

I N N O V A T I O N

P R O V I D E R S

INNOVATION PROVIDERS



LNG
insulation

Insulated pipe
Supports

Bunstocks
Site Production

Chemicals for
in situ application

DUNA products for industrial insulation
Hot, Cold and Cryogenic



DUNA products for industrial insulation Hot, Cold and Cryogenic

Why PIR and PUR?

- **Low thermal conductivity**

The thermal conductivity rating of CORAFOAM® rigid polyurethane/polyisocyanurate foams (PIR/PUR) is the lowest value among expanded materials for insulation.

- **Strength**

CORAFOAM® polyurethanes and polyisocyanurates provide the best balance of physical-mechanical properties and density.

- **Lightness**

The foam structure consists of fine closed cells containing blend of gases which grant excellent insulation properties, and extreme lightness.

- **Low water absorption and low vapour permeability**

Keeping water off any insulation is crucial. Thanks to its particular chemical structure, CORAFOAM® shows very low values of water absorption and permeability.

- **Dimensional Stability**

Thanks to its specific composition and polymer structure rigid PIR/PUR foams show significant performances in size stability in a wide range of operating temperatures.

- **Chemical resistance & Compatibility**

The chemical composition of rigid polyurethane foam provides excellent resistance to a wide range of chemicals, solvents and oils and makes it compatible with a large number of auxiliary materials such as adhesives, mastics etc.

- **Range of service temperatures**

Rigid PIR/PUR foams are suitable for applications in a wide range of temperatures from extreme cryogenics (-200°C /-328°F) up to hot water (+120°C/+248°F); some materials can even withstand +205°C (+400°F).

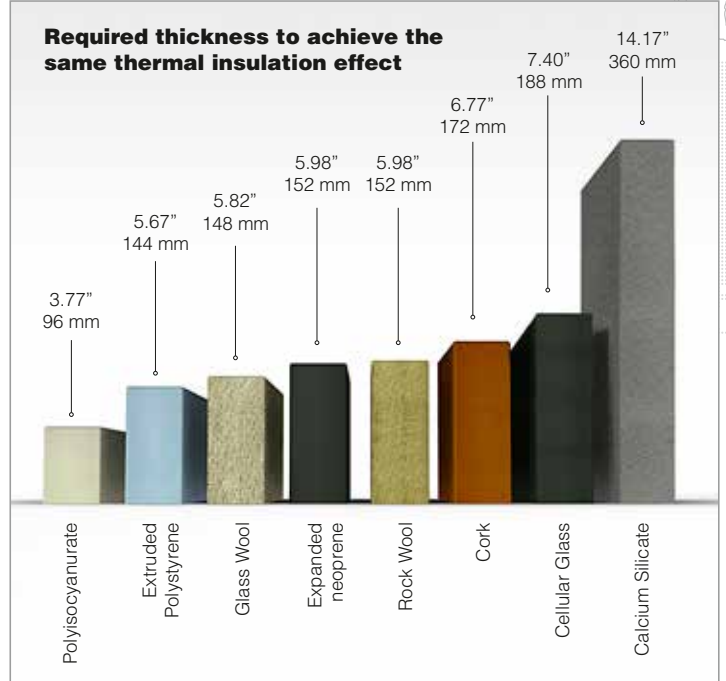
- **Fire properties**

Polyurethanes can be formulated to meet the highest classes of the most stringent fire protection standards.

For these reasons PIR/PUR are massively used in industrial insulation applications, especially when energy saving is the key factor for the good efficiency and performance of the plant e.g. cryogenic units.

- **Liquefied Natural Gas (LNG)**

The natural gas is liquefied at approximately -162 °C (-260 °F); PIR and PUR have a key role in all aspects of the supply chain, from liquefaction, through insulation of the tanks on LNG carriers until the regasification terminal.



Thermal conductivity values of other materials come from the databases and technical data sheets of various manufacturers.

- **Ethylene**

Ethylene is the first building block for most plastics and it is produced through synthesis of natural gas and stored at a temperature of -104°C (-155°F)

- **LPG**

LPG is refined and condensated from petroleum and 'wet' natural gas. Its storage temperatures are between -10 and -45°C (14°F/-49°F), therefore it is considered "soft cryogenic".

- **Ammonia/Fertilizer**

Ammonia contributes significantly to the nutritional needs being a fertilizer, being at the same time a building block for the pharmaceutical industry. Ammonia is synthesized starting from natural gas and it's stored at around -40°C (-40°F).

- **Underground Oil ducts**

The oil is kept fluid at about 80°C (176°F); in this case PIR/PUR serve as hot insulation. Thanks to their great resistance to organic decay, these foams are strongly used for long durability and low maintenance oil pipelines.

Our products for cryogenic insulation

1. PIPE INSULATION

CORAFOAM®



PUR/PIR Blocks

CORAFOAM® DUNAPIPE



Fabricated Pipe Sections

CORAFOAM® DUNAPIPE



Fittings (valves, flanges, elbows, reducers)

DUNAPOL® C



In-situ foam and injection systems

DUNAPOL® SPINPIPE

pouring and spray



Pre-insulation

2. PIPE SUPPORTS, THERMAL BREAKS AND COLUMN BEARINGS

**CORAFOAM®
BLUE CORINTHO® HT**



PIR/PUR Fabricated pieces



DUNAPOL® C



Injection system

3. PRODUCTS FOR ASSEMBLING

**DUNAPOL® AD
DUNAPOX AD**



PU/Epoxy Adhesives

DUNAPAP



Secondary vapour barrier

4. LAND STORAGE TANKS/MARINE TANKERS

DUNAPOL® S



PU Spray System

CORAFOAM®



PIR/PUR Panels

CORAFOAM®



Glass reinforced foams

DUNAPOL® C



Casting systems

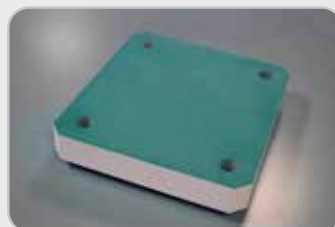
CORAFOAM®

The ideal solution for great numbers of applications, CORAFOAM® PIR/PUR is supplied in blocks, or shaped into fabricated pieces on customer's design (DUNAPIPE). Pipes, flanges, valves, elbows, tees, reducers can be single or multilayered, buttjointed, shiplapped, with or without factory applied DUNAPAP film.



BLUE CORINTHO® HT

High density rigid PIR material (700-800 kg/m³, 43.7-50 lb/ft³), suitable for supports, thermal breaks and column bearings.



DUNAPOL® C

PIR/PUR systems for in situ foam and injection, with tailor made formulations able to match customers' and project requirements.



DUNAPOL® S

Formulated spray system for both onshore and offshore, approved by classification societies for onboard insulation on vessels carrying liquefied gases.



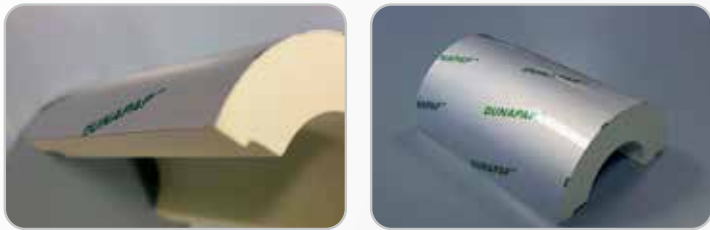
DUNAPOL® SPINPIPE

DUNAPOL® SPINPIPE, PIR system for pre-insulation by pouring on rotating pipe. Seamless and in line with the strictest cryogenic specifications, SPINPIPE improves both scheduling and quality control, reducing labor. The system is available also for SPRAY application.



DUNAPAP

Secondary vapour barrier (12/25/12µ Polyester-Aluminum-Polyester); it is supplied in rolls or factory applied on fabricated items.



DUNAPOL® / DUNAPOX AD

Line of structural polyurethane or epoxy adhesives able to bear cryogenic temperatures available in 1,2 or 3 components, packed in small handy ready-to-use solutions. Reaction speed and viscosities are tailor-made to suit specific customer's requests. DUNAPOL® and DUNAPOX AD are suitable to glue PUR, PIR, metals, wood, cellular glass etc.



DUNACOAT POLYUREAS

Pure, hybrid or aliphatic polyurea spray waterproofing coatings for indoor/outdoor applications. Their resistance to weather conditions make them an excellent choice for protection of exposed insulation.



