
STANDARD SPECIFICATION

THERMAL AND ACOUSTIC INSULATION

FOR
H.V.A.C. INDUSTRY AIRHANDLING EQUIPMENT
CHILLED WATER AND REFRIGERATION PIPEWORK
HOT WATER AND STEAM PIPEWORK
BITUMEN TANKERS
EXTERNAL FIRE PROTECTION OF DUCTWORK AND PENETRATIONS

PRESENTATION COPY
REVISED 2000

DISCLAIMER
The contents of this Specification are designed as a guide and for information purposes only. **T.I.C.A. Queensland** is an Association of Insulation contractors and suppliers, whose purpose is to comply with the specification and instructions of the consulting Engineers and Architects. This specification is to be used in conjunction with and not to supersede the Mechanical Services consulting engineers specification.

The intent of this specification is to supply a commercially acceptable product, and no responsibility will be accepted by **T.I.C.A. Queensland** or its members for any misconceptions or misunderstandings arising from the use of this Standard and its addendums.
SCOPE

This Standard Specification sets out the requirements in regard to the quality of materials and standards of workmanship which shall be adopted in the supply and erection of thermal and acoustic insulation.

SECTION 1

FOR DUCTWORK, AIR HANDLING. EQUIPMENT, FAN CHAMBERS CONDITIONERS AND APPARATUS CONNECTIONS, HANDLING AIR BETWEEN 1 DEG. AND 65 DEG. C.

SECTION 2

FOR CHILLED WATER - REFRIGERATION PIPEWORK-VESSELS - METAL SHEATHING.

SECTION 3

FOR HOT WATER-STEAM PIPEWORK-VESSELS - METAL SHEATHING.

SECTION 4

INSULATING AND METAL SHEATHING OF BITUMEN TANKERS.

SECTION 5

DESIGN REQUIREMENTS FOR EXTERNAL FIRE PROTECTION OF DUCTWORK AND PENETRATIONS

STANDARDS

AS 1045 Method of measurement of absorption coefficients in a reverberation room.
AS 1301 Methods of test for pulp and paper (metric units) P419ts - Water vapour transmission rate of paper.
AS 1366 Rigid cellular plastics sheets for thermal insulation
   Part 1 - Rigid cellular polyurethane
   Part 2 - Rigid cellular polyisocyanurate
   Part 3 - Rigid cellular polystyrene
AS 1530 Methods for fire tests on building materials, components and structures.
   Part 3 - Test for early fire hazard properties of materials.
   Part 4 - Fire-resistance tests of elements of construction.
AS 1668 SAA Mechanical Ventilation and Air conditioning Code
   Part 1 - Fire precautions in buildings with air-handling systems.
AS 2352 Glossary of terms for thermal insulation of buildings.
ASTMC335 Standard test method for steady state heat transfer properties of horizontal pipe insulation.
ASTMD828 Fibrous Glass Duct Construction Standard.
BS 874-1908 Methods for Determining Thermal Insulating Properties, with Definitions of Thermal Insulating Terms.
AS 4200 Pliable building membranes and underlays
AS 4508 Thermal Resistance of insulation for ductwork used in building airconditioning
AS 4254 Ductwork for airconditioning systems in buildings.
# STANDARD SPECIFICATION
## INSULATION AND SOUND ABSORPTION
### SECTION 1
#### CONTENTS

<table>
<thead>
<tr>
<th>SUBSECTION</th>
<th>CLAUSE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MATERIALS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. DUCTWORK INSULATION MATERIALS</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>2. DUCTWORKS INSULATION SURFACE FACINGS</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>3. DUCTWORK PRESSURE SENSITIVE TAPES</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td><strong>GENERAL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. ELECTRIC DUCT HEATER INSULATION</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>2. CUSHION HEAD BOX</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>3. DAMPERS</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>4. INSULATION AT FLEXIBLE CONNECTIONS</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>5. INSULATION OF REGISTERS</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>6. DUCTWORK INSULATION FIXINGS</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td><strong>INSULATION REQUIREMENTS AND METHODS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. DUCTWORK INSULATION SYSTEM SELECTION</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>2. DUCTWORK INTERNAL INSULATION SYSTEMS</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>3. DUCTWORK EXTERNAL INSULATION SYSTEMS</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>4. DUCTWORK INTERNAL INSULATION APPLICATION (STANDARD INTERNAL)</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>5. DUCTWORK INTERNAL INSULATION APPLICATION (METAL INTERNAL)</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>6. DUCTWORK EXTERNAL INSULATION APPLICATION (STANDARD EXTERNAL)</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>7. DUCTWORK EXTERNAL INSULATION APPLICATION (METAL EXTERNAL)</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>8. ACOUSTIC WALLS AND CEILINGS</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>9. BUILT UP FILTER PLENUMS</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>DRAWINGS</strong></td>
<td></td>
<td>01</td>
</tr>
<tr>
<td>HEATER BANK INSULATION T.I.C.A.</td>
<td></td>
<td>02</td>
</tr>
<tr>
<td>CUSHION HEAD BOX INSULATION T.I.C.A.</td>
<td></td>
<td>TICA-1</td>
</tr>
<tr>
<td>PIPE PENETRATION</td>
<td></td>
<td>-2</td>
</tr>
<tr>
<td>FIRE RATING</td>
<td></td>
<td>-3</td>
</tr>
</tbody>
</table>
MATERIALS

1. DUCTWORK INSULATION MATERIALS

TERMINOLOGY: To AS 2352.

MINERAL WOOL: Resin bonded to form batt, board or blanket.

Maximum thermal conductivity: 0.036 W/mK at 20°C.
Alkalinity: pH 7 - 9
Moisture absorption: Non-hydroscopic.
FLEXIBLE TYPE: Be in a flexible blanket form.

