surfaces inwards. Apply Armaflex adhesive to the outer edges.

Allow the adhesive to tack dry (fingernail test) then press the two sections together at one side to make a short seam.



Next, press the opposite sides together, also making a short seam. Repeat alternately closing 50-75mm at a time on each side, working towards the centre.

Press the remainder of the joint firmly together.



Turn the assembly over and press the seam firmly together from the inside, so that a good adhesive joint is achieved across the entire wall thickness.

Apply Armaflex adhesive to the inner joint edges.

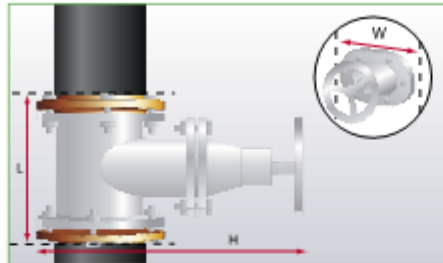


Place the insulation cover over the pipe bend. Allow the adhesive to tack dry then press the joint faces firmly together.

Wet seal jointing details with adhesive, fitted under slight compression, to complete the bend.

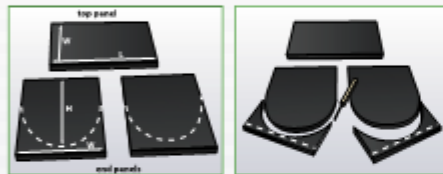
**INSULATING VALVES WITH D-BOX MADE OF ARMAFLEX SHEET**

Recommended method

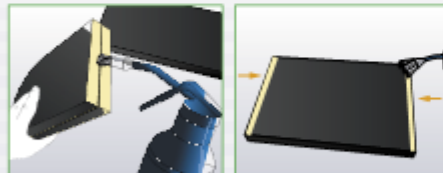


Establish the following measurements:

- L = length of valve + 2 x thickness of insulation
- H = height of valve + 2 x thickness of insulation
- W = Ø (diameter) + 10mm



Mark out and fabricate 2x end panels and 1x top panel using the measurements made in the previous step. Cut cleanly using a small sharp knife.



Apply Armaflex adhesive along the edges as indicated. **Note:** The glue line must be as wide as the thickness of the Armaflex in use.



Glue the top edges of the end panels and the top panel edge. Fix down the end panels to the top panel making sure the edge's are in-line



Use a strip of Armaflex (used thickness) to determine the circumference around one end panel (including the top panel).

Mark measurement L and circumference out and cut the body panel to size. Apply Armaflex Adhesive to the body panel end and the body panel edges as shown.



Gently roll the body panel edges around the end panels until the cover panel resembles a box.

Fix down the square 90° edge as shown. Ensure the edge is in-line and neat. Continue to fix all edges in this way.



Cut holes for the insulated piping connections on each of the end panels and a final cut-out for the valve spindle connection at the top.

Split the box into two halves and fit around the valve.

If required the fitting cover can be slit through three quarters of the way round the fabrication cover and snapped over the fitting - with adhesive applied to all fixing seam details as stated.

To finish, apply Armaflex adhesive to the fixing seams, allow to touch dry and fix the seams together.

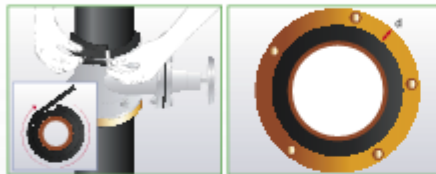
Vapour seal the connections (joints) to the linear insulated pipes using Armaflex adhesive.

**Note:** For external installations, weather-seal around the valve spindle connection cut using Arma-Chek black mastic.

**VALVE INSULATION WITH ARMAFLEX SHEET**

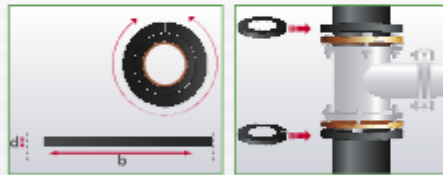
**Traditional method**

Small bore heating and plumbing valves or stopcocks may be insulated using oversized tube sections. The following section gives the general techniques for insulating larger valves and gate valves. It is recommended that the valve body is packed with strips of Armaflex insulation stuck onto the valve body with Armaflex adhesive.

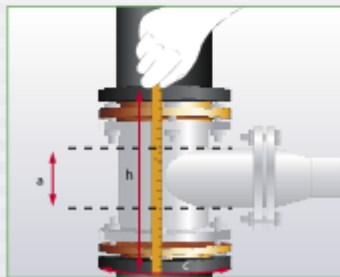


Insulate the pipe as far as the flange. Where applicable, allow for bolt removal.

