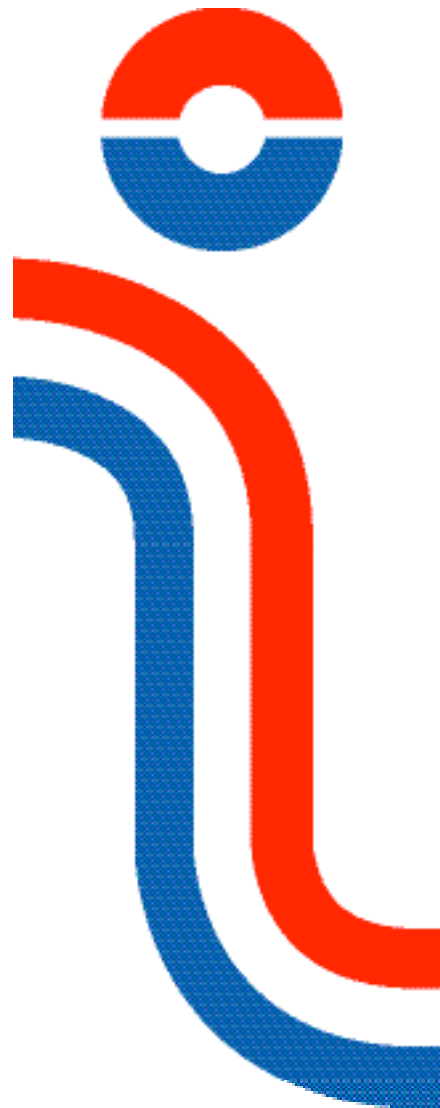


Resolco Insul-Phen

CFC & HCFC Free Thermal Insulation

INSTALLATION AND SPECIFICATION GUIDE

for Applications in the Gulf States & Saudi Arabia



Resolco International bv

Specification: Insul-Phen closed cell CFC & HCFC free phenolic foam Pipe & Equipment Insulation

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1.0 Scope

1.1 This guide covers Resolco's recommended insulation materials, fabrication, installation and application of rigid, Insul-Phen CFC & HCFC free thermal insulation for above ground piping and equipment to be used in Chilled Water and Building Services.

2.0 Installation Subcontractor Responsibility

2.1 Any conflict between the requirements of this specification and related codes, standards, data sheets, drawings, attached commercial contract, etc., shall be referred to Owner for clarification/resolution.

2.2 Subcontractor shall not make assumptions to replace information not furnished by owner. Subcontractor is required to obtain necessary information from Owner or other reliable sources. Any and all claims arising from lack of knowledge of required information will be rejected by Owner.

2.3 Subcontractor shall list and fully describe all deviations from this specification and the related codes.

2.4 Subcontractor shall field verify all (existing) dimensions and conditions shown on Owner drawings. The lines and equipment to be insulated are identified on insulation line list and equipment insulation list. This document identifies insulation type and thickness required for each item.

2.5 Subcontractor shall follow manufacturer's recommendation in safe handling of insulation materials and use of required safety equipment.

3.0 Design

3.1 Definitions

3.1.1 The term "Cold Service" shall normally apply to below ambient operating temperatures. It does not relate to cryogenic applications.

3.1.1.1 It includes anti-sweat which applies to operating temperatures below the ambient temperatures that can cause condensation.

3.1.2 The term "cylindrical surfaces" applies to equipment such as vessel shells, heat exchangers, etc., as well as to piping.

3.1.3 The abbreviation OD when used without a description applies to outside diameter of the insulation and/or finish covering.

3.1.4 The term "Vapour Barrier" refers to a material which retards the passage of water vapour.

3.1.5 The other terms used in the specification shall be in accordance with ASTM C168 "Standard Terminology Relating to Thermal Insulating Materials" or the relevant British Standard.

3.2 Specific Requirements.

3.2.1 Insulation application shall not proceed until after the following have been completed:

All required hydrostatic and pneumatic pressure testing.