SEMI-RIGID TYPE:
Form: Batt or board.

Rigidity: A mean deflection of 6mm for a 50mm thick material and 20mm for a 25 mm thick material, tested as follows:

- Freely support a 900 mm x 1500 mm test piece on its longer sides;
- Allow the test piece to stand for 10 minutes and measure the vertical deflection;
- Turn the test piece over and repeat the test;
- Average the results.

Early Fire Hazard Characteristics: To AS 1530 Part 3:
- Spread of flame index: 0
- Smoke developed index: 3

Acoustic requirements: No less than the following table:

Table 1: Reverberation from method to AS 1045:

<table>
<thead>
<tr>
<th>Insulation:</th>
<th>Absorption coefficients (nominal) at:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>125Hz 250Hz 500Hz 1000Hz 2000Hz</td>
</tr>
<tr>
<td>Perforated foil faced:</td>
<td></td>
</tr>
<tr>
<td>25mm thick:</td>
<td>0.10 0.25 0.68 0.94 0.82</td>
</tr>
<tr>
<td>50mm thick:</td>
<td>0.21 0.62 0.96 0.94 0.83</td>
</tr>
<tr>
<td>Perforated metal clad:</td>
<td></td>
</tr>
<tr>
<td>- 50mm thick:</td>
<td>0.20 0.73 1.00 0.99 0.89</td>
</tr>
</tbody>
</table>
MATERIALS (CONT’D)

2.  DUCTWORKS INSULATION SURFACE FACINGS

MATERIAL:

TYPE A:

Use Insulation Solutions Sisalation 450, Bradford Thermofoil 750, Insulco 550, or approved equal EXTRA HEAVY DUTY.

Physical properties:  Tensile Strength (ASTM D828)
- Longitudinal Direction 13.0 kN/m
- Transverse Direction 10.5 kN/m

INTERNAL FACING:

Perforations:  Uniformly spaced 2.5mm diameter holes providing 10% open area.

EXTERNAL FACING AS VAPOUR BARRIER:

Water vapour permeance:  To AS 1301 P419ts Condition B
- Creased:  2.26 ng/N.s (maximum);
- Uncreased:  1.13 ng/N.s (maximum);

3.  DUCTWORK PRESSURE SENSITIVE TAPES

MATERIAL:  Use Precision 493 or approved equal.
Adhesive:  Non toxic, high tack synthetic pressure sensitive type.
Liner:  Silicone coated paper.
Backin:  Aluminium foil laminate.
Width:  63mm minimum.

PROPERTIES:
- Tensile strength:  120N/25 mm (average minimum).
- Shear adhesion:  To Table 3.2 Shear Adhesion Tests
- Peel adhesion at 180° 17 N/25mm (average minimum).
- (When tested to SMACNA Fibrous Glass Duct Construction Standard)

Water vapour permeance:  To AS 1301 P419ts Condition B.
- Creased:  2.26 ng/N.s (maximum)
- Uncreased:  1.13 ng/Ns (maximum)
MATERIALS (CONT’D)

GENERAL

1. ELECTRIC DUCT HEATER INSULATION

REQUIREMENT: Provide ductwork housing electric duct heaters with 6mm minimum thickness internal insulation as specified in AS 1668, Part 1, Clause 4.4.2. and method shown on drawing T.I.C.A.-01.

2. CUSHION HEAD BOX

REQUIREMENT: Refer to Cushion Head Box Drawing T.I.C.A.-02.

3. DAMPERS

INTERNAL: Leave clearance between the insulation and the edge of the splitter or manually operated damper blades, to prevent damage to the insulation where the damper sweeps.

EXTERNAL: For manual and motorised dampers provide insulated sheet metal hat sections to encase the dampers. Make the hat sections removable for maintenance of damper mechanism.

4. INSULATION AT FLEXIBLE CONNECTIONS

COVERAGE: Cover connection with flexible fibreglass blanket complete with vapour barrier to thickness of adjacent ductwork insulation.

WEATHER PROTECTION: Where connections are exposed to the weather, protect the connection with a weatherproof sheet metal cover by the Airconditioning Contractor.

5. INSULATION OF REGISTERS

EXTENT: Provide insulation to registers as follows:

- Registers within 4m of a doorway to unairconditioned space.
- Registers in a roof space or other unairconditioned space.
MATERIALS (CONT’D)

GENERAL

1. ELECTRIC DUCT HEATER INSULATION

REQUIREMENT: Provide ductwork housing electric duct heaters with 6mm minimum thickness internal insulation as specified in AS 1668, Part 1, Clause 4.4.2. and method shown on drawing T.I.C.A.-01.

2. CUSHION HEAD BOX

REQUIREMENT: Refer to Cushion Head Box Drawing T.I.C.A.-02

3. DAMPERS

INTERNAL: Leave clearance between the insulation and the edge of the splitter or manually operated damper blades, to prevent damage to the insulation where the damper sweeps.

EXTERNAL: For manual and motorised dampers provide insulated sheet metal hat sections to encase the dampers. Make the hat sections removable for maintenance of damper mechanism.

4. INSULATION AT FLEXIBLE CONNECTIONS

COVERAGE: Cover connection with flexible fibreglass blanket complete with vapour barrier to thickness of adjacent ductwork insulation.

WEATHER PROTECTION: Where connections are exposed to the weather, protect the connection with a weatherproof sheet metal cover by the Airconditioning Contractor.