MOST REQUESTED CORAFOAM® FOR INDUSTRIAL INSULATION:

	CORAFOAM®	Nominal Density kg/m³ Lb/ft³	Operating Temperature °C °F	ASTM C591 Grade 2 Type						CINI		RINA
				I	II	III	IV	V	VI	2.7.01	2.7.03	
PIR	PB 35 M1 HC	35 2.18	-200/+120 -328/+248	X			X					
	PB 40 M1 HC	40 2.49	-200/+120 -328/+248		X							
	PB 45 M1 HC	45 2.80	-200/+120 -328/+248		X					X		
	PB 50 M1 HC	50 3.12	-200/+120 -328/+248			X				X		
PIR	GP 40	40 2.49	-165/+100 -265/+212									X
	RTS 60	60 3.75	-200/+120 -328/+248					X				
	RTS 80	80 5.00	-200/+120 -328/+248					X				
	RTS 120	120 7.50	-200/+120 -328/+248						X			
	RTS 160	160 9.98	-200/+120 -328/+248								X	
	RTS 240	240 14.98	-200/+120 -328/+248								X	
	RTS 320	320 19.97	-200/+120 -328/+248								X	
PUR	MD 160	160 9.98	-200/+80 -328/+176								X	
	MD 250	250 15.60	-200/+80 -328/+176								X	
	MD 320	320 19.97	-200/+80 -328/+176								X	
	MD 500	500 31.21	-200/+80 -328/+176								X	
PIR	BLUE CORINTHO® HT 700	700 43.70	-200/+205 -328/+401									
	BLUE CORINTHO® HT 800	800 50.00	-200/+205 -328/+401									



CORAFOAM®

Installation Guidelines

AIM

This installation guide is intended to suggest materials and installation practices for products manufactured by DUNA-Group in the following applications:

- Tank Insulation
- Piping Insulation
- Mechanical Insulation
- Duct Insulation

Properly set up insulation and its maintenance is of extreme importance, so that the insulated system works with the efficiency for which it was designed at the beginning. It is crucial to identify which is the aim of the insulation requested by the system. We indicate here below some of the main purposes:

- Condensation control
- Energy efficiency
- Freeze protection
- Personnel protection
- Process control

Typically, insulation works for an industrial plant project are supported by a dedicated technical specification, issued by qualified Engineering companies, to match project demands. Such document considers local conditions, work out, environment and desired function life, so it prevails on any other technical document, including this guideline.

GENERAL INFORMATION

All insulation material shall be delivered to the project site in original, unbroken factory package distinguished with product designation and thickness. The shipping package should not hold moisture in the event of accidental wet weather. Shipment of materials from the manufacturer to final user shall be shipped in a closed weather controlled cargo container. Materials on job-site shall be warehoused so as to protect the materials from moisture and weather during storage and installation. Insulation material shall be protected from sunlight to prevent UV exposure.

SURFACE CLEANING

Before starting installation, all welding work must be terminated and dust, oil, grease, loose particles, frost and moisture must be removed from surfaces. It is better to have all critical parts primer-painted in order to avoid corrosion.

FABRICATION OF INSULATION

Project specification

All parts must be manufactured starting from cured bunstocks by referenced fabricators and in accordance with ASTM C 585. Before fabrication, store the buns indoors for at least a half day prior to the machining process. This will allow the buns to come into a stabilized state with the surrounding ambient temperatures and relieve possible internal stress that might have developed in the foam due to thermal gap. For best fabrication outcomes, it is advisable the foam buns be cut into pipe shells in length direction to maximize flatness. Cut pieces need to mature for 1 day before the application of the secondary vapour barrier (SVB). After application of SVB, fabricated pipe shells should be installed within the next 45 days avoiding long term warehousing. DUNA suggests, when possible, to fabricate fittings, such as valves, flanges, elbows, and tees in two pieces fly cut or CNC milled, being this the most correct fabrication method. For diameters too large for fly cutting or CNC routing, then they might be fabricated in mitred sections bonded together to have them in two halves with each half made up of equal number of sections.

Sealers, glues and mastics

Glues, joint sealers and mastics, including the solvent based ones, may be used in contact with all DUNA insulation products. Compounds that remain flexible at the working temperature of PIR foam (-184/+93°C, -300/+200°F) are the ones authorized by the DUNA Group. A vapour retarder type joint sealer shall be used on insulation longitudinal joints and butt joints to avoid moisture infiltration. Ask joint sealer original manufacturers for suitable products. Solvent or water based glues may be employed to fix the vapour barrier to the outer surface of Insulation. Refer to vapour barrier installation guidelines and consult specialized manufacturers for a list of products and installation guidelines. Ask our sales office for our DUNAPOL®/DUNAPOX adhesives.

Vapour barriers

Vapour barriers are requested on all the cellular structured insulation materials. They are normally distinguished into 2 main families:

- Secondary Vapour Barriers (SVB), also known as Vapour Retarder (DUNAPAP)
- Primary Vapour Barrier (PVB) A double layer vapour barrier is strongly suggested for LNG applications.

The SVB DUNAPAP shall be applied directly over the last but one layer of insulation while the PVB will be applied on the outermost layer. SVB DUNAPAP is backing up possible failures of the PVB allowing repairing activities without compromising the system safety. The typical SVB is consisting of Polyester-Aluminium-Polyester film (PAP) which should be factory applied by the PIR fabricator. References are made to ASTM standards C 755 and C 1136 for information on choice and specification of vapour barriers. Refer to product literature and installation guidelines from the SVB manufacturer for recommended application instructions. The drawings included at the end of this guide are representative of details commonly used within the field, however, they are not meant to show the only recognized method of installation but to work as an example of commonly used and standard practices. PVBs are normally applied in-situ after the installation of the insulation, directly over the outermost layer of insulation and can be of different nature, e.g. Bitumen mastics, Butyl Rubbers, etc. It's strongly recommended to strictly follow project specification for the selection of the approved PVB and their application.

Contraction/Expansion joints

Contraction/expansion joints must be foreseen in order to mediate the movements of insulation parts following the thermal contraction-relaxation due to thermal gaps. Their position should be regulated pondering the expected pipe movements. They should be installed in the inner insulations layers of the horizontal piping and equipments. Typically the joints are placed at maximum intervals of 6 mt (20 feet). We recommend to inquiry the project engineer to regulate the appropriate position of the contraction/expansion joints for each system. Contraction/expansion joints should be filled with resilient mineral fibers or approved alternatives, with fibers oriented parallel to the direction of the pipe. The filler, in relax status, should be twice the length of the contraction/expansion joint to be packed to the joint length during installation. Ask the competent engineer to regulate the appropriate contraction/expansion filler material.

Jacketing materials

Jacketing materials are mainly intended to mechanically protect the insulation and shall not be considered as vapour barrier. Typical materials for jacketing purposes are aluminum sheets and stainless steel sheets.

Aluminum Sheets

Covering shall be aluminum alloy meeting ASTM B209-10. Use white painted aluminum jacketing for all outdoor applications and consult project specification and jacketing manufacturer for suggested thicknesses. Aluminum jacketing for all fittings, tees, elbows, valves, caps, etc. shall be sectional, factory outlined, or field fabricated to conform tight around insulation. Banding for jacketing shall be 0,5 mm

(0.02") thick by 12.7 mm (1/2") wide stainless steel. No fastener able to penetrate the primary vapour barrier shall be used to fix the aluminum jacket.

Stainless Steel Sheets

The material shall be selected meeting the requirements of ASTM A 167. Use painted stainless steel jacketing for all outdoor applications and consult project specification and jacketing manufacturer for suggested thicknesses. Stainless steel jacketing for all fittings, tees, elbows, valves, caps, etc. shall be sectional, factory outlined, or field-fabricated to conform tight around insulation. Banding for jacketing shall be 0,5 mm (0.02") thick by 12,7 mm (1/2") wide stainless steel. No fastener able to penetrate the primary vapour barrier shall be used to fix the stainless steel jacket.

Insulation Thickness	Layering	Joints type
Until 50 mm (2")	Single Layer	Shiplap
Between 50 mm (2") and 127 mm (5")	Double layer	Butt joints
Above 127 mm (5")	Triple layer	Butt joints

1- LAYER SYSTEM

When a single layer is requested, it is suggested to fabricate insulation parts with shiplap or tongue and groove longitudinal joints and shiplap ends. Insulation in a single layer system shall be fixed to the pipe with 19 mm (3/4") wide fiber strengthened tape.

2- LAYERS SYSTEM

For double layers, all longitudinal joints between the inner and outer layers must be staggered by shifting and rotating parts of the various layers in order to avoid correspondences of joints between interior and exteriors parts; this helps to minimize the risk of thermal bridge. The best solution is to stagger the parts while installing as indicated in the pictures at the end of this guideline. In 2-layers insulation system, internal layer shall not be placed with sealants. The internal and external layer shall remain autonomous of each other in order to allow movement between the layers.

3- LAYERS SYSTEM

Where insulation thickness is larger than 127 mm (5") and a triple layer system is requested, stagger all longitudinal joints between the inner, middle, and outer layers. The best solution is to stagger the parts while installing as indicated in the pictures at the end of this guideline. In a 3-layers insulation system, the inner layer shall not be placed with sealants. The inner, middle and outer layer shall remain autonomous of each other in order to allow movement between the layers.

FITTINGS

Pre-fabricated insulation for fittings like elbows, tees, and valves shall be the same thickness as pipe sections and fabricated with shiplap ends or tongue and groove longitudinal joints to connect to the pipe insulation system.