Application of required substrate protective coating systems, including touch-up of previously applied coatings.

Installation of tracing systems.

3.2.1.1 In cases where it is necessary to insulate before completing the above work, prior written approval of the Owner or his designated representative must be obtained.

3.2.2 Asbestos containing materials shall not be used.

3.2.3 All insulation and finish shall be applied using the best modern practice and finished work shall display a neat appearance.

3.3 Extent of Insulation

3.3.1 General

3.3.1.1 The Owner's Equipment Insulation Schedule lists equipment, i.e., vessels, heat exchangers, machinery, etc., and the Owner's Piping Line List lists lines which are to be insulated in accordance with the specification.

3.3.1.2 The normal operating temperature, required thickness of insulation and insulation requirement code are all pertinent information contained in the above documents.

3.3.1.3 If insulation is unavailable in thickness shown, the next larger thickness commercially available shall be applied.

3.3.1.4 All valves, fittings, vessel drains, and flanges on cold equipment and piping shall be fully insulated.

3.3.1.5 Attachment to cold service vessels such as instrument bridles, gauge glass etc. shall be insulated.

3.3.1.6 Skid mounted piping and equipment shall be insulated per this specification and unless otherwise specified, in applicable purchase documents, shall be insulated by the insulation subcontractor.

3.3.2 Insulation Thickness

3.3.2.1 The insulation thickness tables are designed to minimize condensation on the outer surface at various ambient conditions as shown on each table. The insulation thickness shall be in accordance with the applicable thickness tables.

3.3.2.2 Insulation thickness shall be based on normal operating temperatures and shall not be based on design temperatures.

4.0 ADDITIONAL REQUIREMENTS

4.1 Welding

4.1.1 Field welding, such as welding of studs or nuts for insulation, on any piece of equipment or pipeline is prohibited without prior written approval of the Owner or his designated representative.

4.2 Surface Preparation and Painting.

4.2.1 Before application of insulation, all surfaces shall be cleaned to remove loose rust and paint, dirt, grease or other foreign matter.

4.2.2 Insulation shall not be installed until after field welds and other surfaces which require painting but have not been leak tested and painted.

5.0 MATERIAL

5.1 General

5.1.1 All materials shall be new; materials such as insulation blocks, moulded pipe covering, mastics, adhesives and weatherproofing shall be delivered to jobsite in factory sealed cartons, containers, and/or packages.

5.1.2 Items specified by their properties represent minimum quality requirements. Alternates or deviations must be submitted to the Owner for approval.

5.1.3 The operating temperature must be within the temperature limits for the selected insulation material and/or accessories, as recommended by the Manufacturer.

5.1.3.1 Unless otherwise specified, Manufacturer's recommendation shall be adhered to in application and handling including all safety requirements for the materials.

5.2 Storage and Handling

5.2.1 Storage of insulation and accessory materials must provide adequate protection from damage due to moisture and temperature. All flammable materials must be stored away from ignition sources, such as welding operations.

5.2.2 Storage temperature for mastics, adhesives and sealers shall be within temperature ranges required by the material manufacturer. All materials which are improperly stored and exposed to temperatures outside the recommended temperature ranges should be removed from the site and replaced with new material.

5.2.3 All insulation material shall be kept dry and should be kept off the ground and provided with adequate protection against moisture and inadequate drainage. Wet or damaged material should be replaced with new material.

5.3 Acceptable Materials

5.3.1 Insulation

5.3.1.1 All insulation material for cold service shall be Resolco Insul-Phen CFC & HCFC free phenolic foam insulation as manufactured by Resolco International bv in accordance with ASTM C-1126 and BS 3927 Phenolic Foam Thermal Insulation or approved equal.