Determine the  
 b = circumference of insulated pipe  
 d = depth of flange ring

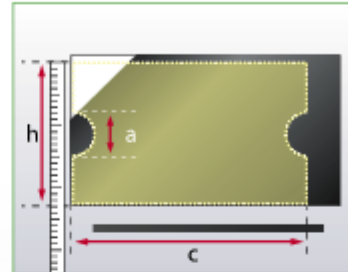


Mark out and cut a strip. Adhere both ends and apply around the flange ring (skin side of Armaflex should face top).

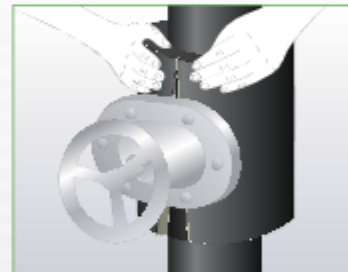


Measure  
 h = height between the outer faces of the two rings.  
 a = diameter of spindle neck  
 c = circumference of the rings

**Important:** Always measure with a strip of Armaflex of the thickness to be used for the insulation. Do not stretch the strip.



Transfer height (h), circumference (c) and diameter of spindle neck (a) to the Armaflex sheet and mark on the cut outs for the spindle neck.



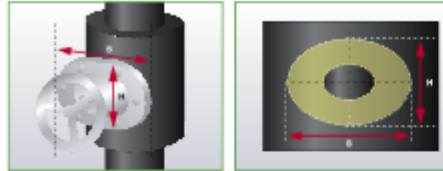
Apply a thin coat of Armaflex adhesive to all fixing seams of the valve cover.

Allow to tack dry (fingernail test), fit, then press together firmly.

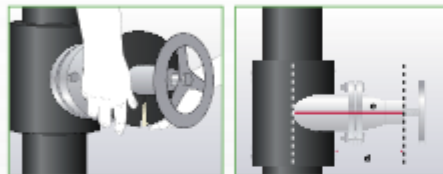
**Note:** The valve body should always be insulated after the insulated pipe has been completed.



**NECK-T / PIPE-T / SPINDLE NECK OF VALVE INSULATION WITH ARMAFLEX SHEET**



Measure the height of the spindle housing flange and its width, and make up an end disc.



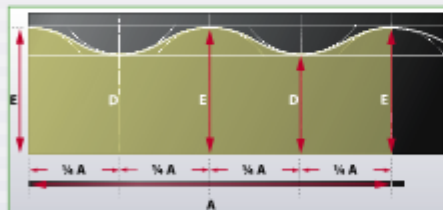
Cut the disc through at one side, apply adhesive to the cut edges, allow to tack dry.

Join the end disc after placing it over the spindle neck.

**Measure**

- A = circumference of the end disc
- d = minimum depths of spindle housing
- e = minimum depths of spindle housing

**Important:** Always measure with a strip of Armaflex of the thickness to be used for the insulation. Do not stretch the strip.

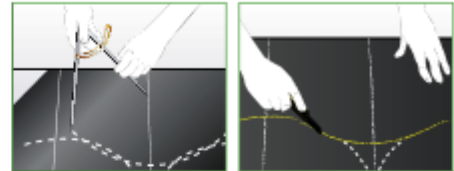


Mark off the circumference (A) into 4 equal sections.

**Transfer these heights**

- D = d + thickness of insulation
- E = e + thickness of insulation

to the Armaflex sheet.



Using the difference between the two heights as a radius, mark out 5 arcs round the intersections of the lines, and join the arcs with a continuous line.

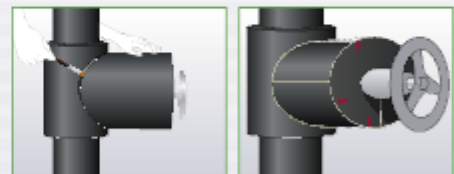
Cut out the shaped section of sheet.



Chamfer away the inside surface at the highest point (where the sheet rests against the side of the valve body).

Apply adhesive to the longitudinal seam, allow to tack dry, then seal round the spindle housing.

**Note:** In external locations, to provide additional protection against water entry, Arma-Chek Mastic Black can be applied around the spindle neck tee covers termination point.

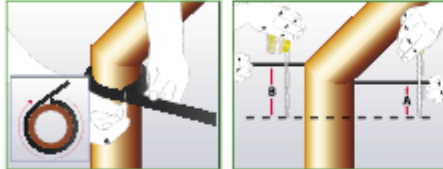


Apply adhesive using the wet seal method to all seams. The valve insulation is now complete.

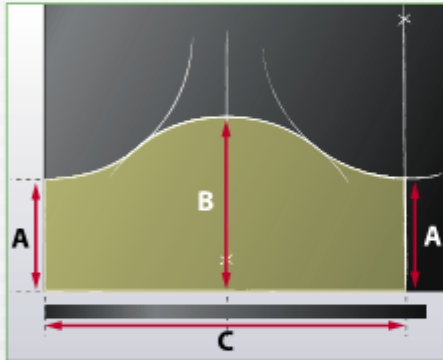
**Note:** D-Boxes, using Armaflex sheet, can also be used to insulate valves.