INSTALLATION AND SECONDARY VAPOUR BARRIER DUNAPAP

Insulation shall be attached with fiber strengthened tape on both internal and external layers of a multi-layered systems. External layer insulation and secondary vapour barrier (SVB) DUNAPAP shall be fixed with fiber strengthened tape. Use a 25% overlap when secondary vapour barrier is factory applied to insulation. Fiber tape shall be positioned to the exterior of the insulation/secondary vapour

barrier system. Secondary Vapour Barrier Film should be cut to length longitudinally and covered around the circumference of the pipe with lap joint and placed facing downward abstaining from the placement of the joint at the top or bottom of the pipe. Lap joints are to be sealed using a liquid glue. Butt joints shall be protected with vapour barrier tape. Coiling wrap configuration can be employed instead of the above installation. Coiling wrapping will necessitate adhesive placed on one edge of the vapour barrier as it is wrapped over the preceding layer. On factory applied secondary vapour barrier film, lap joint to be sealed with Self Seal Lap Tape (SSL). All secondary vapour barrier surfaces should be free of dust, grease, oil and other materials and duly cleaned. Before positioning the SSL tape make sure that there is a good adhesion between the tape and vapour barrier. For other kinds of factory applied secondary vapour barriers, ask manufacturer's instructions on positioning.

PRIMARY VAPOUR BARRIER AND VAPOUR STOPS

Vapour stops shall be used on either side of valves often removed for inspections, valve place left uncovered, or uneven fittings, elbows, tees, etc. where the possibility of moisture infiltration is superior. Install according the drawing or an authorized different design. All insulation shall be tightly fixed and free of voids, spaces and gaps at all joints. Vapour barrier must be continual. All fasteners and ties shall be duly lined up and general work must be of high quality appearance and manufacturing. Before jacketing can be positioned on a portion of the piping, the vapour barrier system on that portion must be terminated and continual.

OUTDOOR PIPING

Specific attention must be paid for insulation applied in outdoor areas to avoid natural agents compromising the insulation works. Insulation shall be defended from protracted exposure to UV rays and weather upon installation. It's necessary to provide jacketing material within two weeks from positioning in order to avoid Ultra Violet degradation. Outdoor jacketing overlap shall be a minimum of 50 mm (2") at butt joints and a minimum of 50 mm (2") at longitudinal joints. Jacketing shall be weather stripped before closing and banding and positioned in order to avoid water infiltration. Straight sections of jacketing shall be duly tied with bands and seals with a maximum spacing of 229 mm (9") on center. End joints shall be fixed with bands and seals centered directly over joint. Do not use screws, staples or other fasteners that could affect the vapour barrier system.

TANK, VESSEL AND EQUIPMENT INSULATION

All insulation materials shall be the same as those used on the pipe interacting with the tank, vessel, or equipment. Tank and vessel head segments shall be twisted cut to conform in single piece or segments to ASTM C 450. Head segments shall be cut so as to get rid of voids at the head section and in the minimum possible number of pieces. Curved segments shall be fabricated to fit the outline of the surface in equal size pieces to fit around the vessel with a minimum number of joints. Cutting in the field shall be minimized as possible. All sections shall be tightly clenched and free of voids, space and gaps. Vertical vessels greater than 4 feet in diameter need an insulation back up ring welded or bolted around the bottom of the tank to preclude the shell insulation from slipping down. Seal all outer layers and single layer butt joints with joint sealer. In multi-layer applications, the horizontal and vertical joints of the internal and external layer twisted segments shall be staggered. Fix the shell insulation with stainless steel bands. DUNA advises secondary vapour barrier to be factory applied by an approved fabricator. In case this is not possible, install vapour barrier film. Tightly cover the vessel or equipment insulation circumferentially with SVB film. Place the seams by a minimum of 2 inches. Seal the overlapped seams with vapour barrier tape. On vertical vessels apply the SVB film beginning with the bottom course and work upwardly. Each course should overlap on top of the lower one thus affording a joint that will naturally drop water. The vapour barrier on curved head sections shall be mastic/ fab/mastic or authorized other. Flat head sections can be wrapped with vapour barrier film.

CORROSION RESISTANT METAL COATINGS

Corrosion of metal pipe, vessels, and equipment under insulation, while not usually determined by the insulation, is still an important issue that must be taken into consideration in any mechanical insulation system. The predisposition for corrosion depends on many causes including the ambient environment and the operating temperature of the metal. DUNA foams are friendly to every type of primer solution, nevertheless we warmly suggest to corrosion engineers to work closely with the fabricator, the contractor, and DUNA's technician to help guarantee a properly designed, made, and long-lasting corrosion-free insulation system.

FULL THICKNESS SHIPLAP ELBOW FITTING

- Shiplap end cut to thickness "X" to accommodate double layer pipe insulation.
- Use instead of double layered fittings.
- Cover elbow with vapour barrier Tape.

TAPING PATTERN

- Use two wraps of tape to guarantee proper bond.
- Use nylon or glass filament type tape 19 mm (3/4") wide.

DOUBLE LAYER EXPANSION / CONTRACTION JOINT DETAIL

Allow sealant beads to cure prior to positioning of external layer.

- Position external layer packed glass fiber between sealant dams on internal layer.
- After glass fiber in contraction joint is laid down, insulation sections on either side of contraction joint shall be compelled together as tightly as possible.

VAPOUR STOP DETAILS

- Mastic should be determined on the service temperature of the system.

- Mastic shall be sealed to the pipe face and lapped back over the top of the vapour barrier if fitting is left exposed

DETAIL OF FACTORY APPLIED VAPOUR BARRIERS

- Vapour Barrier can be installed using SSL tape or using liquid glues.
- Butt joints to be wrapped a minimum of 44 mm (1.5") on each side of joint by vapour barrier tape or butt strip.

TANK HEAD INSULATION DETAIL

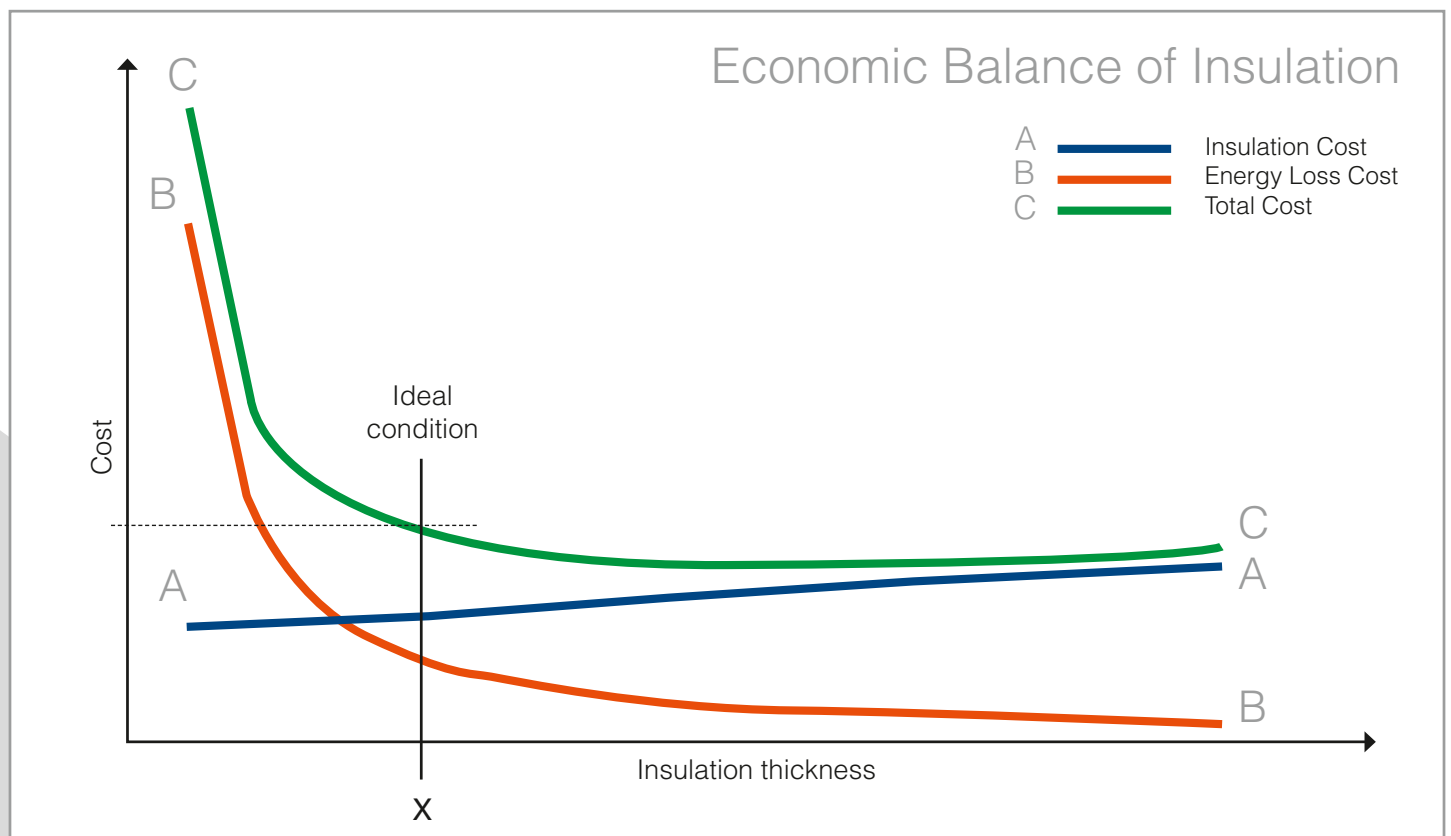
- In multiple layer systems, each layer shall be positioned so that the horizontal and vertical joints in that layer are offset from the matching joints in the previous layer by half the height or width of a full section.
- At joint between wall and head section, the external layer shall be offset below the internal layer by the thickness of a single layer.
- Where mastics or sealants are needed to fix the insulation sections to the tank head ask the manufacturer's recommendations on service and application temperatures.

