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## 1.0 **SCOPE**

This specification covers the technical requirements and essential particulars for the supply, application and finishing of the complete thermal insulation for hot equipment, piping systems, flues, ducts, steam generator casing, fixture casing, steam turbine etc. up to an operating temperature of 565<sup>0</sup>C. This specification is not applicable where the insulation is to be used for dual temperature (both hot and cold) service. Unless specified otherwise in section C and/or data sheet A, the scope of supply of the CONTRACTOR shall include, but not be limited to, the following items :

- (a) Insulation materials of all types as specified and required
- (b) Finishing materials of all types as specified and required
- (c) Auxiliary materials such as binding and lacing wires, wire netting, bands, screws etc., as specified and required
- (d) Angles, clamps, lugs etc. for supporting insulation
- (e) Weather hoods
- (f) Any other material as may be required for making the insulation complete

## 2.0 **CODES AND STANDARDS**

2.1 The supply and application of thermal insulation and finishing covered under this specification shall comply with all currently applicable statutes, regulations and safety codes in the locality where it is to be applied. The materials and application shall also conform to the latest editions of the codes and standards listed. Nothing in this specification shall be construed to relieve the CONTRACTOR of this responsibility.

2.2 The following are some of the codes and standards relevant to this specification :

- IS 277 Galvanised Steel Sheets (Plain and Corrugated)
- IS 737 Wrought Aluminium and Aluminium Alloy Sheet and Strip for General Engineering Purposes
- IS 3144 Mineral Wool Thermal Insulation Materials - Method of Test
- IS 3677 Unbonded Rock and Slag Wool for Thermal Insulation
- IS 3690 Unbonded Glass Wool for Thermal Insulation 650<sup>0</sup>C.
- IS 8183 Bonded Mineral Wool
- IS 9842 Preformed Fibrous Pipe Insulation

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IS 14164 Industrial Application and Finishing of Thermal Insulation  
Materials at Temperatures above (-) 80<sup>0</sup>C and up to (+) 750<sup>0</sup>C

BS 5970 Thermal Insulation of Pipework and Equipment (in the  
Temperature Range (-) 100<sup>0</sup>C to (+) 870<sup>0</sup>C)

### 3.0 **GENERAL DESIGN REQUIREMENTS**

3.1 All exposed portions of the plant which operate at temperatures of 65<sup>0</sup>C and above during normal operation shall be thermally insulated so that the temperature on the outer surface of the finish does not exceed 60<sup>0</sup>C based on an ambient temperature of 30<sup>0</sup>C in still air conditions, unless specified otherwise in data sheet A.

3.2 Insulation thickness for rock wool and glass wool materials have been indicated in data sheet A. These insulation thickness do not include thickness of finishing materials such as cement sand plaster, aluminium or Galvanised Steel (GS) sheet, binding and lacing wires, wire netting and bands etc.

3.3 Insulation thickness indicated in data sheet A shall be regarded as the minimum requirement. BIDDER may provide higher thickness in order to meet the design criteria indicated at para 3.1.

3.4 Equipment and piping which are not insulated from heat conservation considerations but have a surface temperature exceeding 65<sup>0</sup>C shall be insulated for personnel protection when :

- (a) The bottom of the equipment or pipe is less than 2 metres from the ground or working floor or platform or walkway, or
- (b) The equipment or pipe, or parts thereof, are within 600 mm from a working floor or platform or walkway

Equipment and piping to be insulated for personnel protection, shall be insulated to the extent that the temperature on the outer surface of the finish does not exceed 60<sup>0</sup>C.

3.5 Equipment in horizontal position, which are to be insulated for personnel protection, shall be fully insulated when the equipment outside diameter is less than 1250 mm and to a height of 2 metres from the working floor or platform for larger sizes.

### 4.0 **MATERIALS**

#### 4.1 **GENERAL**

4.1.1 All materials shall be new and fresh, incombustible, fire retardant, rot-proof, non-hygroscopic, vermin proof, fungus proof, non-injurious to health, chemically inert, non-corrosive to steel and aluminium (even if

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soaked in water for extended periods) and shall be guaranteed to withstand continuously and without deterioration the maximum temperature to which these shall be subjected to under the specified applications.

4.1.2 The insulation materials and any component of the finished insulation job shall not react chemically, singly or in combination, with water or moisture to form substances that are more actively corrosive to applied surface than water or moisture alone.