**OFFSET ANGLE & PIPEWORK BEND ANGLE JOINTS**

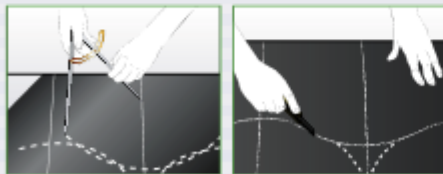
The following illustrations show the various stages of work when insulating a mitre angle or bevel joint in a pipe. The procedure when insulating a right angle pipe joint is effectively the same.



Determine the circumference of the pipe (c).  
**Important:** Always measure with a strip of Armaflex of the thickness to be used for the insulation. Do not stretch the strip.  
 Measure the outer height (B) and the inner height (A) of the mitre joint.



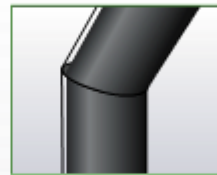
Transfer the circumference to the Armaflex sheet and mark in the centre line.  
 Transfer the outer and inner height to the Armaflex sheet.



Measure the half-circumference using dividers and mark out 3 arcs.  
 Join the arcs with a continuous line.  
 Cut along the line. When repositioned by 180°, the upper and lower sections produce...  
 ...the two parts of the mitre joint.



Apply Armaflex adhesive to the longitudinal seam, then to the connecting seam.



The insulation is now complete.

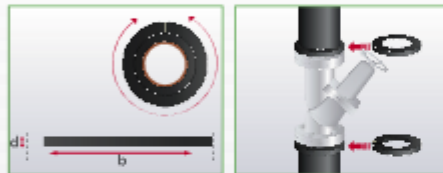
**STRAINERS, STRAINER VALVES & INCLINED SEAT VALVES**

The work involved in insulating a strainer valve or an inclined seat valve is similar (some measurements need to be extended) except that an end disc may be required.



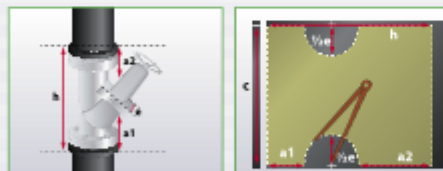
Insulate the pipe as far as the flange.

Determine the  
 b = circumference of insulated pipe  
 d = depth of flange ring



Mark out and cut strip. Adhere both ends and apply around the flange ring (skin side of Armaflex should face top).

**Note:** It is often desirable to apply strips of Armaflex directly to the strainer at this point. Packing out in this way can add additional strength to the fitting cover and can reduce the impact of shrinkage at low temperatures.



h = Measure the distance over the outer faces of the two Armaflex rings you have positioned next to the flanges.

a1 = Measure the distance from the strainer to the outer face of the lower ring

a2 = Measure the distance between the strainer and the outer face of the upper ring

e = depth of strainer

c = Circumference of the rings.

**Important:** Always measure with a strip of Armaflex of the thickness to be used for the insulation.

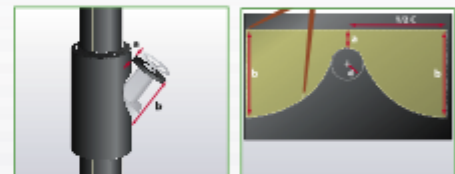
**Warning:** Do not stretch the strip.

Transfer these measurements to the Armaflex sheet and mark the cut-out required for the strainer.



Cut the sheet and attach the insulation to the strainer body using Armaflex Adhesive.

Cut a ring of Armaflex with inner diameter equal to the outer diameter of the insulated offset part of the strainer. Attach this ring at the end of the insulated section as shown using Armaflex Adhesive.



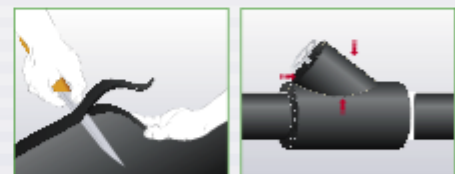
Determine the

a = shortest distance from the ring of Armaflex to the insulation around the strainer body.

b = longest distance from the ring of Armaflex to the insulation around the strainer body.

d = 1/4 diameter of the insulated valve body

Using the circumference of the offset section of the strainer prepare a sheet of Armaflex.

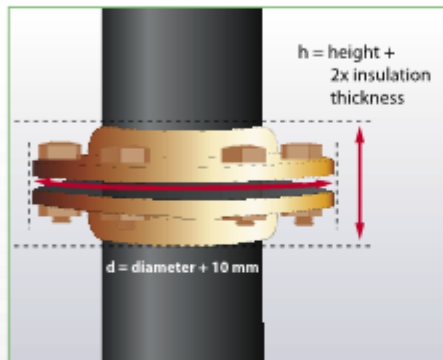


Cut the remaining section of sheet

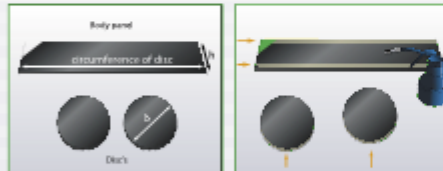
Chamfer the sheet away where it is to touch the insulation around the strainer body.