5.3.1.2 Insul-Phen insulation shall have the following minimum properties:-

100% CFC and HCFC free	
Density	40Kg/m³
Temperature range	-180°C to +120°C
Closed cell content	95% minimum
Compressive Strength.	180 Kpa - parallel to rise
Thermal Conductivity	0.021 W/m.K at 10°C
Fire Rating/Fire Test Requirements	plain and faced - Class O to UK building regs and ASTM E84 25/50 flame spread/smoke emission

5.3.2 Vapour Barrier (Indoor Service)

5.3.2.1 Vapour barrier for indoor service shall be factory applied reinforced aluminium foil, with a class O fire rating. As an alternative, puncture resistant zero perm all service jacket may be used.

5.3.2.2 In areas of high condensation risk or mechanical abuse, consideration should be given to an additional vapour barrier of mastic reinforced with canvas or glass cloth.

5.3.3 External Vapour Barrier

5.3.3.1 The vapour barrier used to seal all piping insulation for outdoor service shall be a mastic type, weather resistant, UVR resistant OR external grade jacketing systems may be considered at the specifier's discretion.

5.3.3.2 All outdoor jacket systems shall be banded using 12.5mm .020 aluminum banding with wing seals at 300mm centres.

5.3.4 Pipe and Hanger Supports

5.3.4.1 Pipe support load bearing insulation shall be fabricated by a Resolco approved fabricator from Resolco CFC & HCFC free heavy density Insul-Phen in 60Kg/m³ or 80Kg/m³ density in accordance with the table. The upper 180° section of the support can be fabricated from standard 40Kg/m³ density Insul-Phen and 40Kg/m³ can be used at the support point up to certain pipe diameters (contact your local Resolco fabricator or technical rep) with a 300mm long saddle.

5.3.5 Fastening Accessories (Tape, Strapping etc.)

5.3.5.1 Tape for fastening pipe covering insulation shall be 20mm Fibreglass reinforced strapping tape or equivalent.

6.0 INSTALLATION

6.1 Application of Insulation (All Services)

6.1.1 General

6.1.1.1 The design requirements of this specification are general and where it is not specific, pipe insulation, pipe fitting, flange and valve insulation and curved segments shall be fabricated by an approved Resolco fabricator.

6.1.1.2 Prior to installation of insulating material, its thickness shall be verified in accordance with the operating temperature and diameter of pipe and equipment. If thickness or material do not verify, Subcontractor shall contact Owner to resolve the conflict. The Subcontractor shall not in any case establish a new thickness or select different material without written approval.

6.1.1.3 The insulation shall be protected from moisture and weather before and during application.

6.1.1.4 All insulation and surfaces to be insulated shall be dry and free from moisture prior to application of insulation and vapour barrier.

6.1.1.5 Piping with 250mm outside diameter and less shall be insulated with 2-piece "sectional" pipe insulation. Above 250mm O.D., sectional pipe covering or prefabricated curved segments may be used.

6.1.1.6 All insulation sections shall be trimmed and tightly butted to eliminate voids, gaps or open joints. Joint sealer shall not be used to fill these imperfections. The insulation shall be fitted to achieve tight fit.

6.1.1.7 Insulation ends shall be rubbed against each other to achieve tight fit prior to application of joint sealer.

6.1.1.8 Application of Joint Sealer

6.1.1.8.1 Joint sealer should be considered where there is an increased high condensation risk.

6.1.1.9 Application of Tape and Banding

6.1.1.9.1 Insulation shall be fastened circumferentially with 20mm. wide tape 50mm from each end and one in the middle of pipe section and a minimum of two tapes per each section of equipment insulation. The tapes shall be pulled tight to seal all joints. Bands shall be used above 406mm O.D. and on all curved wall segments where tapes do not close insulation joints tightly.

6.1.1.9.2 All tapes shall be taped at least 50% on itself or overlapped by 50mm.

6.1.1.9.3 Tightening of tapes or bands shall not crush or crack the insulation. Cracked or broken insulation shall be replaced.