5. INSULATION OF REGISTERS

EXTENT: Provide insulation to registers as follows:

- Registers within 4m of a doorway to unairconditioned space.
- Registers in a roof space or other unairconditioned space.
GENERAL (CONT'D)

6. DUCTWORK INSULATION FIXINGS

FIXING PINS: The following types, installed in accordance with the manufacturer's instructions may be used:

- Welded pin with integral head;
- Welded pin with press-on head;

Characteristics: Fixing pins shall:

- Be corrosion resistant;
- Not damage insulation;
- Not project more than nominally through the insulation;
- Indefinitely sustain a 25 kg tensile dead load test perpendicular to the duct wall;
- Be the correct length for the specified insulation thickness;

INSULATION REQUIREMENTS AND METHODS

1. DUCTWORK INSULATION SYSTEM SELECTION

EXTENT AND TYPES OF INSULATION: The requirements for extent, types and required thickness to be clearly shown on the drawings or schedules in the specification.

2. DUCTWORK INTERNAL INSULATION SYSTEMS

TYPE STANDARD (INTERNAL)
Insulation type: Semi-rigid
Surface finish: Factory applied perforated reinforced aluminium foil laminate

TYPE METAL (INTERNAL)
Insulation type: Semi-rigid for rectangular ductwork
Flexible for circular and flat oval ductwork
Surface finish: Perforated metal clad.

3. DUCTWORK EXTERNAL INSULATION SYSTEMS

TYPE STANDARD (EXTERNAL)
Insulation type: Flexible
Surface finish: Factory applied reinforced aluminium foil laminate
Vapour barrier: Required

TYPE METAL (EXTERNAL)
Insulation type: Semi-Rigid
Surface finish: Metal clad
Vapour barrier: Factory applied reinforced aluminium foil laminate
INSULATION REQUIREMENTS AND METHODS (CONT’D)

4. DUCTWORK INTERNAL INSULATION APPLICATION (STANDARD INTERNAL)

REQUIREMENT: Place the insulation so that the surface designed to be exposed faces the air stream. Completely cover with liner the portion of the duct designated to be lined, using an individual piece of insulation for each side of the duct.

Edges: Factory bond aluminium foil laminate to the insulation to allow a turn back of the facing under the insulation for a distance of not less than 75 mm without crushing the edges. Bond the turn back to the insulation. Do not join insulation or laminate unless the size of duct makes this impractical. Allow insulation to extend proud of duct work at each end to allow cushion joints to fully seal during assembly.

Fixing pins: Support the edges using fixing pins spaced at 300 mm approximate centres parallel to the edge and within 50 mm of an end or 75 mm of a joint. Elsewhere, fix the insulation at 300 mm maximum centre with a minimum of one row per duct side.

Clips: Use bevel edged metal speed clips with a minimum diameter 20 mm. Secure speed clip flush to the face of the insulation without depressing the surface more than 5 mm.

5. DUCTWORK INTERNAL INSULATION APPLICATION (METAL INTERNAL)

REQUIREMENT: Place the insulation so that the surface designed to be exposed faces the air stream. Support the insulation against the duct surfaces with 0.5mm zincanneal sheet metal uniformly perforated with 2.5 mm diameter holes providing 10% open area, and cut and folded to the inside dimension of the duct to form an overlapping joint at a corner. Rivet the overlapping surfaces at 300 mm approximate centres.

COVERAGE: Completely cover with liner the portions of the duct designated to be lined. Overlap the adjacent sides at the corners. Use as individual piece of insulation for each side of the duct. Where this is not possible, butt the edges of adjacent pieces.

FIXING: Use Z. Section 0.6 galvanised steel barrier fastened to the ductwork with blind pop rivets. Provide conductivity barrier to prevent cold tracking. For duct sides over 600 mm hold in position at 600 mm maximum centres with a minimum of one row of rivets per duct side, keeping cold bridging to a minimum.

6. DUCTWORK EXTERNAL INSULATION APPLICATION (STANDARD EXTERNAL)

REQUIREMENT: Wrap the insulation around the outside of the duct. Completely cover with insulation the portions of the duct designated to be insulated. Keep the number of joints to a minimum.

JOINTS: Square and butt together the edges of adjacent pieces of insulation.

VAPOUR SEALING: Lap the vapour barrier at least 50 mm at the joints. Seal with 63 mm reinforced laminated aluminium foil pressure sensitive tape. Where the blanket is impaled over pins, cover with a 63 mm square piece of foil and adhesive or 63 mm square piece of the same pressure sensitive tape to complete the vapour barrier.
INSULATION REQUIREMENTS AND METHODS (CONT'D)

6. DUCTWORK EXTERNAL INSULATION APPLICATION (STANDARD EXTERNAL) (cont’d)

**FIXING**

Pins: For horizontal ducts 600 mm and above hold the insulation in position on the underside by means of fixing pins spaced at 400 mm maximum centres with a minimum of one row. For vertical duct 600 mm and above provide pins to all sides at maximum of 400 mm centres.

Straps: Use 12 mm wide poly strapping at 600 mm centres to support insulation.

7. DUCTWORK EXTERNAL INSULATION APPLICATION (METAL EXTERNAL)

**REQUIREMENT:** Insulation for this method to be semi rigid complete with vapour barrier before applying metal sheathing.

**SUPPORT:** Support the insulation against the duct surface with 0.6 mm galvanised sheet steel cut and folded to the outside dimensions of the insulation.

**JOINT IN SHEATHING:** Lap the joints in the sheathing for a distance of not less than 30 mm and rivet at 200 mm centres. Factory made joints may be of the grooved seam or spot welded types. Use self tapping screws where the removal of the sheathing for maintenance or access to dampers and the like is required.

**SEALING:** Where exposed to weather seal the joints with a silicone mastic sealant.

8. ACOUSTIC WALLS AND CEILINGS

**REQUIREMENT:** Provide the following:-

- Resin bonded mineral wool.
- Minimum thickness - 50 mm
- Semi rigid batt or board form.
- Be fixed behind 0.6 mm acoustic grade perforated zincanneal sheet having uniformly spaced perforations of 2.5 mm diameter providing 10% open area.