4.1.3 In order to protect the workers from the hazards of insulation materials, suitable protective gadgets shall be provided. Required safety precautions shall be taken during handling and application of insulation.

4.1.4 The insulation material shall be kept dry at all times during transport, storage and installation. Decking and covering tarpaulins alone are not adequate for any length of time and shall not be allowed except in extreme emergencies and only for short period. Stacking of insulation materials directly on ground shall not be done. No wet insulation shall be installed. If wet insulation is present, it shall be removed and replaced with new dry insulation. The insulation may be protected with plastic film but shall be vented to prevent sweating.

#### 4.2 INSULATION MATERIALS

The insulation material shall be one or more of the following types as specified in data sheet A.

|       | <u>Material<br/>Description</u>                                                                                                                     | <u>Material<br/>Code</u> |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| 4.2.1 | Unbonded rock wool mattress as per IS 3677 Type 2 at an application density of 150 Kg/M <sup>3</sup> for temperatures 65 to 399 <sup>0</sup> C      | U150                     |
| 4.2.2 | Unbonded rock wool mattress as per IS 3677 Type 2 at an application density of 200 Kg/M <sup>3</sup> for temperatures 400 to 565 <sup>0</sup> C     | U200                     |
| 4.2.3 | Unbonded glass wool mattress as per IS 3690 Type 2 at an application density of 80 Kg/M <sup>3</sup> for temperatures 65 to 550 <sup>0</sup> C      | U80                      |
| 4.2.4 | Lightly resin-bonded rock wool mattress as per IS 8183 at an application density of 100 Kg/M <sup>3</sup> for temperatures 65 to 399 <sup>0</sup> C | L100                     |
| 4.2.5 | Lightly resin-bonded rock wool mattress as per IS 8183 at an application density of 150 Kg/M <sup>3</sup> for temperatures 400                      | L150                     |

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to  
565<sup>0</sup>C

4.2.6 Bonded rock wool pipe sections as per IS 9842 at an application density of 144 Kg/M<sup>3</sup> for temperatures 65 to 565<sup>0</sup>C PS1

4.2.7 Calcium silicate preformed blocks, slabs and pipe sections as per IS 8154 at an application density of 200 Kg/M<sup>3</sup> for temperatures 65 to 565<sup>0</sup>C CS1

#### 4.3 FINISHING MATERIALS

The finishing material shall be one or more of the following types as specified in data sheet A.

|       | <u>Material Description</u>                                                                                                  | <u>Material Code</u> |
|-------|------------------------------------------------------------------------------------------------------------------------------|----------------------|
| 4.3.1 | Portland cement and inorganic fibre with water proofing compound at an application density of 1050 to 1100 Kg/M <sup>3</sup> | FC                   |
| 4.3.2 | Aluminium sheet as per IS 737, designation 31000, condition H3 for insulation material codes U150, U 200 and U 80            | AL1                  |
| (a)   | Insulation outside diameter above 450 mm - sheet thickness 18 SWG                                                            |                      |
| (b)   | Insulation outside diameter 150 to 450 mm - sheet thickness 20 SWG                                                           |                      |
| (c)   | Insulation outside diameter below 150 mm - sheet thickness 22 SWG                                                            |                      |
| (d)   | Flues and ducts - sheet thickness 1.0 mm                                                                                     |                      |
| (e)   | Steam generator casing and rear wall enclosure - sheet thickness 1.6 mm                                                      |                      |
| 4.3.3 | Aluminium sheet as per IS 737, designation 31000, condition H3 for insulation material codes L100, L150, PS1 and CS1         | AL2                  |
| (a)   | Insulation outside diameter above 450 mm - sheet                                                                             |                      |

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- thickness 20 SWG
- Insulation outside diameter
- (b) 150 to 450 mm - sheet thickness 22 SWG
- (c) Insulation outside diameter below 150 mm - sheet thickness 24 SWG
- (d) Flues and ducts - sheet thickness 1.0 mm
- (e) Steam generator casing and rear wall enclosure - sheet thickness 1.6 mm

4.3.4 GS sheet as per IS 277, designation GP, for insulation material codes U150, U200 and U80 GS1

- (a) Insulation outside diameter above 450 mm -sheet thickness 20 SWG
- Insulation outside diameter
- (b) 150 to 450 mm - sheet thickness 22 SWG
- (c) Insulation outside diameter below 150 mm - sheet thickness 24 SWG
- (d) Flues and ducts - sheet thickness 1.0 mm
- (e) Steam generator casing and rear wall enclosure - sheet thickness 1.2 mm

