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भारतीय मानक मसौदा
छिड़काव द्वारा लगाये जाने वाले तापरोधन के अनुप्रयोग — रीति संहिता: भाग 2
कैल्शियम सिलिकेट
(IS 12432 (Part 2) का पहला पुनरीक्षण)

Draft Indian Standard
Application of spray applied insulation — Code of practice: Part 2
Calcium Silicate
{ First Revision of IS 12432 (Part 2) }

(ICS 27.220, 91.120.10)

Thermal Insulation Materials Sectional
Committee, CHD 27

Last Date for Comments: **10th May 2024**

Thermal Insulation Materials Sectional Committee, CHD 27

FOREWORD

(Formal clauses shall be added later)

The spray application and finishing of hydrated calcium silicate insulation is a method used commonly for thermal insulation of irregular surfaces which are normally encountered in steam turbines, large vessels, and systems, and for fire protection of structures, etc.

Application of inorganic hydrated calcium silicate sprayable insulation involves spraying of the material on a cleaned surface through a spray gun with controlled amount of water to promote adhesion. After drying, this application serves the purpose of providing thermal insulation up to a temperature of 800°C to the surface on which it has been applied.

This standard was originally published in 1999. This revision is being done to incorporate the knowledge gathered from experience in these years. This revision will also bring out the standard in the latest style and format of the Indian Standards. The relevant clauses have been added and the references have been updated.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*)'.

Draft Indian Standard
Application of spray applied insulation — Code of practice: Part 2
Calcium Silicate
{ *First Revision of IS 12432 (Part 2)* }

1 SCOPE

This standard (Part 2) prescribes code of practice for application and finishing of sprayable inorganic hydrated calcium silicate insulation to the surfaces operating at temperatures up to 800 °C.

2 REFERENCES

The Indian Standards listed below contain provisions which through reference in this text, constitute provisions of this Indian Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this Indian Standard are encouraged to investigate the possibility of applying the most recent editions of the Indian Standards:

<i>IS No.</i>	<i>Title</i>
IS 3069 : 2020	Glossary of Terms, Symbols, and Units Relating to Thermal Insulation Materials (<i>Second Revision</i>)
IS 9743 : 2020	Thermal Insulation Finishing Cement — Specification (<i>Second Revision</i>)
IS 11128 : 2018	Spray applied hydrated calcium silicate thermal insulation (<i>first revision</i>)
IS 14164 : 2008	Industrial application and finishings of thermal insulation materials at temperatures above - 80°C and up to 750°C — Code of practice (<i>first Revision</i>)

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 3069 and those given below shall apply.

3.1 Applicator

An individual or an organization undertaking the responsibility of performing the spray application of the desired insulation over the desired installations.

3.2 Hot Side Temperature

The temperature of the hot fluid inside the insulated surface under consideration.

3.3 Thickness

The thickness of insulation material only that is, excluding any protective or other finish.

4 MATERIAL

4.1 The material used for insulation shall conform to the requirements specified in IS 11128.

4.2 The applicator shall ensure that the thermal insulating and finishing materials are suitable for use at the operating temperatures and under the physical conditions as stated by the purchaser, provided the material is supplied by the applicator. In case, the purchaser or any other agency appointed by the purchaser, specifies or supplies the material, the responsibility for the performance of such materials shall rest with the purchaser or supplier, as the case may be, and the applicator shall be responsible only for the workmanship and finish. If the insulation material conforms to the requirements specified in IS 11128, the applicator's responsibility shall be confined only to the methods of application as specified in this standard.

5 APPLICATION

5.1 General

5.1.1 All insulation materials shall be applied so as to be in intimate contact with the surface on which they are applied.

5.1.2 The insulation shall be reinforced/supported when applied on vertical surfaces or on surfaces facing downwards such as under-deck applications. Supports shall include cleats, studs, washers, nuts, bolts, lugs, pins or collars, depending on the type of surface being insulated, and shall be either welded to the surface or to bands, which are then strapped round the surface. These supports serve to hold the insulation in place and prevent its slipping, and in addition, provide anchorage for lacing wire or wire netting which may be required to reinforce the insulation. Depending on the function, supports shall either penetrate only partly through the insulation or protrude slightly beyond it but in no case supports shall protrude through the final finish.

The purchaser shall indicate in his specification the type of supports and the agency which is to supply and fix them, and shall further state whether welding will be allowed at site.

5.2 Surface Preparation

5.2.1 Before application of spray insulation, the surface shall be wire brushed to remove all dirt, dust, rust, scale, shop paint, etc, if any. Any confirmation due to oil/grease shall be removed with suitable solvent. For cleaning austenitic stainless steel surface, only cleaning medium with free chloride content not exceeding 35 ppm shall be used.

5.2.2 All austenitic stainless steel surfaces proposed to be insulated and subjected to an operating temperature of 250°C and above shall be painted with suitable heat resistant anti-corrosive paint before application of insulation.

NOTE — It has been found that if the chloride content in the material exceeds 0.01 percent by mass and if the conditions are such that chloride concentration can take place on the surface of certain austenitic stainless steel, there is a possibility of stress corrosion at elevated temperature. If such an instance arise, measures should be taken during the application of insulation, for example, a coating of sodium silicate inhibitor prior to application of insulation.

5.2.3 Firm anchoring shall be welded on to the pads/strips provided on the body of equipment/casings. The length of the anchors should be 10 mm less than the total thickness of insulation.

5.2.4 Installation/construction of support framework shall depend on the total insulation thickness. Holding framework shall be such that it can take up vibration of the equipment. Supporting framework shall consist of distant lugs which shall be either welded on to cleats, studs, washers provided at the surface of the equipment or to bands which are strapped round the surface.