**FIXING:**

Use 50 x 50 x 50 mm Z sections manufactured from 0.6 mm galvanised steel fixed to walls or ceilings with ‘Expandable Anchors’ or equal, at 600 mm centres. Leave the Z sections 150 mm clearance above all floors and be finished at this point with ‘U’ channels manufactured from 0.6 mm galvanised steel.

Cut the insulation batts or boards to size and fit between the Z sections.

Perforated sheeting shall then be fitted to the Z sections with a minimum overlap of 20 mm at all joints. At exposed edges of sheets and at all flashings around ducts, doors and openings the edge of the sheeting to have a 10mm feather to give a neat finish. Fix the perforated metal with pop rivets at 200 mm centres.
INSULATION REQUIREMENTS AND METHODS (CONT’D)

9. BUILT UP AIR FILTER PLENUMS

REQUIREMENT: In filter access area plenums only. Cover all insulated areas (including floor) with 0.6 thick perforated zincanneal steel sheeting.

WALLS AND CEILING: Overlap sheeting a minimum of 20mm on all edges and rivet to galvanised steel Z or channel section.

FLOOR: For insulated floors provide Z sections one way at 200mm centres on the longest side.
# STANDARD SPECIFICATION

**CHILLED WATER - REFRIGERATION PIPEWORK**

**VESSELS - METAL SHEATHING**

## SECTION 2

### CONTENTS

<table>
<thead>
<tr>
<th>SUBSECTION</th>
<th>CLAUSE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MATERIALS</strong></td>
<td>1. PIPEWORK INSULATION MATERIALS</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2. PIPEWORK INSULATION SURFACE FACINGS</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>3. PIPEWORK PRESSURE SENSITIVE TAPES</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>4. ELASTOMERIC SPONGE PRESSURE SENSITIVE TAPE</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>5. TANK AND VESSEL INSULATION MATERIAL</td>
<td>2</td>
</tr>
<tr>
<td><strong>GENERAL</strong></td>
<td>1. PIPEWORK SUPPORTS</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>2. CONDENSATE DRAINS</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>3. PUMPS</td>
<td>3</td>
</tr>
<tr>
<td><strong>INSULATION REQUIREMENTS AND METHODS</strong></td>
<td>1. PIPEWORK EXTENT OF INSULATION</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>2. PIPEWORK INSULATION THICKNESS</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>3. PIPEWORK VAPOUR BARRIER TYPES</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>4. PIPEWORK INSULATION APPLICATION</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>5. PIPEWORK METAL SHEATHING</td>
<td>6</td>
</tr>
</tbody>
</table>
1. CHILLED WATER - REFRIGERATION PIPEWORK
   VESSELS - METAL SHEATHING
   SECTION 2

MATERIALS

1. PIPEWORK INSULATION MATERIALS - INSULATION

   EARLY FIRE HAZARD CHARACTERISTICS: To AS 1530 Part 3:

   Not to exceed the following:
   ■ Spread of flame index: 0
   ■ Smoke developed index: 5

   TERMINOLOGY: To AS 2352

   MINERAL WOOL: Fibres made from molten glass and rock (includes fibreglass), resin-bonded to form one-piece tubular section.

   Requirement: Do not use mineral wool for below ambient pipework with the following exceptions:
   ■ For filling air gaps around valves and fittings.
   ■ For wrapping of flexible connections to maintain flexibility.

   EXPANDED POLYSTYRENE (E.P.S.): To AS 1366 Part 3, Class S and colour coded brown, machine cut to form tubular half-sections for pipe insulation or batts for insulating fittings.

   ELASTOMERIC SPONGE: Chemically blown closed-cell PVC or equivalent elastomeric material formed into tubular sections for pipe insulation, or sheets for insulating fittings, with a smooth natural finish, and vapour barrier properties.

   Vapour barrier permeability: Not greater than 0.25 metric permeability/cm when tested by the desiccant method to ASTM C335.

2. PIPEWORK INSULATION SURFACE FACINGS

   MATERIAL:
   Use Insulation Solutions Sisalation 450, Bradford Thermfoil 750, Insulco 550 or approved equal EXTRA HEAVY DUTY GRADE

   Physical Properties:

   Tensile Strength (ASTM D828)
   Longitudinal Direction  13.0 kN/m
   Transverse Direction    10.5 kN/m

   EXTERNAL FACING AS VAPOUR BARRIER
   Water vapour permeance: To AS 1301 P419ts Condition B
   ■ Creased: 2.26 ng/N.s (maximum)
   ■ Uncreased: 1.13 ng/N.s (maximum)
MATERIALS (CONT’D)

3. PIPEWORK PRESSURE SENSITIVE TAPES

MATERIAL: Precision 493 or approved equal.
Adhesive: Non toxic, high tack synthetic pressure sensitive type.
Liner: Silicone coated paper.
Backin: Aluminium Foil Laminate
Width: 50 mm minimum

-OR-

MATERIAL: Precision 400 F or approved equal.
Adhesive: Non toxic, high tack synthetic pressure sensitive type.
Liner: Silicone coated paper.
Backin: Aluminium Foil Laminate
Width: 50 mm minimum

4. TANK AND VESSEL INSULATION MATERIAL

EXPANDED POLYSTYRENE (E.P.S.): To AS 1366 Part 3, Class S and colour coded brown, moulded to the contour of the tank or vessel.

GENERAL

1. PIPEWORK SUPPORTS

Spacers:
For cold pipe systems: Polyurethane Blocks Extra Heavy Duty Foil

To insulated pipe: Provide a spacer between the bracket and the pipe, of length not less than twice the bracket width and of thickness equal to the insulation. Apply the reflective foil laminate vapour barrier between the spacer and the bracket of full width to allow continuation of the vapour barrier. If metal sheathing is required provide a .5 zincanneal band between the vapour barrier and bracket to allow metal sheathing to be swaged down on each side of the bracket.