4.3.5GS sheet as per IS 277, designation GP, for insulation material codes L100, L150, PS1 and CS1 GS2

- (a) Insulation outside diameter above 450 mm - sheet thickness 22 SWG
- (b) Insulation outside diameter 150 to 450 mm - sheet thickness 24 SWG
- (c) Insulation outside diameter below 150 mm - sheet thickness 26 SWG
- (d) Flues and ducts - sheet thickness 1.0 mm
- (e) Steam generator casing and rear wall enclosure- sheet thickness 1.2 mm

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#### 4.4 AUXILIARY MATERIALS

##### 4.4.1 Binding and Lacing Wires

- (a) For temperatures up to 399<sup>0</sup>C : Annealed GS 20 SWG
- (b) For temperatures from 400 to 565<sup>0</sup>C : Annealed SS 304 20 SWG

##### 4.4.2 Wire Netting

- (a) For temperatures up to 399<sup>0</sup>C : 20 SWG GS wire with 20 mm hexagonal opening
- For temperatures from 400 to
- (b) 565<sup>0</sup>C : 20 SWG SS 304 wire with 20 mm hexagonal opening

##### 4.4.3 Bands

- (b) For securing aluminium and GS sheets : 20 SWG GS, 20 mm wide  
24 SWG anodised aluminium or SS 304, 20 mm wide
- (c) For securing aluminium foil on SS surface : 24 SWG aluminium, 20 mm wide

##### 4.4.4 Screws

Screws shall be of self-tapping type and shall be of aluminium or stainless steel for aluminium sheets and GS for GS sheets.

#### 4.5 INSULATION OF EQUIPMENT AND PIPING ( EXCEPT STEAM TURBINE)

##### 4.6 GENERAL

4.6.1 The application of insulation shall be made in a professional manner. The insulation shall be applied to all surfaces when these are at ambient temperature. Ample provision shall be made for the maximum possible thermal movement and the insulation shall be applied in a manner which shall avoid breaking or telescoping due to alternate periods of expansion and contraction. A single layer of insulation shall not be more than 75 mm thick.

4.6.2 Insulation shall be applied after all leak tests on equipment and piping are over and the section of the plant has been specifically released by the PURCHASER for such work. If insulation has to be applied before the leak

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test, all welded and flanged joints shall be left exposed and insulated after satisfactory completion of the leak test.

- 4.6.3 All surfaces to be insulated shall be clean and dry before the insulation is applied. The surfaces shall be cleaned of all foreign material such as scale, dirt, rust and paint, by the use of steel wire brushes and steel scrapers, where necessary. Where a surface is not free of paint the CONTRACTOR shall notify the PURCHASER of the condition for remedial action. The insulation shall be applied after remedial action, suggested by the PURCHASER, has been taken by the CONTRACTOR.
- 4.6.4 Carbon steel and low alloy steel surfaces to be insulated shall be thoroughly cleaned by wire brushing. For operating temperatures below 125°C, the surface shall be given one coat of heat-resistant aluminium paint of coating thickness not less than 20 microns.
- 4.6.5 All stainless steel surfaces to be insulated shall be protected against chloride attack as follows :
- (a) For operating temperatures up to 500°C, the stainless steel surfaces shall be mechanically separated from insulation surface by wrapping with 0.1 mm (42 SWG) thick aluminium foil. Application and other details shall be same as those described for steam traced piping in para 5.2.6.
  - (b) Above 500°C, the metal surface shall be given one coat of heat-resistant aluminium paint of coating thickness not less than 20 microns.
- 4.6.6 All sheet metal joints shall be sealed with bitumastic paint and made effectively weather and water-proof. All flat surfaces shall be adequately sloped to prevent pools of water collecting. The sheet shall be protected internally with 2 coats of bitumastic paint .
- 4.6.7 All actions shall be taken to complete the application of finishing on exposed surfaces covered with insulation before closing the day's work. If this is not practicable, adequate precautions shall be taken to protect the insulation from weather, for example by wrapping it with polythene sheet, roofing felt or other approved material.
- 4.7 **INSULATION ON PIPING**
- 4.7.1 All vertical pipes shall be provided with suitable insulation supports to prevent the insulation from collapsing due to its own weight. Any welding required, shall be carried out by the CONTRACTOR with the prior permission of the PURCHASER and only under his direct supervision. Where welding is not permitted, suitable clamped supports shall be used. The insulation shall be applied starting from bottom up. Mattress type insulation materials shall be clamped from top.