6.1.1.10 Application of Insulation for Elbows, Valves and Fittings

6.1.1.10.1 Insulation material for bends and elbows shall be two piece prefabricated cover made from same insulation material and same thickness as for straight piping or fabricated at site from straight section.

6.2 Cold Insulation Pipe Support

6.2.1 Pre-insulated pipe supports for cold service shall be used for supporting pipes. Pipe support spacing shall be calculated per each system allowing for pipe weight, insulation weight, pipe content weight and appropriate safety factor. The spacing shall be calculated by a qualified piping engineer or follow the project pipe support specification.

6.2.2 High compressive strength insulation such as Resolco Insul-Phen 60Kg/m³ or 80Kg/m³ phenolic foam shall be used at the saddle supports. The bearing surface shall be calculated to withstand stresses on pipe support system.

6.2.3 Insulation protection saddles made from galvanized carbon steel with 180° arc shall be provided and installed at all pipe hangers and supports. The curvature of saddle shall fit the outside diameter of insulation.

6.2.4 The vapour sealed high density Insul-Phen shall be covered with vapour barrier and protective cladding of flat metal sheeting and the cold shoes shall be properly fastened upon completion of insulation work.

6.3 Vapour Barrier and Cladding (Indoor Service)

6.3.1 Application of Aluminium Foil Vapour Barrier

6.3.1.1 Fabricated insulation shall have factory applied integral Aluminium Foil vapour barrier.

6.3.1.2 Vapour barrier jacket must be sealed longitudinally by a 50mm wide Aluminium Foil tape. Butt joints shall be sealed with 50mm wide Aluminium Foil tape.

6.3.1.3 Aluminium Foil vapour barrier shall be wrinkle free and shall cover all outer surfaces of insulation.

6.3.1.4 Irregular surfaces, contraction joints and fittings shall be vapour sealed with reinforced vapour barrier mastic. Mastic shall be allowed to dry.

6.4 Vapour Barrier and Cladding (Outdoor Service)

6.4.1 General

6.4.1.1 All insulated surfaces shall be covered with a vapour barrier. The vapour barrier and metal weatherproofing shall be installed as soon as practical after the insulation work has been completed. The Vapour barrier shall be continuous on all surfaces including contraction joints, valves, flanges, etc.

6.4.1.2 All materials applied in one day shall have the vapour barrier applied the same day. Any exposed insulation shall be temporarily protected with a combination moisture and/or UV barrier such as black polyethylene film to keep rain water out. The film shall be sealed to pipe or equipment.

6.4.2 Application of Vapour Barrier Mastic

6.4.2.1 A vapour barrier coating of mastic reinforced with glass cloth shall be applied to all outer surfaces of irregular surfaces and fittings such as elbows, valves, valve packing glands, vessel heads etc.

6.4.2.2 Vapour barrier mastic shall be applied to a minimum total dry (cured) film thickness of 0.75mm. or as recommend by the mastic manufacturer.

6.4.2.3 The first layer of mastic shall be applied evenly by suitable means as a tack coat over insulation.

6.4.2.4 Reinforcing cloth shall then be stretched tight, embedded into the still tacky first layer of mastic with minimum 3 inch overlap.

6.4.2.5 Apply second layer of mastic.

6.4.2.6 Vapour barrier mastic shall be carried from outer surface of insulation to the uninsulated metal parts of the vessel or piping to provide continuous vapour seal at all terminations, projections, nozzles, and caps.

6.4.2.7 Vapour barrier on attachments shall be extended an additional 150mm over uninsulated surface.

6.4.2.8 The glass cloth shall be completely covered with mastic and there shall be absolutely no cracks, holes, thin spots or open joints in the vapour barrier.

6.4.2.9 The vapour barrier mastic shall be allowed to dry per Manufacturer's recommendation before application of metal jacketing.

6.4.2.10 Final dry thickness of vapour barrier shall be checked. The vapour barrier shall be continuous and shall be checked for cracks, thin spots and pinholes, etc. Unsatisfactory areas shall be repaired.