5.2.5 Whenever it is necessary to prevent ingress of oil/any liquid into the insulation, metallic or oil/fire resistance, mastic protection is provided.

The studs shall be wrapped with suitable non-conducting material of 3 mm thickness to avoid direct contact with wire mesh.

5.3 Insulation Application

5.3.1 Application of spray applied hydrated calcium silicate insulation conforming to IS 11128 shall be performed in accordance with the manufacturer's specification and instruction.

5.3.2 The insulation shall be sprayed over the equipment at a desired density and in the thickness range of 25 mm to 40 mm for each layer, subject to the total area to be insulated and pitch of the anchors. A layer of galvanized wire netting of size 22 gauge × 20 mm or 20 gauge × 25 mm shall then be wrapped and tightened over the initial layer. Where the layer interface temperature is above 350°C, stainless steel wire meshing and lacing shall be used. Reinforcing mesh shall be provided over each successive layer of 25 mm to 40 mm thickness of insulation to build up the total insulation thickness.

5.3.3 Self setting cement/finishing cement conforming to IS 9743 shall be trowel applied all over the insulated surface with a first coat of 4 mm to 5 mm. The final coat of self-setting cement shall be applied after reinforcing the fabric all around the insulated surface.

5.3.4 The surface shall be finally finished with a coat of fire and oil-resistant paint.

6 MEASUREMENT

The measurement of the insulation work done shall be carried out in accordance with the method prescribed in IS 14164.

7 EXCHANGE OF DESIGN DATA

7.1 Information to be Supplied by the Purchaser

The purchaser should state either precise details of the insulation requirements or the service conditions for which the insulating materials are required so that the applicator can make recommendations. In the case of the later, the purchaser should provide the relevant information as prescribed in **4.1** and **4.2**.

7.1.1 *Details of Plant to be Insulated*

The purchaser shall provide the following information stating the details of the plant to be insulated:

- a) Location, whether indoor or outdoor but protected or outdoors exposed to weather or enclosed in ducts or trenches below ground level;
- b) Difficult or unusual site conditions with regard to transport, scaffolding, weather protection or excessive humidity;
- c) Nature and material of construction of vessels to be insulated;
- d) Dimension of surface, adequately detailed in the form of drawings, preferably coloured to indicate areas to be insulated. Alternatively, the following detailed information will be required:
 - i. Surface dimension of flat or large curved vessels,
 - ii. External diameter of pipes,
 - iii. Length of each size of surfaces to be insulated,
 - iv. Number and type of fitting, and
 - v. Whether rotating or stationary.
- e) Details of any section which is to be left uninsulated to facilitate testing, for example, welded and flanged joints.

7.1.2 *Temperature Conditions*

The purchaser should provide the following information stating details of temperature conditions of the plant to be insulated:

- a) Normal working temperature for each portion of the plant to be insulated,
- b) Maximum temperature for each hot surface, if higher than (a) above.
- c) Where a specified temperature is required on the outer surface of the insulation, it may be necessary also to give the conditions of ambient air for which the surface temperature is to be calculated, for example, velocity of air passing over the surface.

7.1.3 *Basis on Which the Thickness of Insulation is to be Determined*

The purchaser should provide the following information stating the basis on which the thickness of the insulation is to be determined:

- a) Specified temperature on outer surface of insulation (60 °C max, unless otherwise specified),
- b) Specified heat loss per unit dimension at 0 m/sec wind speed and 27 °C temperature,
- c) Economic thickness (*see* Note 1),
- d) Specified conditions of temperature for the surface to be insulated (*see* Note 2),
- e) Specified conditions of fluid at point of delivery,
- f) Special thickness requirements and maximum allowable heat loss,
- g) Any other such criteria.

NOTES

1 If the economic thickness is required to be calculated the following additional information will be necessary:

- i. Cost of heat to be used for calculation purposes,
- ii. Evaluation period (working hours), and
- iii. Whether or not the cost of finish is to be included in the calculation.

2 Insulation to provide specified conditions at boundary surfaces of the containment systems may be required for reasons such as the following:

- i. To avoid differential thermal expansion between the insulated surface and adjacent structure,
- ii. To prevent condensation of moisture on the internal surfaces of the containment system, and
- iii. To ensure that the walls of the containment system are not subjected to excessive temperature.

7.2 Information to be Supplied by Manufacturer/Contractor

The manufacturer/contractor should provide the following information:

- a) Information pertaining to the relevant portions of **4.1**.
- b) The manufacturer's declared value of thermal conductivity appropriate to the temperature of use and the corresponding bulk density. The manufacturer's declared value shall include any necessary commercial tolerances.
- c) Limitations of use, physical and chemical.
- d) The overall thickness, with details of the thickness of the individual layers.
- e) Information regarding the surface preparation.

8 TESTS

8.1 Tests for Thickness

Tests for the thickness shall be carried out after application. Local irregularities on the insulation surface shall be ignored.

If the arithmetic mean of not less than nine probe measurement at a given location is less than the minimum thickness as required by the purchaser or less than the commercial thickness offered by the application (subject to agreed tolerances) whichever is appropriate, the material applied at that location shall be deemed not to comply with this standard. Individual probe shall be +15 percent or 6 mm, whichever is lower.

8.2 Test for Bulk Density

During application, a test panel shall be fitted on surface of equipment. When application of the equipment is completed, the test panel shall be removed and tested for bulk density. The gap that will be produced shall be filled up by spraying.

8.2.1 The number and location of these test panels shall be mutually agreed to between the purchaser and the application. However, minimum number of test panels shall be three.

8.2.2 Under no circumstances, material shall be cut out from the surface of equipment for checking bulk density.

8.2.3 The average bulk density shall not be beyond +15 percent of the agreed value. However, none of the bulk density values at the test panels shall be below 25 percent of the agreed value.