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- 4.7.2 If rock wool preformed pipe section insulation material is used, the sections shall be fitted closely to the pipe. Where there is more than one layer of insulation material, all joints shall be staggered. Each section shall be held in place by circumferential bands or wires at spacing not greater than 450 mm. If mattress is used, the insulation shall be formed to fit the pipe and applied with edges pulled together tightly at the longitudinal joint and secured by lacing wire. The insulation shall be turned to bring this joint to the lower side. Adjacent length shall be butted closely and laced together with lacing wire. Mattress insulation shall be backed-up by wire-netting on one side. For insulation thickness of more than 75 mm, where application shall be in two or more layers, each layer of mattress shall be backed up with wire netting.
- 4.7.3 When calcium silicate is the insulation material, all pipes up to and including 300 mm nominal diameter shall be covered with preformed rigid sections to form a robust pipe covering. Larger sizes shall be covered with segmental blocks moulded to a diameter to fit the curved surfaces. All sectional and segmental insulation shall be carefully fitted to the pipes with side and end joints butted tightly and securely wired in place at spacing not greater than 400 mm.
- 4.7.4 The ends of all wire loops shall be firmly twisted together with pliers, bent over and carefully pressed into the surface of the insulation. All calcium silicate insulation joints shall be fully staggered and any cavities between joints and cracks if any in both inner and outer layers shall be filled with insulating cement.
- 4.7.5 When preformed insulation material is used, the number of segments shall be minimum and all joints shall be filled with the same basic insulation material in loose form.
- 4.7.6 The thickness of insulation for steam traced lines shall be the higher value as determined by the size and temperature of the steam tracer and the service line. The tracer shall be tightly wired to the main pipe at intervals of 500 mm. Aluminium foil not less than 0.1 mm thick (42 SWG) shall then be wrapped around both the pipe and tracer with an overlap of at least 25 mm and wired or banded in place. This is to prevent insulation from separating the pipe and tracer and to provide a hot air enclosure and also to provide a barrier to radiant energy leaving the pipe. The insulation proper shall then be fitted and finished in the normal way. Cross-section of preformed insulation shall be suitable for accommodating tracers.
- 4.7.7 All insulation shall be protected by a finishing material as specified in data sheet A. The sheets shall be installed with the longitudinal lap joints at 45° below the horizontal for horizontal pipes and the joints sealed with bitumastic paint. On vertical pipes the sheets shall be applied working from bottom up. Each section of sheets shall have a minimum overlap of 50 mm longitudinally and circumferentially. Each circumferential joint shall be made weather-proof by securing with a band of sheet material and

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sealing with bitumastic paint. Longitudinal lap joints shall be fixed with screws at approximately 150 mm centres.

- 4.7.8 Weather hoods shall be provided for insulated piping passing through roof, and external walls.

#### 4.8 INSULATION ON PIPE FITTINGS, VALVES AND SPECIALITIES

- 4.8.1 All pipe fittings, valves and specialties shall be covered with the same type and thickness of insulation as specified for the adjoining pipe, with the special provisions and/or exceptions as listed below. On pipe fittings, insulation outside diameter shall be same as the outside diameter of adjacent pipe insulation.
- 4.8.2 Unless specified otherwise in section C or data sheet A, all valves and specialties, shall also be insulated to the same extent as the adjacent piping.
- 4.8.3 Unless specified otherwise in section C, valves and specialties of sizes 100 mm NB and larger shall be provided with removable box type insulation. Box shall be fabricated from sheet material specified for adjoining pipes. Pipe insulation on adjoining flanges shall be stopped at one bolt length plus 25 mm before flange to permit removal of the bolts and nuts. The insulation shall be applied after the finish has been applied over insulation on the adjacent piping. Flanged joints shall be insulated. Arrangement shall be similar to that for valves. Unions shall not be insulated.
- 4.8.4 Non-metallic expansion joints shall not be insulated. Metallic expansion joints identified in bill of materials shall be insulated.
- 4.8.5 Traps shall not be insulated. However, trap discharge lines and safety valve discharge lines shall be insulated for personnel protection only.
- 4.8.6 Pipe hanger clamps shall be covered with insulation along with the pipe. Upper bolts of three-bolt hanger clamps shall not be insulated. On piping outdoors, a weather hood packed with waterproof sealing material shall be supplied and installed.
- #### 4.9 INSULATION ON EQUIPMENT
- 4.9.1 Where the insulation material is in the mattress form, cleats in the form of wire nails or nuts or angles and flats for supporting the insulation material, shall be welded to the equipment by others. If wire nails are to be used as insulation cleats, these shall be bent and secured with the metal fabric of the mattress, after the insulation has been applied. Where insulation cleats are in the form of M6 and M10 nuts, the CONTRACTOR shall supply and install bolts of suitable length for fixing the insulation. The insulation applied to equipment shall be reinforced with wire netting. One course of wire netting shall be applied to the surface of the