**FLANGE BOXES**

The following section gives the installation techniques for insulating flanges. On chilled water or refrigeration applications it is advisable to pack the gaps between the nuts with strips of Armaflex insulation.



Using a pair of callipers, determine the diameter of the flange face. Please add 10mm to this measurement. Measure the length of the flange (incl. Bolts) and add 2x the insulation thickness of the used sheet. Where applicable allow for bolt removal.



Transfer these measurements to a piece of Armaflex sheet. Mark out two concentric circles with dividers. Repeat on a second piece of sheet. Cut out two Armaflex rings.

Determine the circumference of the disc.



Roll the body panel up and round the the end disc's, do not stretch during application. Check alignment throughout. Place the edge to the a joining seam's edge opposite.



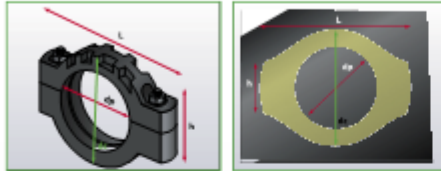
Using a small sharp knife cut out for the insulated pipe diameter.

To finish fit the two half's of the flange box around the flange and wet seal all seams and joints to the insulated pipe branch.

If required the fitting cover can be snapped over the fitting, by only cutting the insulation cover half way through.

**VICTAULIC COUPLINGS**

1. Insulate pipes up to the coupling.



2. Determine  
 $dc$  = diameter of coupling + 2 x insulation thickness  
 $h$  = height of screws + 2 x insulation thickness  
 $L$  = length of coupling
3. Using  $\frac{1}{2}$  of  $dc$  (diameter coupling + 2 x insulation thickness) as a radius transfer a circular arc to the Armaflex sheet and mark a horizontal centre line.
4. From the centre of the line mark the width of the coupling.
5. At both ends mark out the height of the screws plus 2x insulation thickness at a 90° angle to the centre line.
6. Connect the four endpoints and the circular arc with a tangent so that a oval like disc is built.
7. Determine the diameter of the insulated pipe and mark it on the Armaflex sheet.
8. Cut out this disc and use as a template to create a second identical disc.



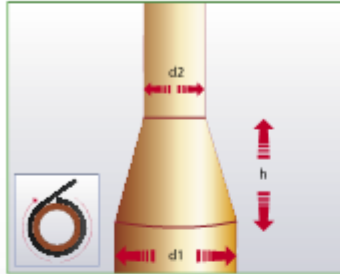
9. Adhere both discs immediately next to the coupling as shown.
10. Determine the circumference of the disc and measure the distance over the outer faces of the two disc's.  
  
Transfer these measurements to a sheet of Armaflex.

**Important:** Always measure with a strip of Armaflex of the thickness to be used for the insulation. Do not stretch the strip.

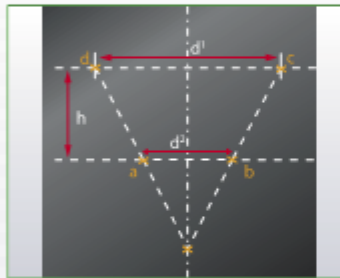


11. Cut this section and adhere over the Armaflex discs around the coupling.

**CONCENTRIC REDUCERS**

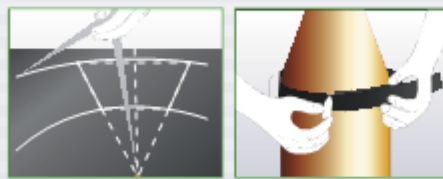


Determine the following measurements  
 $h$  = height of the reducer, incl. both welds  
 $d1$  = diameter of larger pipe + 2 x insulation thickness  
 $d2$  = diameter of smaller pipe + 2 x insulation thickness



Mark out the Armaflex sheet with a centre line .  
 $d1$  and  $d2$  are marked off at each end, as shown, to give points  $a, b, c$  and  $d$  (yellow markings show meeting points).

Distance between the lines  $d1$  and  $d2$  is height  $h$ .  
 Extend the lines  $d-a$  and  $c-b$  to meet at the apex point which is on the extension of the centre line.

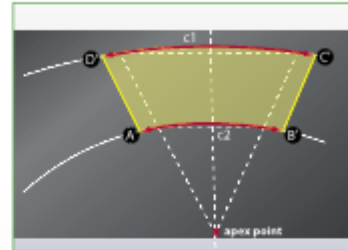


From the apex point strike two arches through  $a-b$  and  $d-c$ .

Determine the circumference of the  $c1$  (large pipe) and  $c2$  (small pipe) .