INSULATION THICKNESS

The customer's engineer should be asked to guarantee the insulation thickness necessary to avoid condensation on the external surface of the insulation system jacketing. In a few cases, the thickness must also guarantee the insulation thickness necessary to limit the heat gain to a specific value (usually 25 Watt/m² (8 btu/hr-ft²) of external jacketing surface). A number of assumptions must be made, based on indoor/outdoor, humidity, wind, cycling, safety factors, and so on. We suggest you asking a qualified engineer and have them work closely with the contractor, and DUNA to help guarantee a properly designed, positioned, and long-lasting insulation system.

Economic thickness, therefore, is defined as the thickness of insulating materials that minimizes the total-cost curve, this curve being the sum of the cost of installed insulation and the cost of energy loss.

At low thickness values, the cost of insulation is low, but the cost of energy loss is high. Additional thickness reduces the loss of energy, but only up to a certain point, beyond which adding further insulation is no useful anymore.



COLD SERVICE INSULATION

HR	80%
Average Ambient T	35 °C (95°F)
Wind Speed	2,2 km/h (1.4 miles/hour)
Max Heat Gain	25 W/m ²
Jacket Emissivity	0,9
Dew Point	31,1 °C (88°F)
Insulation Material	CORAFOAM® PB 50 M1 HC

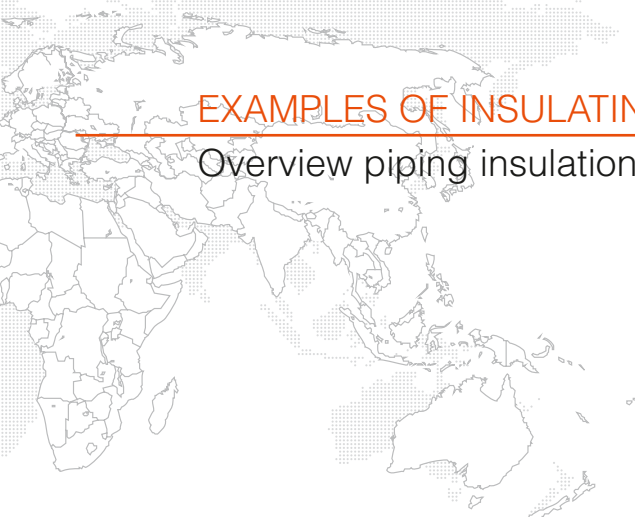


PIPE DIAM “	Service Temperature °C									
	0	-20	-40	-60	-80	-100	-120	-140	-160	-180
1/2	30	30	40	50	50	60	60	70	70	80
1	30	30	40	50	60	60	70	80	80	90
1 1/2	30	40	50	50	60	70	80	80	90	90
2	30	40	50	60	70	70	80	90	90	100
2 1/2	30	40	50	60	70	80	80	90	100	100
3	30	40	50	60	70	80	90	90	100	110
4	30	40	50	60	70	80	90	100	110	110
6	30	40	60	70	80	90	100	110	110	120
8	30	50	60	70	80	90	100	110	120	130
10	30	50	60	70	80	100	110	110	120	130
12	30	50	60	70	90	100	110	120	130	140
14	30	50	60	70	90	100	110	120	130	140
16	30	50	60	80	90	100	110	120	130	140
18	30	50	60	80	90	100	110	120	130	140
20	30	50	60	80	90	100	110	130	140	150
22	30	50	60	80	90	100	120	130	140	150
24	30	50	60	80	90	110	120	130	140	150
26	30	50	60	80	90	110	120	130	140	150
28	30	50	60	80	90	110	120	130	140	150
30	30	50	60	80	90	110	120	130	140	150
32	30	50	60	80	100	110	120	130	140	150
34	30	50	60	80	100	110	120	130	140	160
36	30	50	60	80	100	110	120	130	150	160
38	30	50	70	80	100	110	120	130	150	160
40	30	50	70	80	100	110	120	130	150	160

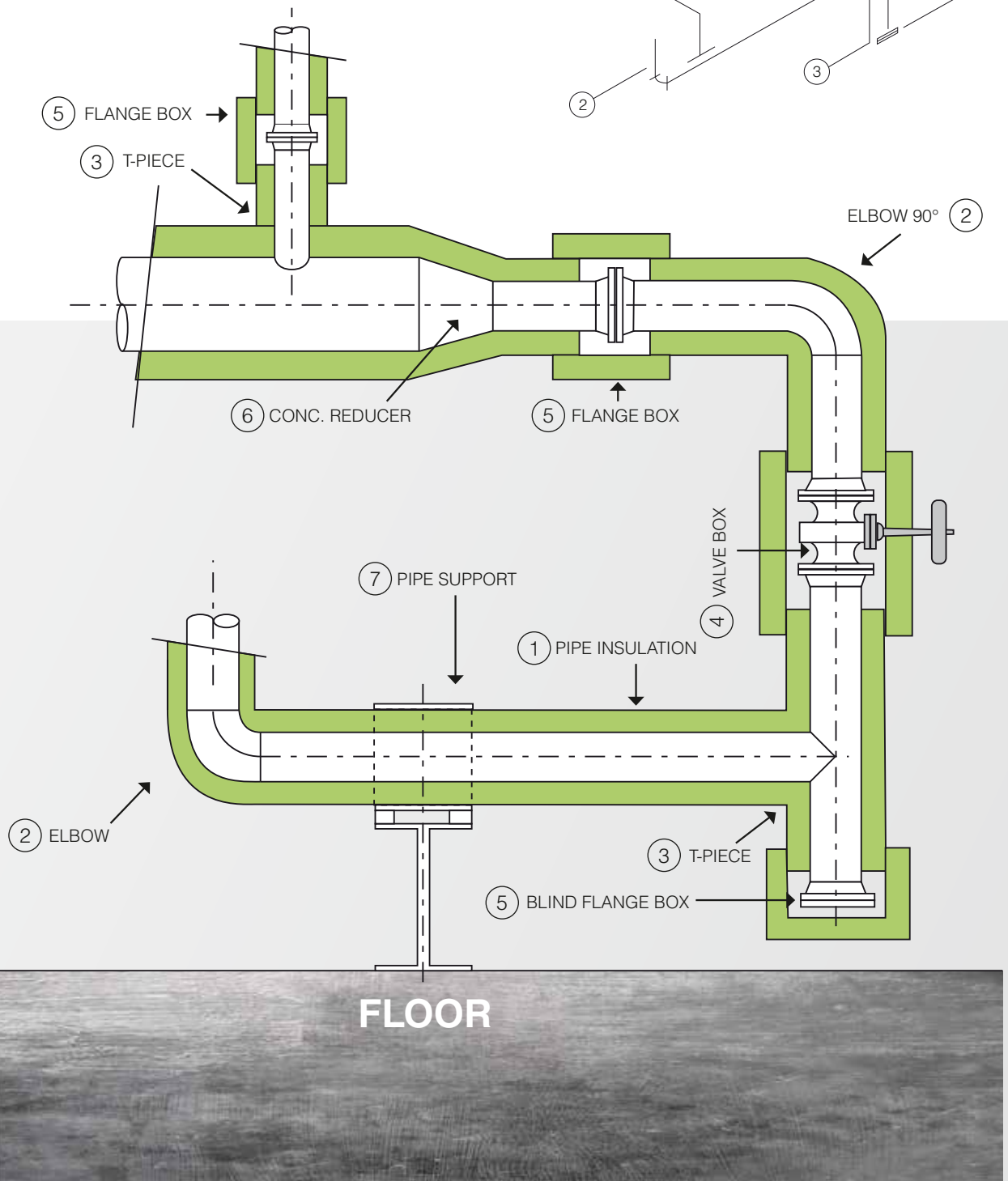
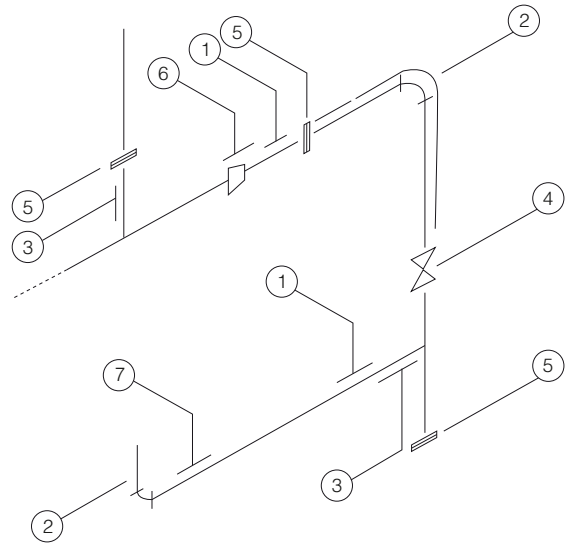
Thicknesses reported in this table are shown for demonstrative purpose only and they are strictly related to boundary conditions reported above. They are calculated using ASTM C680-10 algorithm, without considering any safety coefficient and assuming a perfect design and installation of insulation system. DUNA assumes no responsibility for any use of data shown in this table. We strongly recommend to contact a qualified insulation-design engineer for a proper thickness calculation related to any specific project.