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equipment and each layer of insulation shall be backed up with wire netting. All irregularities of the surface shall be filled and levelled over with insulating cement. All mattress joints shall be butted tightly and the mattresses shall be secured with 20 mm wide 24 SWG GS bands at 450 mm centres. After banding, all mattress edges shall be laced tightly.

- 4.9.2 When calcium silicate is the insulation material, segmental blocks moulded to fit the curved surfaces shall be used for cylindrical portions of the equipment. Flat blocks shall be used for equipment of diameter greater than 2500 mm and for flat surfaces.
- 4.9.3 For equipment up to 2500 mm in diameter and temperatures up to 200°C, the blocks shall be cut and fitted so that the inner diameter of insulation is 13 mm greater than the equipment outside diameter to take care of equipment circumferential expansion. The blocks shall be applied tightly butted and sealed with insulating cement. The insulation shall be secured by circumferential bands in such a way that tension of the bands produces compression on the butt edges rather than on the surface towards the equipment.
- 4.9.4 For equipment either above 2500 mm in diameter or at temperatures above 200°C, a 25 mm thick rock wool fibre mattress insulation shall be applied around the equipment prior to the application of calcium silicate. Calcium silicate blocks must be cut and fitted to the outside radius of the equipment plus the thickness of the rock wool spacer insulation. The insulation, when installed, shall not compress the fibrous mattress.
- 4.9.5 All equipment, unless specified otherwise, shall have a smooth aluminium or GS sheet finish as specified in data sheet A, applied in a manner similar to that specified for piping. For fixing of aluminium or GS sheets, spacer rings at 1000 mm centres shall be welded to the equipment by the CONTRACTOR. If welding is not permitted, spacer rings shall be suitably clamped. Spacer ring material shall be the same as that of the surface to be insulated. All vertical and horizontal sheets shall be overlapped a minimum of 75 mm. The lapped joints of adjoining sections of sheets shall be secured with screws. On all equipment above 2500 mm diameter and flat surfaces the sheet shall be further secured by circumferential bands at approximately 1000 mm centres. Each sheet joint shall be sealed with bitumastic paint. The roof sections shall overlap the side walls to prevent water seepage between insulation and the equipment wall. Side wall sheets shall be securely banded at intersections of the side wall and roof sections.
- 4.9.6 All equipment manholes, hatches, bolted or screwed cover plates, flanged ends etc. shall have removable box type insulation, with same thickness of insulation as for adjacent surfaces. Insulation adjoining such equipment openings shall be tapered towards these openings to permit removal of bolts, screws, heads, covers or plates with no damage to adjacent surface insulation or cover. Nozzles and other connections on tanks, heaters and other equipment shall be insulated in the same manner as the pipes.

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4.9.7 Pump casing shall be completely insulated with removable type of boxes fabricated from the specified sheet material.

4.9.8 Name plates on equipment shall not be insulated.

#### 4.10 CEMENT SAND PLASTER FINISH

4.10.1 On piping and equipment, where cement sand plaster finishing is specified in data sheet A, a barrier of polythene bonded hessian with the hessian layer outwards or bituminised Kraft paper shall be provided over the insulation. A total of 15 mm thick cement sand (1:4) plaster shall be applied in two layers after a GS wire netting is stretched over the entire surface of the barrier and securely fastened down. The plaster shall be hand-trowelled over the wire netting to a smooth finish. Curing shall be carried out by wrapping damp hessian cloth around the plaster. The application of finishing plaster shall be terminated, at the end of day's work, at an expansion joint.