**Important:** Always measure with a strip of Armaflex of the thickness to be used for the insulation.

**Warning:** Do not stretch the strip.



Transfer the two circumferences by using the two strips used to measure the circumferences and mark the final dimension of the insulation of the reducer.

Cut out the reducer piece with a sharp knife (yellow area indicates the cutting lines)



Apply a thin coat of adhesive to the edges to be joined, allow to tack dry. Press together firmly at one end, then at the other end and complete the joint.

Complete insulation by insulating the pipes on either side of the reducer and wet seal both butt joints.

**INSULATING PIPE SUPPORTS**

Where Armaflex is installed, the use of Armafix or Armaload pipe supports are the preferred solution for the prevention of ice and condensation on cold installations. However, when Armafix pipe supports are not selected, the following instructions are imperative:

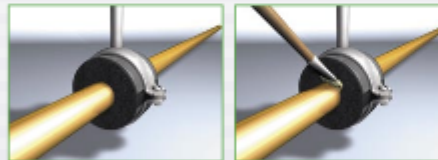
- Ensure that the Armaflex is fitted tight to the support, with no air gaps present and vapour sealed with Armaflex adhesive.
- Install Armaflex self adhesive tape to the butt joint where the Armaflex and the support meet. Ensure the surface of the butt joint is free from dust before installing the Armaflex tape.

**INSTALLING ARMAFIX INSULATED PIPE SUPPORTS**

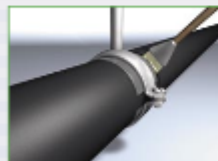
Armafix pipe supports are sections of Armaflex with load bearing PUR/PIR inserts and an aluminium outer shell cladding.



**Note:** Select the correctly dimensioned Armafix pipe support (min. insulation thickness of tube).



Use a standard pipe support bracket around the outer aluminium shells.



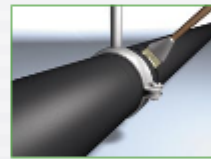
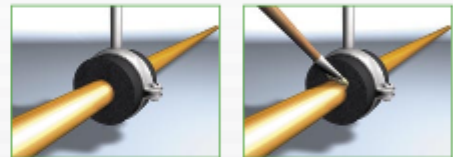
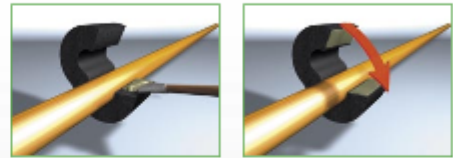
Install the Armaflex insulation on either side of the Armafix pipe support. Wet seal the butt joints with the Armafix pipe support using Armaflex adhesive.

**Note:** Ensure that the pipe insulation is installed under slight compression.

**INSTALLING ARMALOAD PIPE SUPPORTS**

Armaload pipe supports are sections of high density elastomeric insulation with **no** outer aluminium shell. Armaload pipe supports are suitable for use on heating, hot water and domestic cold water pipes.

**Note:** Contact Armacell customer services before installing Armaload pipe supports on chilled water and cold pipes.

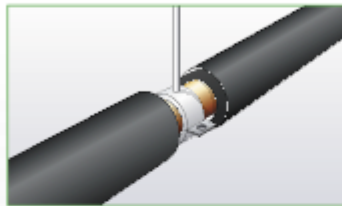


**Note:** Ensure that the pipe insulation is installed under slight compression.

**INSULATING “OVER” (ENCAPSULATING) PIPE SUPPORTS**

On cold lines pipe supports must be insulated to prevent condensation. If no insulated pipe supports have been specified the following approach should be followed as a minimum precaution.

**Note:** It is best practice to always have an insulated pipe support such as Armaflex or Armaload installed.



1. Install the Armaflex as close to the fixing bracket as possible. Seal the ends of the tube to the pipe with Armaflex adhesive.



2. With a large off-cut of Armaflex tube, core out a small hole to allow for the oil thread support of the bracket and slit with a small sharp knife along the flat face of the tube.



3. Place the Armaflex cover over the support area, mark and cut the true circumference of the cover. Fix and vapour seal all seams and joints in and around the attached insulation using Armaflex adhesive.  
**Note:** Armaflex 3mm Insulating self adhesive tape can be applied 50-100mm along the attached oil thread support.

**INSULATING THROUGH MOUNTED “SADDLE” SUPPORTS**

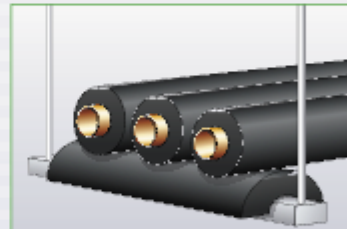
Insulate throughout continuously using Armaflex tube / sheet. Where the mounted “saddles” are located as shown, install two half (galvanized) metal sleeves around the insulated pipe.