EXAMPLES OF INSULATING SOLUTIONS WITH DUNA-USA PRODUCTS

Overview piping insulation details



ISOMETRIC DIAGRAM

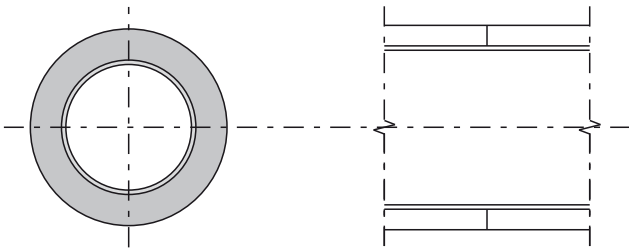


1

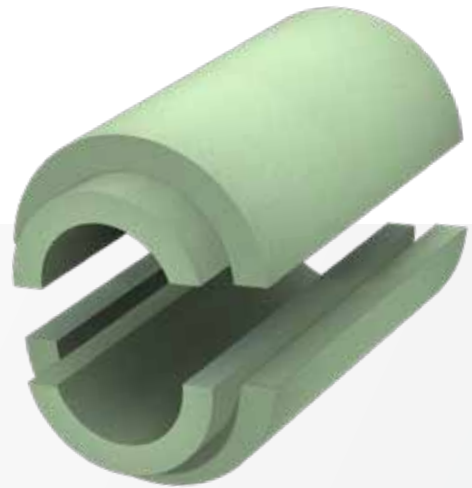
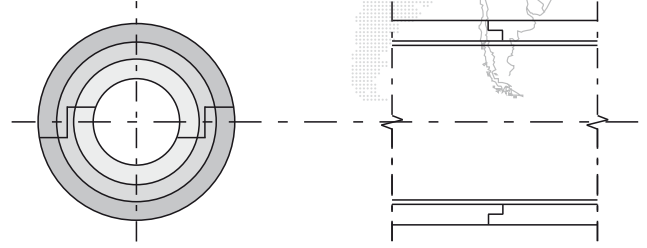
STRAIGHT PIPES

All pieces can be single or multilayered, butt joint or (circumferentially AND/OR longitudinally) shiplapped

Single layer, Butt jointed

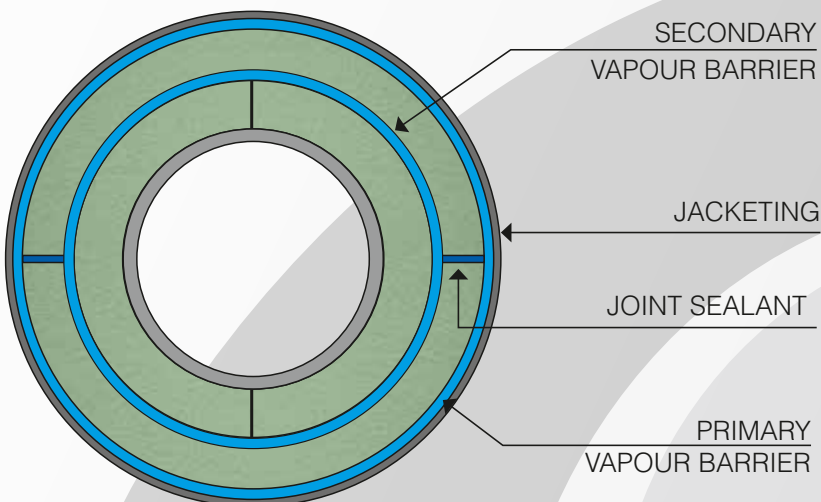


Single layer, longitudinally and circumferentially shiplapped

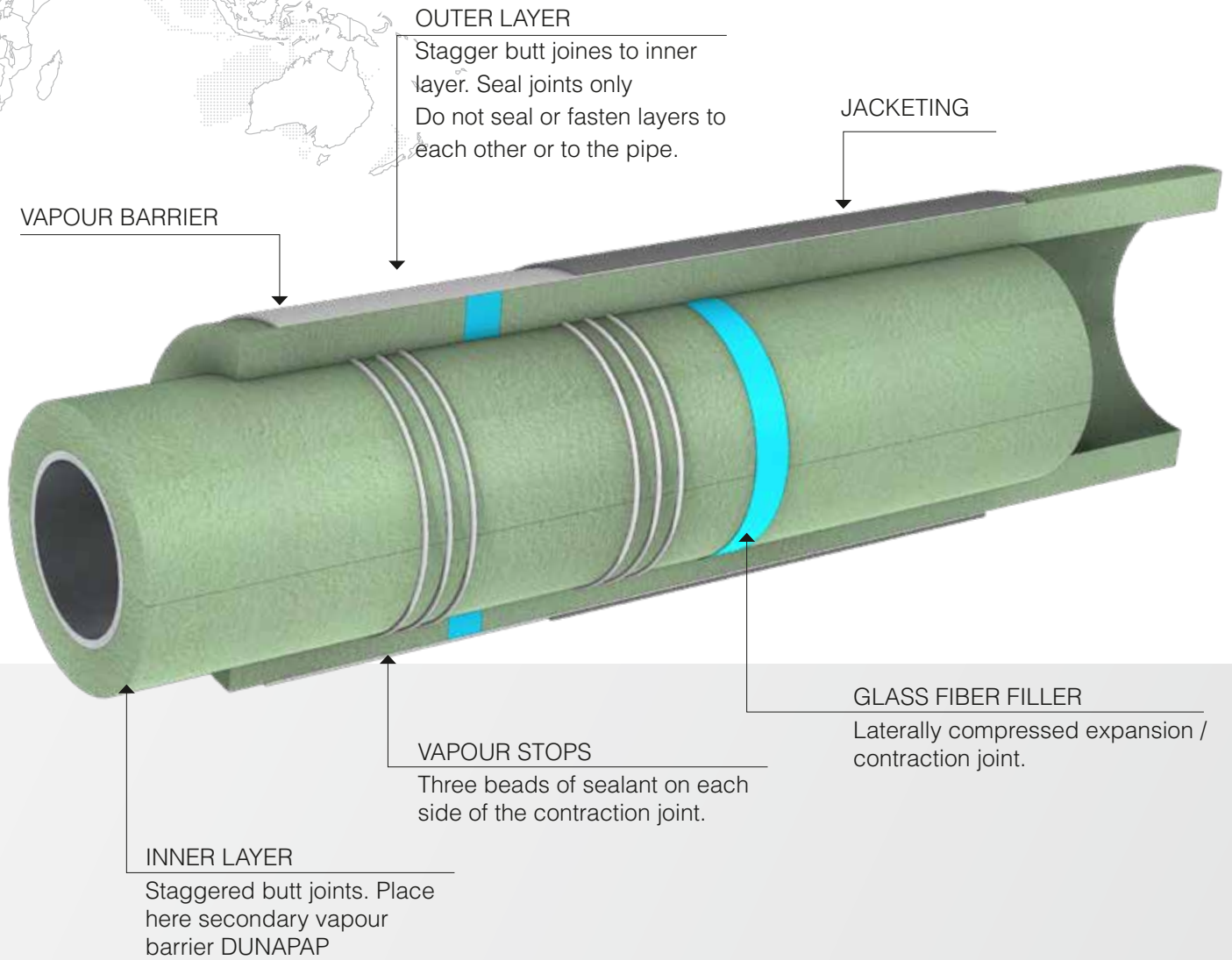


DOUBLE LAYER APPLICATION

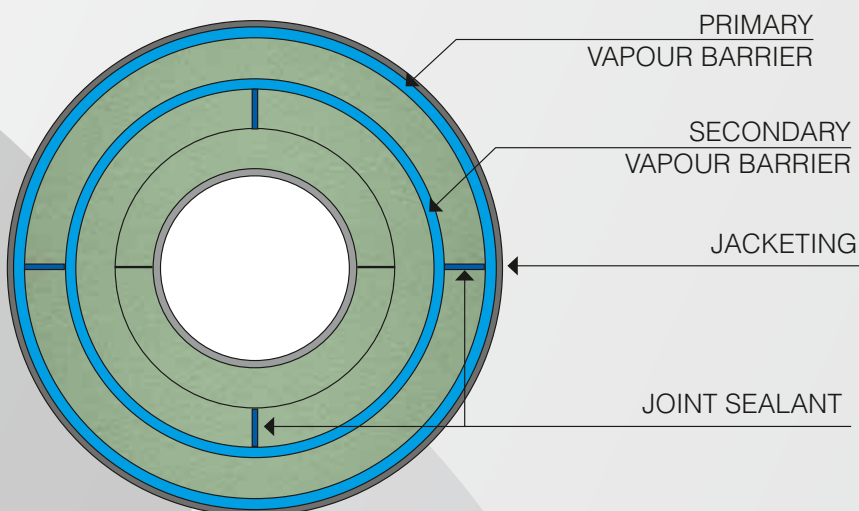
All multilayered pipes must be staggered