REQUIREMENT: Complete the vapour barrier and metal sheathing band at pipe supports during the construction stage to prevent removal of brackets at the insulation stage.

2. CONDENSATE DRAINS:

REQUIREMENT: Use elastomeric closed cell pipe insulation with a minimum of 13 mm wall thickness on condensate drains and on low or medium temperature pipework where limited space prohibits the use of other specified insulation. Where practical install without slitting; where slitting is unavoidable, it shall be glued and taped with P.P.C. foam tape.
GENERAL (CONT’D)

3. **NOTE TO MECH. CONTRACTORS**

   DRIP TRAY: Provide and fit stainless steel drip trays for all chilled water pumps strainers and uninstalled fittings. Tray to be sized to collect condensate from the above items and be fitted with a 20 mm drain piped to waste.

INSULATION REQUIREMENTS AND METHODS

1. **PIPEWORK EXTENT OF INSULATION**

   COLD PIPING: Piping carrying fluids at temperatures below ambient for chilled water piping, cold refrigerant and condensate piping, and associated valves and fittings.

   VAPOUR BARRIER: To be continuous over insulation on all piping carrying fluids at temperatures below ambient.

2. **PIPEWORK INSULATION THICKNESS**

   MINIMUM THICKNESS: To the following table:

<table>
<thead>
<tr>
<th>PIPE SIZE</th>
<th>15-40mm</th>
<th>50-80mm</th>
<th>100-125mm</th>
<th>150mm</th>
<th>200mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulate in two layers</td>
<td>- all joints to be staggered</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Below - 35 deg. C</td>
<td>75mm</td>
<td>75mm</td>
<td>125mm</td>
<td>150mm</td>
<td>150mm</td>
</tr>
<tr>
<td>Below - 20 deg. C</td>
<td>65mm</td>
<td>75mm</td>
<td>75mm</td>
<td>100mm</td>
<td>100mm</td>
</tr>
<tr>
<td>Below - 2 deg. C</td>
<td>50mm</td>
<td>65mm</td>
<td>70mm</td>
<td>75mm</td>
<td>100mm</td>
</tr>
<tr>
<td>Over - 2 deg. C. 9 deg. C</td>
<td>40mm</td>
<td>40mm</td>
<td>50mm</td>
<td>50mm</td>
<td>50mm</td>
</tr>
<tr>
<td>9 deg. C to 20 deg. C</td>
<td>25mm</td>
<td>25mm</td>
<td>25mm</td>
<td>40mm</td>
<td>50mm</td>
</tr>
</tbody>
</table>

3. **PIPEWORK VAPOUR BARRIER TYPES**

   METHOD 1:

   REFLECTIVE FOIL LAMINATE:
   Insulation Solutions heavy duty sisalation 450, Bradford Thermofoil 750, Insulco 550 or approved equal.

   METHOD 11:

   MASTIC: An approved No.10 water based fire resistant mastic, reinforced with an open-weave glass fibre fabric.
INSULATION REQUIREMENTS AND METHODS (CONT’D)

4. PIPEWORK INSULATION APPLICATION

MATERIAL: Use E.P.S. for all applications unless other type shown.

REQUIREMENT: Use for pipes carrying fluids at temperatures below ambient.

METHOD 1:

PROCEDURES: Except for factory insulated pipe, do not begin to apply insulation until pipework pressure testing is complete. Before installing insulation, ensure that scale, rust, grease and the like has been removed from the pipework surface by the Mechanical Contractor and that the surface to be insulated is clean and dry.

PROTECTION: Ensure that all steel pipework has had one coat of zinc phosphate primer applied by the Mechanical Contractors before insulation commences.

PREPARATION:

TYPE A: Use machine cut pipe sections to specified thickness. Factory bond the aluminium foil laminate to the insulation with a longitudinal lap.

APPLICATION: In order to prevent cold tracking and also moisture travelling along the pipework, apply a coating of adhesive conforming to early fire hazard properties to all mating surfaces of the insulation sections. In addition, apply a coating of the same adhesive to the internal surface of the insulation sections mating to the pipe.

TYPE B: Use machine cut pipe sections to specified thickness. Factory bond the aluminium foil laminate to the insulation with a longitudinal lap of not less than the wall thickness. Internal diameter of the insulation section to be 2 mm larger than pipe.

APPLICATION: Apply an oil based mastic, Fosters - 30-45.
- All mating faces of polystyrene on joints between sections.
- To the section of pipe to be insulated.
- To the faces of the polystyrene and the pipe support blocks at the joints.

Longitudinal joints to be staggered a minimum of 25 mm between sections.

BENDS: Cut the insulation into segments to follow the contour of the bend, glue together and fix to the pipework. Use mitred elbows where this is not possible.

LONGITUDINAL LAP: Seal the aluminium foil laminate to complete the vapour barrier.

JOINTS: Fix the aluminium pressure sensitive tape over all joints. Vapour barrier to be continuous over all fittings, flanges and valves. All joints to be neatly finished. Provide a seal completely free of perforations or leaks.

STRAPS: Fix the insulation at 450 mm centres using poly strap.
4. PIPEWORK INSULATION APPLICATION (CONT’D)

METHOD 1: (cont’d)

FITTINGS, VALVES AND FLANGES: The insulation to be cut and formed to fit around fittings, valves and flanges. Where not possible use mineral wool insulation or pug to fill the air gap. Where the insulation thickness has been reduced, apply a further layer of polystyrene section to maintain the thickness specified for the pipe.

METHOD 2:

REQUIREMENT: Completely as for Method 1 with the following exceptions:

- Delete the factory bonded aluminium laminate.
- Use metal straps in lieu of poly strap.
- Apply vapour barrier as follows.