**Note:** 1 - 1.5mm thick galvanized sheet will be suitable. If using metal sheet with a highly reflective, low emissivity, surface the insulation thickness may no longer be sufficient to prevent condensation.



**INSTALLING ARMALOAD PIPE SUPPORT SECTIONS**

Armaload is a high density load bearing grade of Armaflex in the form of a one metre long, half round section. It is designed to be used as a load bearing insert between overhead support systems, such as unistruts, and banks of small bore copper pipes insulated with Armaflex.



Use only with copper pipes up to 54mm O.D.

Suggested hanger spacing:

Outer pipe - Ø mm	Distance of hangers
≥ 35	3 m
42	2 m
54	1.5

Some compression will occur on both the Armaload and the Armaflex, but this is acceptable and has been allowed for in the design principal.



**INSULATING VESSELS AND TANKS WITH ARMAFLEX SHEET**

**Draw up a cutting schedule**

Work out the most efficient way of covering the surfaces using Armaflex sheet (2 x 0.5 metre) or continuous roll (1m width and length 4-15m dependent upon the thickness).

Armaflex sheet layout for large vessels and tanks  
**Note:** ensure that sheet joints are staggered.



**Compression joints**

Provide an allowance of an additional 5mm on all dimensions when cutting from Armaflex sheet or roll.

Always make compression joints. On curved surfaces, measure the circumference with a strip of Armaflex of the same thickness to be used for the insulation, including any surface finish. Do not stretch the strip.



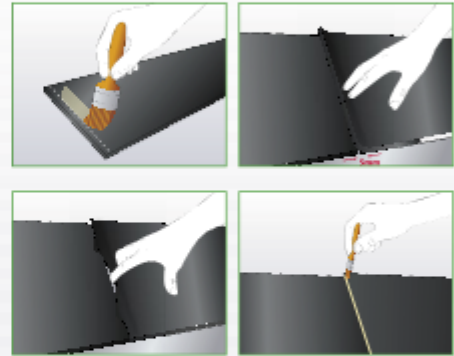
**Adhesion**

Apply Armaflex adhesive first to the insulation before applying adhesive to the metal surface.

**Note:** All over adhesive is required on both contacting surfaces in all situations. No "spot" or "strip" adhesive is recommended.

All seams are joined wet. Leave about 15 mm without an adhesive coating on the Armaflex surface. Attach the connecting sheet with adhesive and with 5 mm overlap. Then press in the overlapping butt joint to give additional compression.

Wet sealing of joints on flat surfaces:



**Multi-layer application**

Where multi-layer insulation is installed use Armaflex cleaner, after 36 hours (see page 10) to remove any talc, chalk, dirt, grease and moisture from the surfaces to be joined. Stagger all seams and butt joints on the second layer relative to the first layer.

**Complex shapes**

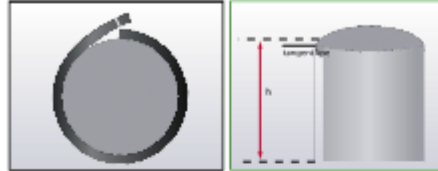
Where complex shapes are to be insulated, the shape of the body is outlined with chalk and this may be transferred directly to the Armaflex sheet by pressing the flexible material against the metal surface so that the chalk is transferred. Cut along the chalked line with a sharp knife to obtain a good fit for the Armaflex.

**Outdoor installations**

All Armaflex materials (excl. HT/Armaflex) used outdoors will require additional protection against UV radiation. We recommend the use of Armafinish FR paint or one of the Arma-Chek Systems (see page 5).

HT/Armaflex insulation does not require painting when used outdoors.

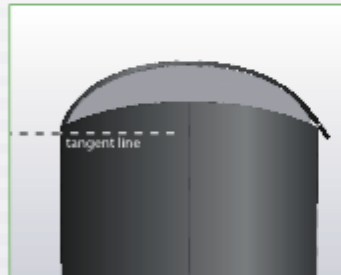
**INSULATING SMALL ( $\varnothing < 1.5\text{m}$ ) TANKS AND VESSELS USING ARMAFLEX SHEET**



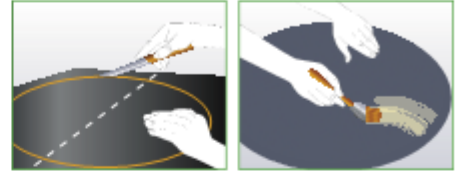
1. Determine the circumference of the tank.  
**Important:** Always measure with a strip of Armaflex of the thickness to be used for the insulation.  
**Warning:** Do not stretch the strip.



2. Transfer the circumference to the Armaflex sheet and cut to the required size. Spread a thin film of adhesive onto the Armaflex sheet... and then onto the metal surface. When the adhesive is tack dry (fingernail test) place Armaflex sheet in position and press firmly to achieve a good bond.