DOUBLE LAYER APPLICATION



TRIPLE LAYER APPLICATION

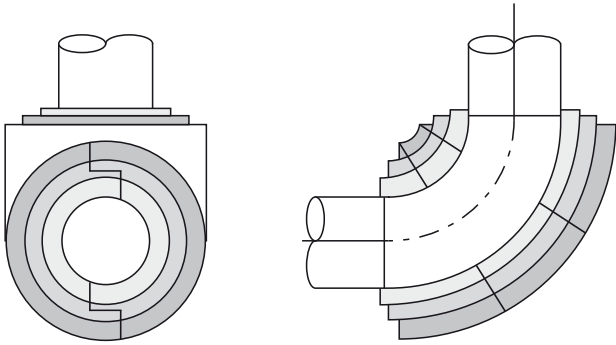


2

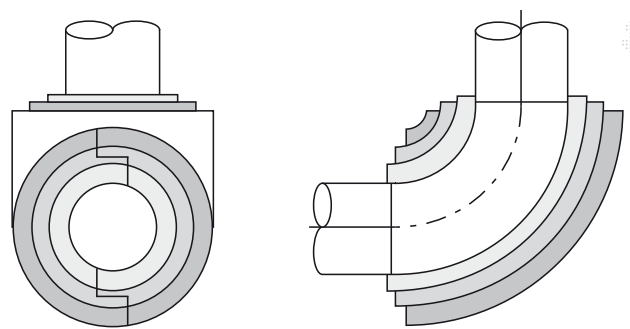
ELBOWS

All pieces can be single or multilayered, butt joint or circumferentially AND/OR longitudinally shiplapped,