VAPOUR BARRIER APPLICATION:

First Coat: Apply one tack coat of Fosters 30/90 Vapour Safe Mastic or Equal to the entire surface of the insulation by gloving at the rate of 0.8 litres /per square metre.

Glass Fabric: Over this wet coat a single layer of open weave No. 10 glass fabric cloth 0.1 mm thick and approximately 0.051 kg/m² to be laid. Draw cloth smooth and tight with all joints lapped not less than 50 mm.

Finish Coat: Apply finish coat of Fosters 30/90 Vapour Safe Mastic or Equal to the entire surface of the insulation by gloving at the rate of 1.6 litres /per square metre within 30 minutes after the first coat application.
INSULATION REQUIREMENTS AND METHODS (CONT’D)

5. **PIPEWORK METAL SHEATHING**

**MATERIAL:** Zincanneal sheet.

**THICKNESS:** 0.5 mm

**INSTALLATION:** Cut and roll the metal sheathing to the correct size. Longitudinal and transverse joints to be lapped a minimum of 40 mm with all exposed edges swaged. Position longitudinal and vertical joints to the most sheltered location. Cone down at terminations and transitions.

**BENDS:** Provide pre drilled lobster back bends containing at least three segments. Use mitered elbows where the size of the pipework or the radius of the pipe bend does not allow the use of segmented bends. Each segment to have an inner and outer swage formed at the transverse edges. The longitudinal joint to be fixed using pop rivets of correct length ensuring the vapour barrier is not damaged.

**FIXING:** Sheathing to be clamped at 450 mm maximum centres with 12 mm x 0.5 mm galvanised straps.

**WEATHERPROOFING:** Weatherproof external joints and fixings with non-setting mastic.

**SERVICEABLE ITEMS:** Provide removable boxes or cover plates to allow ease of access for equipment requiring maintenance. Use screws for all removable boxes. Alternatively obtain approval from Superintendent’s Representative to provide drained stainless steel drip trays as an alternative to insulating valves and fittings where the integrity of the vapour barrier cannot be maintained.

- At motorised chilled water control valves
- At valves requiring regular maintenance and adjusting.

**REQUIREMENT:**

- All insulated strainers
- Valves at pumps
- Control valves
- Flexible connections
- Demountable joints
## STANDARD SPECIFICATION

### HOT WATER - STEAM PIPING

### SECTION 3

### CONTENTS

<table>
<thead>
<tr>
<th>SUBSECTION</th>
<th>CLAUSE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MATERIALS</strong></td>
<td>1. PIPEWORK INSULATION MATERIALS</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2. PIPEWORK INSULATION SURFACE FACINGS</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>3. PIPEWORK PRESSURE SENSITIVE TAPES</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>4. ELASTOMERIC SPONGE PRESSURE SENSITIVE TAPE</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>5. TANK AND VESSEL INSULATION MATERIAL</td>
<td>2</td>
</tr>
<tr>
<td><strong>GENERAL</strong></td>
<td>1. PIPEWORK SUPPORTS</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>2. BUILDING PENETRATIONS</td>
<td>2</td>
</tr>
<tr>
<td><strong>INSULATION REQUIREMENTS AND METHODS</strong></td>
<td>1. PIPEWORK EXTENT OF INSULATION</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>2. PIPEWORK INSULATION THICKNESS</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>3. PIPEWORK INSULATION APPLICATION (MINERAL WOOL)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>4. PIPEWORK INSULATION APPLICATION (ELASTOMERIC SPONGE)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>5. PIPEWORK METAL SHEATHING</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6. TANK AND VESSEL INSULATION APPLICATION</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>7. TANK AND VESSEL METAL SHEATHING</td>
<td>4</td>
</tr>
</tbody>
</table>
HOT WATER - STEAM PIPING

SECTION 3

MATERIALS

1. PIPEWORK INSULATION MATERIALS

EARLY FIRE HAZARD CHARACTERISTICS: To AS 1530 Part 3:

Not to exceed the following:
- Spread of flame index: 0
- Smoke developed index: 3

TERMINOLOGY: To AS 2352

MINERAL WOOL: Fibres made from molten glass, rock (includes fibreglass), resin-bonded to form one-piece tubular section.

ELASTOMERIC SPONGE: Chemically blown closed-cell PVC or equivalent elastomeric material formed into tubular sections for pipe insulation, or sheets for insulating fittings, with a smooth natural finish, and vapour barrier properties.

Vapour barrier permeability: Not greater than 0.25 metric permeability/cm when tested by the desiccant method to ASTM C335.

2. PIPEWORK INSULATION SURFACE FACINGS

MATERIAL:
Use Insulation Solutions Sisalation 450 Bradford Thermfoil 750, Insulco 550 or approved equal EXTRA HEAVY DUTY.

Physical Properties:
Tensile Strength (ASTM D828)
- Longitudinal Direction: 13.0 kN/m
- Transverse Direction: 10.5 kN/m

EXTERNAL FACING AS VAPOUR BARRIER
Water vapour permeance: To AS 1301 P419ts Condition B
- Creased: 2.26 ng/N.s (maximum)
- Uncreased: 1.13 ng/N.s (maximum)

3. PIPEWORK PRESSURE SENSITIVE TAPES

MATERIAL: Precision 493 or approved equal.
Adhesive: Non toxic, high tack synthetic pressure sensitive type.
Liner: Silicone coated paper.
Backing: Aluminium Foil Laminate.
Width: 50 mm minimum.

-OR-

MATERIAL: Precision 400F or approved equal.
Adhesive: Non toxic, high tack synthetic pressure sensitive type.
Liner: Silicone coated paper.
Backing: Aluminium Foil Laminate.
Width: 50 mm minimum.