6.4.3 Application of Metal Cladding for Piping - If Required

6.4.3.1 Metal jacketing shall be applied over all outer surfaces of vapour sealed insulation work located outdoors.

6.4.3.2 All openings in the jacket for nozzles, brackets, protrusions, etc. shall be cut as close as possible to achieve a tight fit. Silicone or butyl based caulking compound shall be used to seal all the projections and penetrations.

6.4.3.3 A minimum of 2 inch overlap shall be provided on all circumferential and longitudinal joints.

6.4.3.4 The longitudinal lap on horizontal piping and equipment shall be located alternatively at either 10 o'clock or 2 o'clock positions to shed rain water.

6.4.3.5 Circumferential lap shall have one band and intermediate bands shall be installed at 300mm centres.

6.4.3.6 Jacketing on vertical pipes shall be supported by "S" clips made from stainless steel metal bands.

6.4.4 Application of Metal Cladding for Equipment

6.4.4.1 Aluminum shall be used for all horizontal equipment, vessel heads, manways, nozzles and flashing.

6.4.4.2 Jacketing for horizontal and vertical cylindrical surfaces shall be applied with 3 inch circumferential and longitudinal laps, except 40mm corrugated jacketing shall be lapped a minimum of two corrugations.

Resolco Insul-phen Rigid Phenolic Insulation

INSULATION THICKNESS

Based on UAE conditions

Internal - Maximum dry bulb 24°C, Relative Humidity 55%

External - Maximum dry bulb 46°C, Relative Humidity 85%

Chilled Water temp 6°C. Domestic Hot Water 75°C

Table 1 - Insulation Thickness

These are typical values and all recommendations should be verified with Resolco for suitability and compliance with local/project conditions.

Pipe Size (mm OD)	Chilled and Cold Water		Domestic Hot Water	
	Internal (mm)	External (mm)	Internal (mm)	External (mm)
21	20	30	15	25
27	20	30	15	25
34	20	35	15	25
42	20	35	20	25
48	20	35	20	25
60	20	35	20	25
76	25	40	20	25
89	25	40	20	30
114	25	40	20	30
127	25	40	20	30
168	25	40	25	30
219	25	45	25	30
273	30	45	25	35
324	30	45	25	35
356	30	50	25	35

Table 2 - Pipe Supports

Heavy density Insul-phen rigid foam (properties per manufacturers data sheet)

Pipe Size (mm OD)	Typical Support Spacing (metres)	Foam Density (Kg/m ³)	Support Length (mm)	Metal Spreader Plate Gauge
21	3-4	60	100	None
27	3-4	60	100	None
34	3-4	60	100	None
42	3-4	60	100	None
48	3-4	60	100	None
60	4	60	100	20ga
76	4	80	100	20ga
89	4	80	100	20ga
114	4	80	100	20ga
127	4	80	100	20ga
168	6	120	125	16ga
219	6	120	125	16ga
273	6	120	125	16ga
324	4	120	200	14ga
356	4	120	200	14ga

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Information is given subject to the condition that persons acting on it will perform all relevant tests and take full responsibility for their own final determination as to its suitability for their purposes prior to use in any specific intended application. Under no circumstances will Resolco be responsible for any damages incurred as a result of the use of or reliance upon any information relating to Insul-phen given in this literature.

Insul-phen is sold for commercial and/or industrial use only and should be used in accordance with the design of the complete insulation system specified by professionally competent engineers and consultants.

Insul-phen should be applied following the manufacturer's installation instructions and to meet the standards set out in the National Commercial and Insulation Standards (1999 Fifth Edition) as published by MICA and endorsed by NIA.

Any recommendations made by Resolco or its representatives are based on what is believed to be reliable test data, experiments and experience; without any guarantee of accuracy. It should be noted that surface burning characteristics derived from ASTM E 84 are not intended to reflect hazards presented by Insul-phen under actual fire conditions. Conditions of sale are available on request.



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