4.10.2 The cement sand plaster finish shall have the following properties :

- (a) A light shower of rain, falling immediately after application shall not wash off the plaster.
- (b) At any time, one week or more after application, it shall not shatter if struck a sharp blow with a 0.7 Kg hammer. Such a blow may damage the finishing locally but shall not cause large pieces to break away.
- (c) When set, it shall withstand prolonged exposure to the weather without additional protection.

4.10.3 Outdoors, the finishing plaster shall be applied immediately after application of insulation. If this is not practicable, the CONTRACTOR shall take adequate precautions to protect the insulation from weather, e.g. by wrapping it with polythene sheet, roofing felt or other approved material.

#### 5.0 INSULATION EXPANSION JOINTS

Necessary insulation expansion joints shall be provided to prevent cracking of rigid insulation and hardsetting finishing cement layer. Insulation expansion joints shall be provided at intervals. These shall also be fitted on both sides and within 1000 mm of each bend and branch connections. At the insulation expansion joint, there shall be complete cut through the insulation and the sheet metal covering shall be provided with sliding joints.

#### 6.0 STEAM TURBINE INSULATION

6.1 Steam turbine and its integral piping shall be lagged with calcium silicate plastic composition in multiple layers.

6.2 Before applying the insulation, the surface to be insulated shall be thoroughly cleaned with wire brush to remove all dirt, rust and scale. After

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cleaning, the insulation shall be applied in successive layers to the required thickness. Each individual layer shall be properly dried before the next layer is applied.

- 6.3 The heating of the steam turbine cylinder before the application and drying of the individual layers shall be by infra-red lamps. The CONTRACTOR shall provide all equipment and make all necessary arrangements.
- 6.4 The insulation shall be reinforced with GS wire netting and lacing. Where layer interface temperature is 400<sup>0</sup>C and above, SS 304 wire netting and lacing shall be used. Reinforcing wire netting shall be provided over each successive layer of insulation.
- 6.5 The insulation shall be secured to the steam turbine cylinder and steam chests. For securing the insulation properly, nuts shall be provided on the outer steam turbine casing and steam chest. Studs of suitable length shall be screwed on to the nuts and the insulation shall be held rigidly by the studs.
- 6.6 The studs shall be wrapped with asbestos mill board paper or rope to avoid direct contact of the wire-mesh with the studs. The studs shall be of stainless steel material.
- 6.7 The insulation shall be finished with a layer of hard setting insulating cement, trowelled to a smooth finish, to prevent damage.
- 6.8 The steam turbine shall then be covered with 1.2 mm thick aluminium appearance cladding.

#### 7.0 **MEASUREMENT**

Measurement of insulation over equipment and piping shall be as per IS 14164.

#### 8.0 **GUARANTEES**

- 8.1 The CONTRACTOR shall demonstrate to the PURCHASER that the temperature of the outer surface of the finish has not exceeded 60<sup>0</sup>C. Temperature shall be measured at the middle of a segment of piping run to be mutually agreed. Two measurements, one at the top and other at the bottom, shall be taken at the measuring points. These temperatures shall be taken as the representative temperature for that length of piping.
- 8.2 The CONTRACTOR shall guarantee that, if the temperature on the outer surface of the finish exceeds 60<sup>0</sup>C, the CONTRACTOR shall either replace the insulation with a superior material or provide additional insulation thickness at the PURCHASER'S discretion at no extra cost to the PURCHASER.

#### 9.0 **MISCELLANEOUS**

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Approval of the PURCHASER shall be obtained of samples of all materials and necessary test certificates of approved national laboratories, before despatching these to site. Insulation shall not be applied until specific release is given by the PURCHASER.

### **DATA SHEET C**

#### **DATA TO BE FURNISHED BY THE CONTRACTOR AFTER THE AWARD OF CONTRACT**

1. List of drawings and documents to be submitted for review, approval and information with scheduled submission dates
2. Quality Assurance Plan (QAP)
3. List of insulation materials with specifications and properties like density, thermal conductivity etc.
4. Values for thermal conductivity at various mean temperatures for all insulation materials
5. List of finishing materials with specifications
6. List of auxiliary materials with specifications
7. Test certificates for insulation and other materials
8. Detailed insulation application and finishing procedure