1. MATERIALS (CONT'D)
4. TANK AND VESSEL INSULATION MATERIAL

MATERIAL:
Bradford Supertel Board
Bradford Fibretex 350 or equal.
Insulation Solutions Light Equipment Insulation
Tasman Industrial Equipment Insulation.

GENERAL

1. PIPEWORK SUPPORTS

Spacers:
- For hot pipe systems: Hardwood or foamglass block, or metal spiders.

To insulated pipe: Provide a spacer between the bracket and the pipe, of length not less than twice the bracket width and of thickness equal to the insulation. If metal sheathing is required provide a 0.05 zincanneal band between the spacer and bracket to allow metal sheathing to be swaged down on each side of the bracket.

REQUIREMENT: Complete the metal sheathing band at pipe supports during the construction stage to prevent removal of brackets at the insulated stage.

2. BUILDING PENETRATIONS

REQUIREMENT: See TICA Drawings - TICA 1-2-3

INSULATION REQUIREMENTS AND METHODS

1. PIPEWORK EXTENT OF INSULATION

REQUIREMENT: Insulate the following:

HOT PIPING:
- Steam, condensate, heating, warm and hot water pipework:
- Pipework hazardous to personnel, e.g. blow down piping:
- Piped services where trace heating is incorporated:

Exceptions: Do not insulate:
- Sludge and drain valves in pipework carrying hot fluids:
- Condensate waste pipes, unless otherwise specified.
- Steam trap assemblies.
- Items requiring regular service.
- Valves-strainers or the like.
INSULATION REQUIREMENTS AND METHODS (CONT’D)

2. PIPEWORK INSULATION THICKNESS

MINIMUM THICKNESS: To the following table:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>15-40mm</th>
<th>50-80mm</th>
<th>100-125mm</th>
<th>150mm</th>
<th>200mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 deg. C to 90 deg. C.</td>
<td>25mm</td>
<td>25mm</td>
<td>25mm</td>
<td>40mm</td>
<td>50mm</td>
</tr>
<tr>
<td>Up to 120 deg. C.</td>
<td>25mm</td>
<td>40mm</td>
<td>40mm</td>
<td>50mm</td>
<td>50mm</td>
</tr>
<tr>
<td>Up to 175 deg. C.</td>
<td>25mm</td>
<td>40mm</td>
<td>50mm</td>
<td>50mm</td>
<td>65mm</td>
</tr>
<tr>
<td>Up to 200 deg. C.</td>
<td>40mm</td>
<td>50mm</td>
<td>50mm</td>
<td>65mm</td>
<td>65mm</td>
</tr>
</tbody>
</table>

3. PIPEWORK INSULATION APPLICATION - (MINERAL WOOL)

REQUIREMENT: Use for pipes carrying fluids at temperatures above ambient.

SURFACE FINISH: Use factory bonded aluminium foil laminate.

APPLICATION: Fit the insulation tightly to the pipework surface without gaps. Close butt the ends of insulation sections. Use the minimum number of joints. If the insulation is in half-sections, make only half-circumferential joints at any one place. Finish the insulation surface to a neat, true, smooth appearance without irregularities.

4. PIPEWORK INSULATION APPLICATION - (ELASTOMERIC SPONGE)

APPLICATION: For hot water run outs only.

REQUIREMENT: Use elastomeric closed cell pipe insulation with a minimum of 13 mm wall thickness on hot water and medium temperature pipework up to a max temperature of 90° C.

APPLICATION: Where practical install without slitting; where slitting is unavoidable, it shall be glued and taped with Nashua 357 tape or approved equal.

5. PIPEWORK METAL SHEATHING

MATERIAL: Zincanneal sheet.

THICKNESS: 0.5mm

INSTALLATION: Cut and roll the metal sheathing to the correct size. Longitudinal and transverse joints to be lapped a minimum of 40 mm with all exposed edges swaged. Position longitudinal and vertical joints to the most sheltered location. Cone down at terminations and transitions.
INSULATION REQUIREMENTS AND METHODS (CONT’D)

5. PIPEWORK METAL SHEATHING (CONT’D)

BENDS: Provide pre-drilled lobster back bends containing at least three segments. Use mitered elbows where the size of the pipework or the radius of the pipe bend does not allow the use of segmented bends. Each segment to have an inner and outer swage formed at the transverse edges. The longitudinal joint to be fixed using pop rivets of correct length.

FIXING: Sheathing to be clamped at 450 mm maximum centres with 12 mm x 0.5mm galvanised straps.

WEATHERPROOFING: Weatherproof external joins and fixings with non-setting mastic.

6. TANK AND VESSEL INSULATION APPLICATION

MATERIAL THICKNESS: Unless shown otherwise.

<table>
<thead>
<tr>
<th>Temperature Range</th>
<th>Required Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to and including 90 deg. C.</td>
<td>50mm</td>
</tr>
<tr>
<td>90 deg. C. to 175 deg. C.</td>
<td>75mm</td>
</tr>
<tr>
<td>Over 175 deg. C.</td>
<td>As specified</td>
</tr>
</tbody>
</table>

Installation

Wrap insulation of the required thickness around the tank or vessel with all joints tightly abutted and strapped at a maximum of 500mm centres. Form ends with cut segments of insulation to match the contours of the tank or vessel.

Encase the entire tank or vessel (excluding the base of a vertical tanks) with metal sheathing of the type specified for adjacent pipework. Provide serviceable items, (manholes, tube bundles) with removable boxes or cover plates to allow maintenance to be carried out.

7. TANK AND VESSEL METAL SHEATHING

MATERIAL: Zincanneal Sheet.