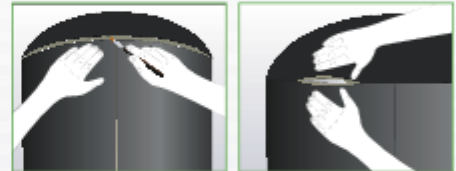


3. Determine the curve length of the domed surface.  
**Important:** Always measure with a strip of Armaflex of the thickness to be used for the insulation.  
**Warning:** Do not stretch the strip.



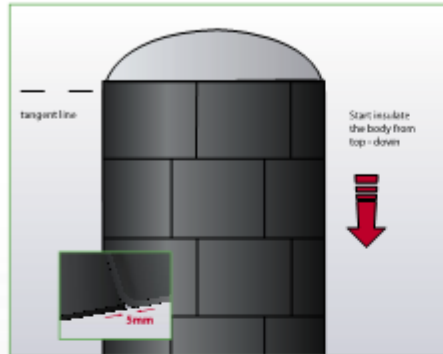
4. Using the curve length as the diameter mark out a complete disc on a piece of Armaflex sheet. If this disc is too large to fit on a single sheet of Armaflex first adhere multiple sheets together.

5. Cut around the disc.
6. Spread a thin film of adhesive onto the back of the Armaflex sheet... and then onto the metal surface.



7. When the adhesive is tack dry (fingernail test) place Armaflex sheet in position onto the top of the tank and press firmly down from the centre, avoiding any slipping of the material, to achieve a good bond.
8. Apply an additional wet seal along the edges at the top of the tank.
9. After the adhesive has been given time to tack dry press the edges of the seam firmly together.

**KEY BASIC APPLICATION PROCEDURES FOR LARGE VESSELS Ø > 1.5 MTS.**



Install the Armaflex sheet panels from the domed end section of the vessel as shown. Use all-over adhesive coverage to both surfaces.

Continue to install the panels of Armaflex around this domed end section. Ensure the Armaflex sheet is fitted under compression. After the first ring of panels are installed, continue to apply other panels of Armaflex sheet around the body of the vessel as shown.

When the entire surface area of the vessel body is completed, to finish, insulate the dome ends as shown by installing vertical Armaflex panels.



To determine the circular edge cut profile, which is located around the completed body section of dome end – mark the Armaflex circular edge with White marking chalk.

With the first pre-cut Armaflex sheet panel as required, place with a 50mm overrun, the sheet over the profile edge, apply firm pressure and remove. The underside of the Armaflex sheet will show the impression of the required profile.

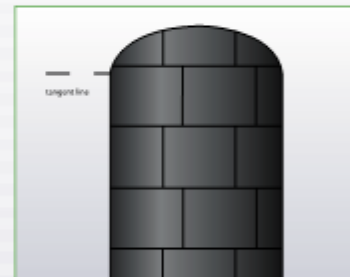
Cut the marked profile with a shape knife and install directly to the section required with all over adhesive coverage. Note: Do not apply adhesive to the circular profile edges of the domed end. This is done last by wet sealing the jointing details as described below.

Continue to install the required insulation panels as required to complete the domed section.



To finish, "wet seal the domed panels to the main insulated body sections as shown within the section relating to vessels below 1.5 mts.

If required the dome end profile sections can be chamfered, to fit the body panel edge perfectly.



**USE OF ADHESIVE IN APPLICATIONS INVOLVING HOT AND HUMID ENVIRONMENTS**

High atmospheric humidity's and temperatures lead to faster evaporation of the solvent in Armaflex adhesive. This means that a film of moisture may appear on the surface of the adhesive. Consequently the reliability of the adhesive seam cannot assured as the surfaces to be joined may not bond together.

Under these conditions, the following points may be observed as an alternative to our installation instructions:

- Apply Armaflex adhesive as normal in a thin uniform film on both surfaces.
- Unlike normal bonding, the surfaces to be glued should be held together under pressure whilst wet.

**Note:** Due to the shorter curing time adhesive can only be applied to a limited area at one time. Depending on the atmospheric humidity, temperature, material thickness and practical installation condition we recommend a tube length of around 1 m as a reference figure.

- To prevent possible tensions within the material and the enclosed solvent opening the seam, seams should be held in place immediately after bonding with Armaflex adhesive tape crosswise to the glued seam every 20 cm or so.

**INSULATION OF NON-ARMAFLEX-SYSTEM PIPE SUPPORTS**

Armafix pipe supports represent the best option to create a full water vapour sealed system and prevent condensation on cold applications.

Often, cold clamps made of PUR/PIR complete the pipe hanging systems.