MITRED ELBOW



MILLED ELBOW



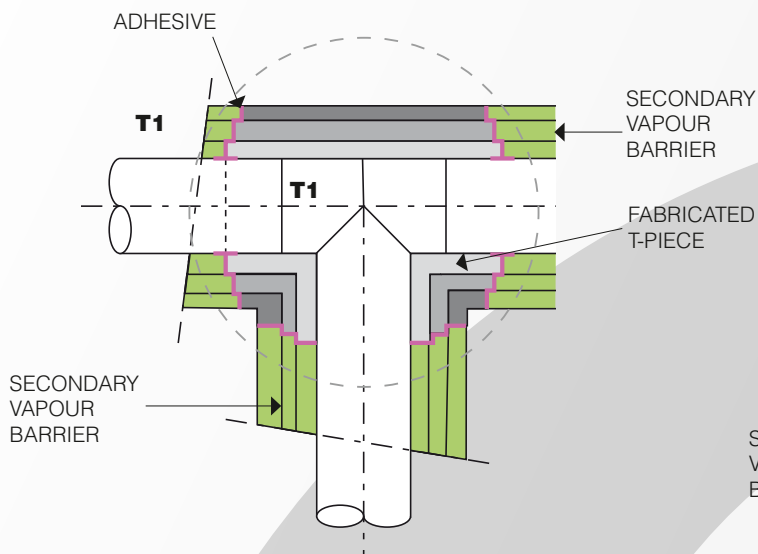
CIRCUMFERENTIALLY ONLY SHIPLAPPED ELBOW



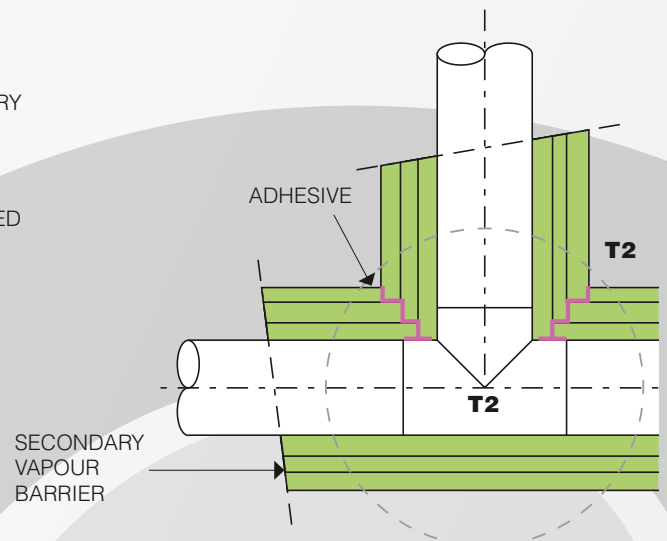
3

TEES

T1 = FABRICATED

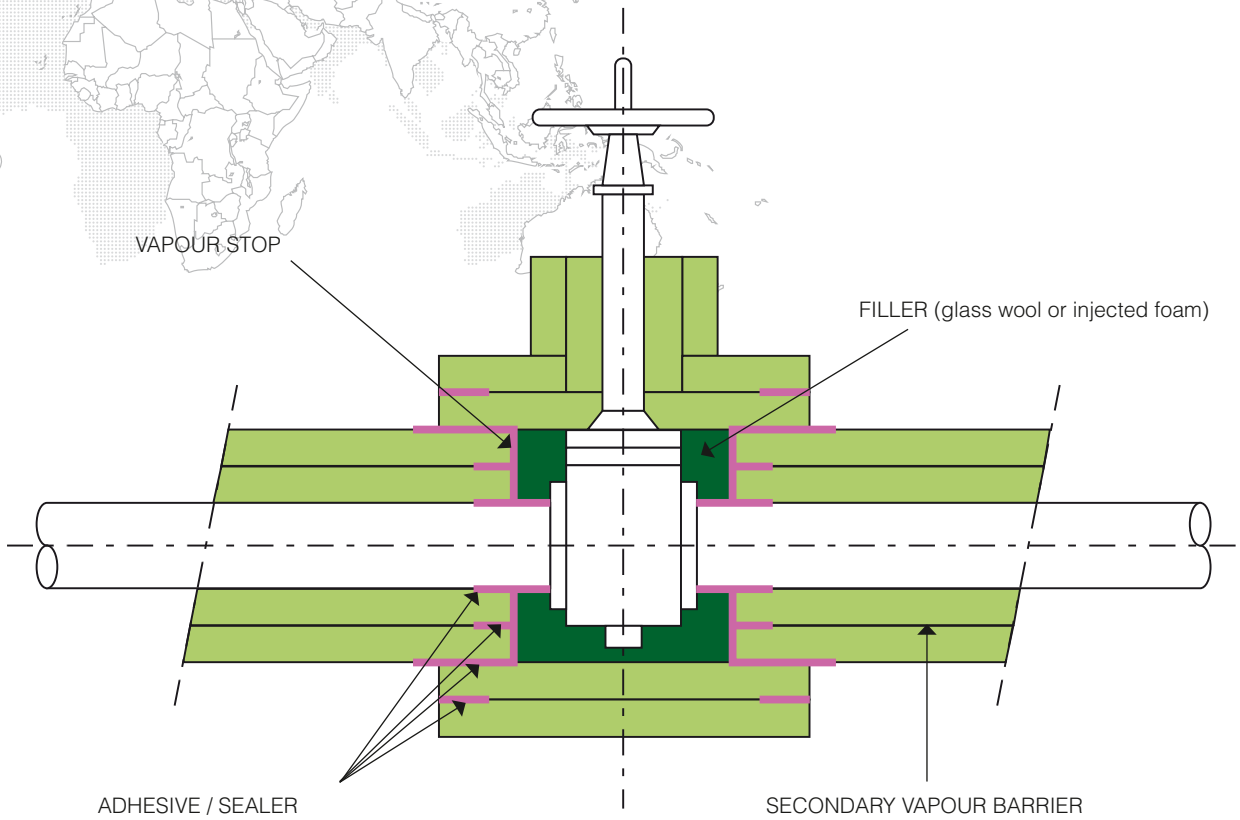


T2 = ASSEMBLED



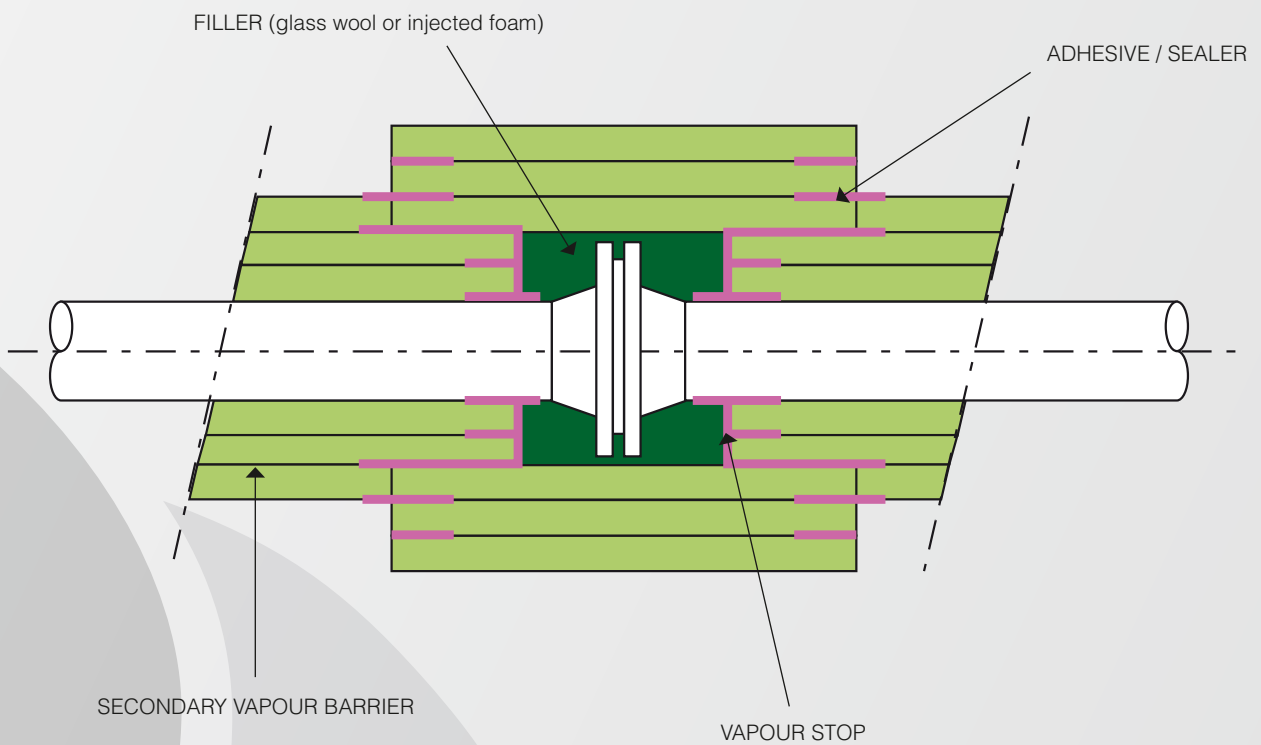
4

VALVES



5

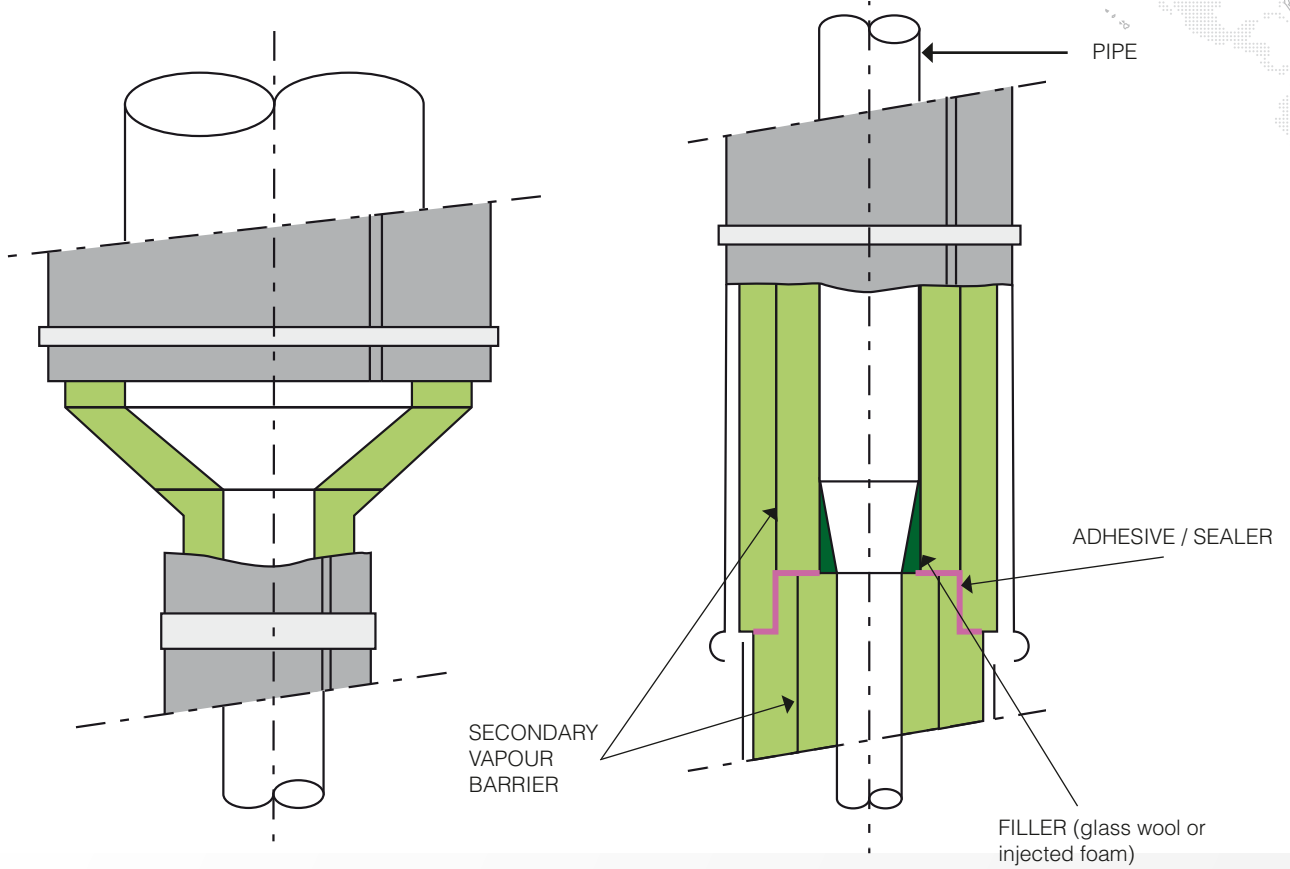
FLANGES



6

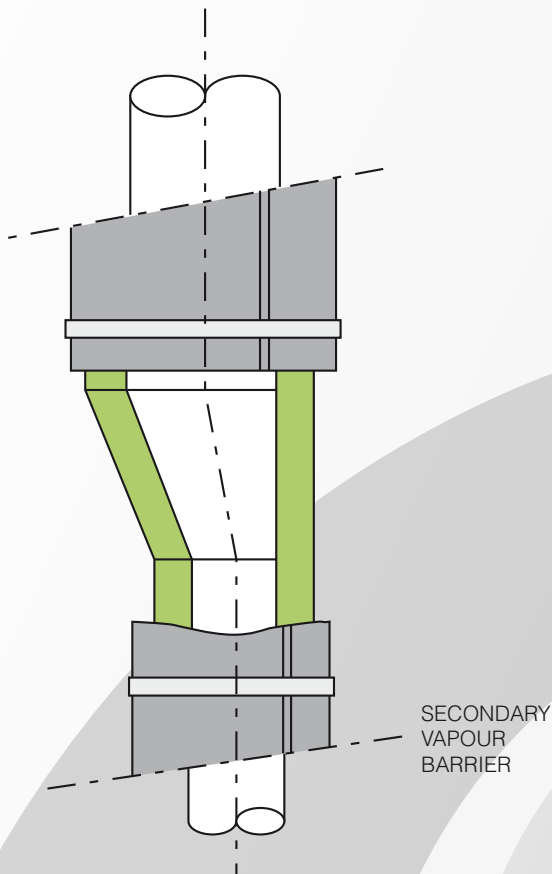
REDUCERS

CONCENTRIC

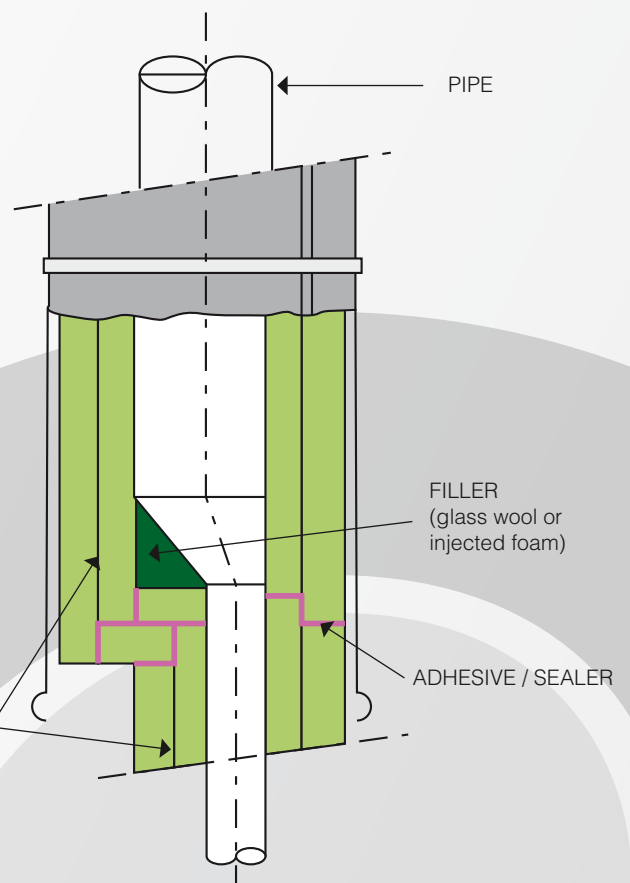


ECCENTRIC

SINGLE LAYER SYSTEM

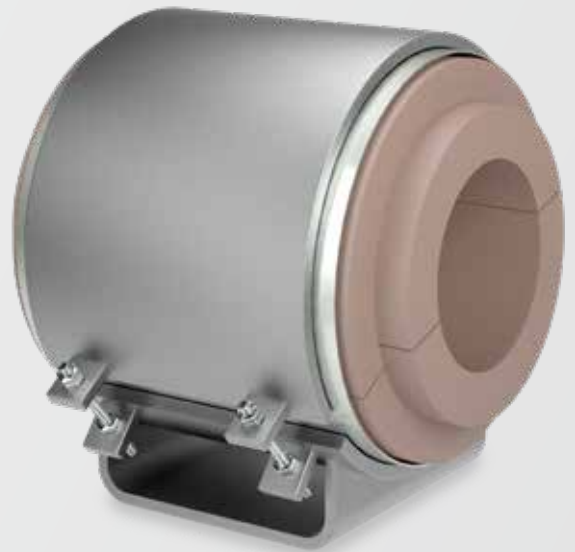
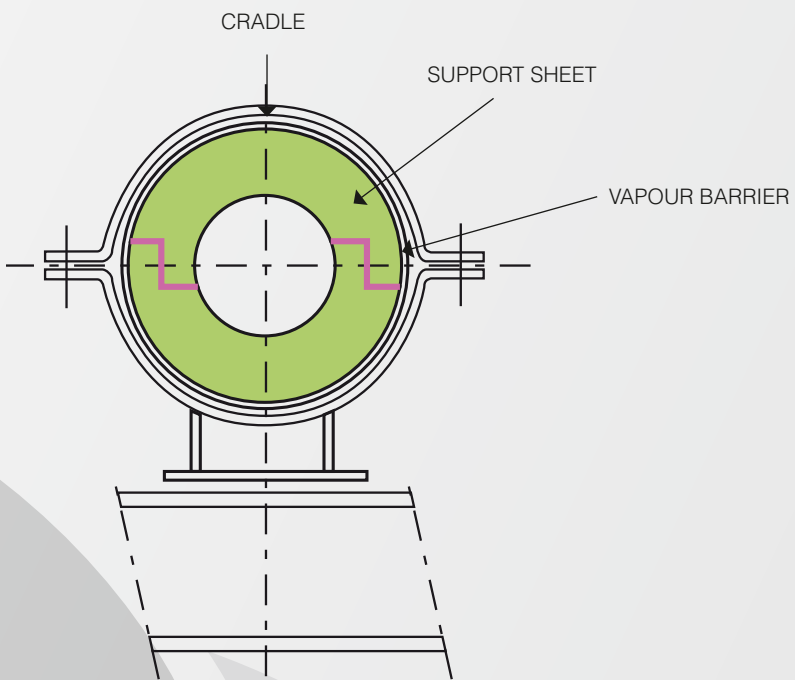
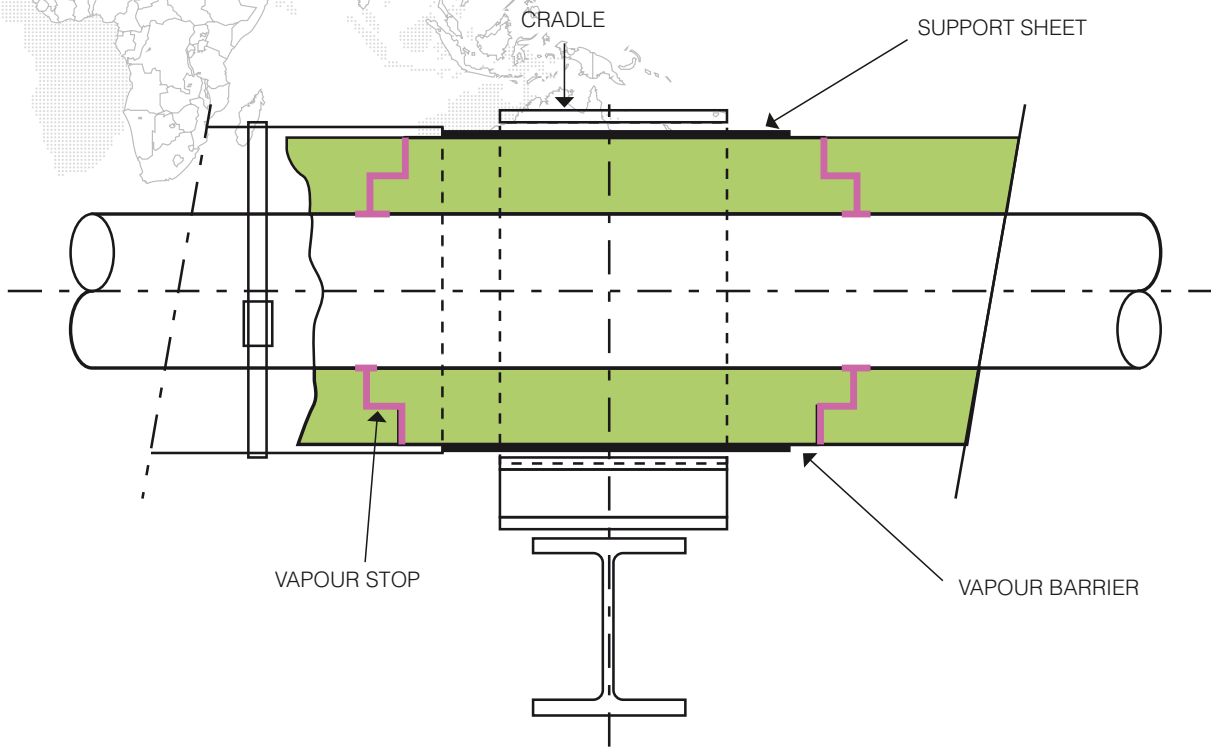


DOUBLE LAYER SYSTEM



7

INSULATED PIPE SUPPORTS



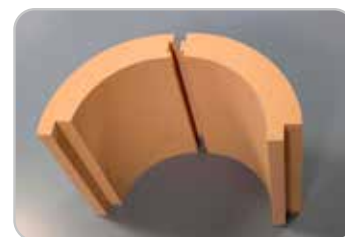
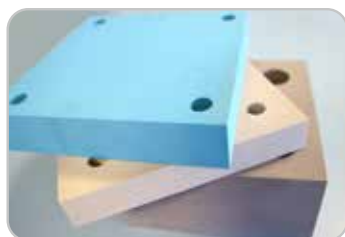
Disclaimer:

This guideline is offered as a handbook for the purpose described herein. No warranty of procedures, either verbalized or involved is intended. All values shown outline typical characteristics and do not constitute in any way a sales specification; they are based on DUNA-Group's current knowledge and experience of the products when properly stored, handled and applied in accordance with our recommendations.

DUNA-Group does not accept any responsibility for incorrect use of its products as it cannot ensure the correct methods of application have been followed; we specifically disclaim any liability for consequential or incidental damages of any kind, including lost profits.

Please always ask for the most recent technical data sheet.

I N N O V A T I O N P R O V I D E R S
INNOVATION PROVIDERS

**DUNA-CORRADINI SpA**

Via Modena Carpi, 388
41019 Soliera,
MODENA, Italy
Tel.: (+39) 059 893911
Fax: (+39) 059 565403

info@dunagroup.com
www.dunagroup.com

**DUNA-USA Inc.**

4210 FM 1405 Baytown, Texas 77523 - U.S.A.
Tel.: (+1) 281 383 3862
TOLL FREE: 866 383 DUNA
Michigan Plant: 5900 West 6th street Ludington,
Michigan 49431

info-dunausa@dunagroup.com
www.dunagroup.com/usa

**DUNA-EMIRATES LLC FZC**

P.O. Box 50024
Fujairah, U.A.E.

Tel.: (+971) 09 228 2409
Fax: (+971) 09 228 2399

info-dunaemirates@dunagroup.com
www.dunagroup.com/emirates