THICKNESS: 0.5mm

APPLICATION: Provide metal sheathing using method outlined in PIPEWORK METAL SHEATHING.
## STANDARD SPECIFICATION

**INSULATING & METAL SHEATHING OF BITUMEN TANKERS**

### SECTION 4

### CONTENTS

<table>
<thead>
<tr>
<th>CLAUSE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. STANDARDS</td>
<td>1</td>
</tr>
<tr>
<td>2. INSULATION MATERIALS AND METHODS</td>
<td>1</td>
</tr>
<tr>
<td>3. THICKNESS OF INSULATION</td>
<td>1</td>
</tr>
<tr>
<td>4. FIXING OF INSULATION</td>
<td>1</td>
</tr>
<tr>
<td>5. FIXING OF METAL SHEATHING TO OUTSIDE OF TANKER</td>
<td>1</td>
</tr>
<tr>
<td>6. EXTRANEOUS FITTINGS</td>
<td>1</td>
</tr>
</tbody>
</table>
INSULATING AND METAL SHEATHING OF BITUMEN TANKERS

SECTION 4.

ASSOCIATED STANDARDS

The following Standards, including any subsequent amendments, shall apply:
A. AS 1530, Part 3 - 1976 - Test for early fire hazard properties of materials.

2. INSULATION MATERIALS AND METHODS

GENERAL: Materials used for Thermal Insulation treatment, when tested for Early Fire Hazard Properties in accordance with AS 1530, Part 3, shall meet the following standards -
- Spread of Flame Index not to be greater than 0.
- Smoke Developed Index not to be greater than 3.
- Submit test certificates from a recognised testing laboratory to certify that the material offered has been tested and shown to have achieved the above standards.

Type: Materials used for Thermal Insulation shall have a Thermal Conductivity at a mean temperature of 20°C of not more than 0.032W/mk when tested in accordance with BS 874 or ASTMC 518-70.

3. THICKNESS OF INSULATION

THICKNESS: The insulation shall be 50mm thick.
MATERIAL: Insulation Solution High Temperature, Tasman High Temperature, Bradford High Temperature Thermatel or equal.

4. FIXING INSULATION

FIXING: Place the insulation around the outside of the tank and hold in place with 13mm aluminium Banding evenly spaced at 400 mm centres. The banding is to be tied off at all joins with Aluminium Banding Clips.

5. FIXING TO METAL SHEATHING TO OUTSIDE OF TANKER

SHEETING: The Insulation to be completely metal sheathed with 22 gauge aluminium. Silicone sealer to be applied on all joints before overlapping with another sheet - overlaps to be a minimum of 50mm.

RIVETS: Aluminium to be fixed to the bottom supports with sealed aluminium pop rivets, inserted through aluminium body washers of 32mm diameter.

SEALER: Both ends of tanker to be joined to the sides by a Pittsburgh seam. Silicone sealer to be applied to joints before joining.

6. EXTRANEOUS FITTINGS

REQUIREMENT: All ladders and lighting to be detached from tanker by the manufacturer before insulating and sheeting is applied.
DESIGN REQUIREMENTS
FOR
EXTERNAL FIRE PROTECTION OF DUCTWORK AND PENETRATIONS

SECTION 5

1. Where ductwork is required to be protected from possible fire, special treatment of the ductwork is required.

Ductwork shall be protected with a system that meets the requirements of AS 1530 part 4 and AS 1668 part 1.

Stair pressurisation ducts shall be protected from fire outside the duct in terms of STABILITY, INTEGRITY AND INSULATION.

Ducts used for exhausting air from the fire compartment shall be protected such that fire from the inside or outside will not cause collapse (STABILITY) or fissures (INTEGRITY) and shall also meet the INSULATION requirement when passing through other compartments in the building. This insulation requirement may be waived by the relevant authority where no combustible materials can come into contact with the ductwork.

- Sprayed coatings
- Board systems
- Lightweight panels
- Purpose made ducts

SPRAYED COATINGS: Spray material base, consists of one of the following - Rockwool, Vermiculite. Cement or Cellulose materials which have binders and inhibitors added. Finish varies from soft to very hard. Sprays usually provide fire resistance of 1 to 2 hours, others give up to 4 hours. Care should be taken to ensure system offered meets criteria required - especially for large ducts. Application is by special spray machines designed for the product being used. Often a number of coats have to be applied to ensure required thickness.

BOARD SYSTEMS: Boards are manufactured using Vermiculite, Cementaceous mixes and Laminated materials such as steel and cement. A wide range of proprietary brands are available giving protection which varies from 15 minutes to 4 hours. Fixing of boards is normally by glueing, screwing or a combination of both.

LEIGHTWEIGHT PANELS: These high density panels are manufactured from Rockwool and have a fibreglass scrim coating. Density is 200 kg m$^3$. Panels are fixed by using glue or patent fixings which allow for fast installation and replacement. The panels are clean to use and their light weight makes for fast, easy installation.
EXTERNAL FIRE PROTECTION OF DUCTWORK AND PENETRATIONS (CONT’D)

PURPOSE MADE DUCTS: These are usually designed to travel through fire protected areas and are often joined to conventional ducts outside the protected areas. Construction is of special sandwich panels made from sheets of perforated steel with a cement centre. Thickness of these sheets are 6mm and 9mm. The robust nature of these ducts ensures that little or no mechanical damage occurs and eliminates maintenance. Protection up to 4 hours can be obtained and the system is often used in large air plenum, gas ventilation and external duct applications. The material has the advantage of providing a walkable surface which will not sustain damage.

SEALING OF PENETRATIONS: A large variety of products exist for sealing flues, pipes, ducts and cables which pass through fire walls and floors. The range varies from special fire rated mortars, through mastics, silicones to purpose made “pillows”, Rockwool sections and pipe collars. Care should be taken to ensure products offered conform to AS 1540 Part 3.

As all fire rated installations need certification, it is often better to employ the services of contractors specialising in this type of work. T.I.C.A. members who carry out this type of work provide advice as to systems needed to meet specific requirements.