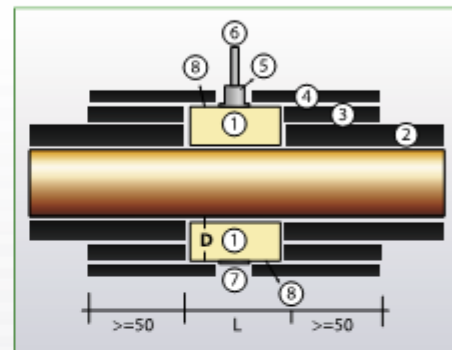
In these cases it is important, that a vapour tight bonding between the cold clamps and the Armaflex insulation is achieved.

This interface represents a thermal bridge where condensation may occur and adhesion at these points requires special attention:

1. Clean the surface of the clamp, using Armaflex cleaner.
2. Apply Armaflex Adhesive on the surfaces which are to be adhered. Allow this first layer of Armaflex adhesive to dry.
3. Apply a second thin coat of Adhesive evenly on both the surface of the clamp and the Armaflex adhesive joints. After the adhesive has cured, the joints should be pressed together in a brief but firm action.
4. When adhering both butt joints under pressure per form a "wet-seal" around the joint, when the clamps have been adhered in advance (please see above)

5. If necessary double the Armaflex thickness to the diameter of the PUR-support.
6. To secure the butt joints apply a overlapping strip of Armaflex using all over adhesive.

**Schematic cross section of a connection of Armaflex tubes with a clamp made of PU rigid foam**



- ① Clamp made of PU rigid foam
- ② Insulation thickness  
D = 20, 30, 40, 50 mm  
L = 100 and 250 mm
- ③ Armaflex tube
- ④ Armaflex double layer
- ⑤ Armaflex overlap (thickness ≥ 9 mm)
- ⑥ Connecting thread M10
- ⑦ Threaded bar M10
- ⑧ Two-part screw pipe clamp, zinc coated aluminium facing

## 2.2 Efficient Use of Materials and Reducing Waste

As mentioned earlier in the course notes (*module 5 – unit1 – section 1.4*), poor measuring of jobs, lack of foresight, mistakes in manufacturing, poor fitting of lagging and cladding, reworking of jobs, all lead to inefficient use and waste of time and materials. Proper planning, well trained staff, good measurements and good fabrication/ installation methods will lead to the efficient use of time and materials and help reduce waste.

## 2.3 Neat Layout of Work Space and Tools

There are many benefits to be gained both for the employee and the employer by having a neat and tidy work space.

### Benefits to the Employee

- It will make the workspace more pleasant to work in.
- It will make the job more satisfying.
- It will make you more efficient.
- It will make the workspace safer to work in.
- It will help to remove obstacles and frustrations in your work.
- It will make it easier to communicate to other employees.
- It will create a better work ethos.

### Benefits to the Employer

- Reduction in accidents.
- Better quality products.
- Lower costs, everything in its place, easier to control stock.
- More efficient use of materials and a reduction of waste.
- Building customer confidence through more efficient production and quicker delivery times.

## The 5 “S” Method

### (1) Sort

Sorting means looking at your work area and deciding what items are needed and what items are not needed. You get rid of the items which you don't need which will eliminate cluttering of the work area and create much needed space.

### (2) Set in Order

Set in order means keeping needed items in the correct place to allow easy and immediate retrieval. This could mean tidying your toolbox and putting the tools in their proper place or organising better storage facilities for workshop tools close to where they will be needed.

### (3) Shine

Shine means keeping your work area swept and clean on a daily basis, both in the workshop and on site. This gives the work area a clean appearance and makes it safer to work in.

#### **(4) Standardize**

This stage means making the first three steps mentioned above a habit. People must know their responsibilities and make the system a part of their work.

#### **(5) Sustain**

This means making it a habit of properly maintaining correct procedures over time. No matter how well the other parts of the system are implemented, it will not work for long without a commitment from all employees and the employer to sustain the system.

### **2.4 Accurate Cutting of Materials and Minimising Waste**

*Refer to section 2.1 above.*

### **2.5 Storage of Cut Materials in an Orderly Fashion for Fitting**

- All insulation materials should be stored in a clean dry area until required.
- Slab insulation should be stored flat and packs of slab insulation should not be stacked any more than four high.
- Insulation to be fitted on pipe-work should be located close to the section of pipe-work without causing an obstruction or trip hazard.

### **2.6 Safe Disposal of Waste Materials**

Waste material should be disposed of correctly and in accordance with local authority regulations. Dispose of waste materials regularly to avoid possible ignition or wind dispersal. Ensure polythene packaging is kept away from children. Recycle all waste materials when possible. If recycling facilities are not available on site, remove the waste materials and dispose of them at the nearest recycling facility.

## Summary

The use of manufacturer's data sheets in selecting the correct material is a vital part of the system design and installation procedures. Manufacturer's data sheets will provide such information as sizes available, density and application techniques. These data sheets provide a wealth of information which makes it easier for the person fabricating and installing the product.

Proper planning, well trained staff, good measurements and good installation techniques will reduce waste of materials and increase the efficiency of the overall installation of the job.

SOLAS

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