मानकः पथप्रदर्शकः

COMPENDIUM OF INDIAN STANDARDS

ON

THERMAL INSULATING MATERIALS

Prepared By

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INTRODUCTION

A **Thermal Insulating Material** is a substance that reduces or slows down the transfer of heat between objects or environments with different temperatures. These materials have **low thermal conductivity**, which means they do not easily allow heat to pass through them.

Key Characteristics:

- **Low thermal conductivity** (usually less than 0.1 W/m·K)
- Often lightweight and porous
- Can be solid, liquid, or gas-based (though solids are most common for insulation)

By minimizing heat transfer, thermal insulating materials improve **energy efficiency**, maintain **temperature control**, and increase **comfort and safety** in various settings.

This compendium aims at providing an overview of Indian Standards on thermal insulating materials, offering insights into their varieties and the specified requirements in them.

By compiling relevant standards on thermal insulating materials in a single document, this compendium serves as a ready reference for professionals involved in the manufacture and usage of thermal insulating materials.

Indian Standards on Thermal Insulating Materials

1. IS 10555 : 2002 (Reaffirmed in 2024) Exfoliated vermiculite - Specification

Scope: This standard prescribes the requirements and methods of sampling and test for exfoliated vermiculite loose fill insulation.

Key Provisions:

1. Five grades of the material are defined.
2. Requirements have been specified regarding incombustibility, solubility, moisture content, particle size, bulk density, thermal conductivity, moisture absorption and grit content.
3. Optional requirements have also been specified for sulphur content and chloride content.

2. IS 11128 : 2018 Spray applied hydrated calcium silicate thermal insulation

Scope: This standard prescribes the requirements and methods of sampling and test for spray-applied, hydrated calcium silicate thermal insulation.

Key Provisions:

1. Requirements have been specified regarding density, compressive strength, thermal conductivity, adhesion, heat resistance, incombustibility and moisture content.
2. Optional requirements have also been specified for fire protection.

3. IS 11307 : 2025 Cellular Glass Block and Pipe Thermal Insulation — Specification

Scope: This document specifies the requirements and test methods for factory-made cellular glass products, which are used for thermal insulation of building equipment and industrial installations, with an operating temperature range of approximately –265 °C to + 430 °C. The products are manufactured in the form of slabs, faced or unfaced boards, pipe sections, segments and prefabricated ware.

Key Provisions:

Requirements have been specified regarding thermal conductivity, compression strength, dimensions, bending strength, point load, compressive creep, long-term water absorption, water vapour diffusion resistance, fire behavior, maximum service temperature, minimum service temperature and trace quantities of water-soluble ions and the *p*H-value.

4. IS 11308 : 2024 Hydraulic Setting Thermal Insulating Castables for Temperatures up to 1 250 °C — Specification

Scope: This standard prescribes the requirements and the methods of sampling and test for hydraulic setting thermal insulating castables for use as either hot face or cold face backing of refractory linings, at temperatures up to 1 250 °C.

Key Provisions:

1. Two types are defined depending upon the suitability for use at temperatures up to 1050 °C (type 1 050) and up to 1250 °C (type 1250).
2. Requirements have been specified regarding moisture content, ferric oxide content, density, crushing strength, thermal conductivity and heat resistance along with general requirements.

5. IS 12436 : 1988 (Reaffirmed in 2022) Specification for Preformed Rigid Polyurethane (Pur) and Polyisocyanurate (Pir) Foams for Thermal Insulation

Scope: This standard covers the requirements, and methods of sampling and test for preformed rigid polyurethane (PUR) and polyisocyanurate (PIR) foam for thermal insulation in the form of boards, cut and moulded slabs, cut and moulded pipe sections, cut and moulded radiused and bevelled lags, panels with adhesive integrally laminated facings, panels with adhesive applied facings, and cut and moulded special shapes.

Key Provisions:

1. Two types are defined based upon the compressive strength properties and two grades are defined based upon the used material i.e. PIR (Polyisocyanurate) and PUR (Polyurethane).
2. Requirements have been specified regarding standard sizes and dimensions, thickness and its tolerance, dimensional stability, compressive strength, horizontal burning, thermal conductivity and water vapour transmission.

6. IS 13204 : 2024 Rigid Phenolic Foam for Thermal Insulation — Specification

Scope: This standard specifies the requirements and methods of sampling and test for rigid phenolic foam for thermal insulation purposes. It applies to slab (blocks, boards, and profiled sheets) and profiled sections (pipe sections and radiused or bevelled lags) cut from pipes. The nominal temperature range for which the insulation material is suitable is - 180 °C to + 130 °C without any facing. The material is normally supplied with craft paper facing on both sides.

This standard is not applicable to continuously extended phenolic foam pipe insulating sections.

Key Provisions:

Requirements have been specified regarding composition, standard sizes and dimensions, thickness and its tolerance, density, compressive strength, dimensional stability, water vapour permeability, apparent water absorption, horizontal burning, closed cell content and thermal conductivity.

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This standard is not applicable to continuously extended phenolic foam pipe insulating sections.

Key Provisions:

Requirements have been specified regarding composition, standard sizes and dimensions, thickness and its tolerance, density, compressive strength, dimensional stability, water vapour permeability, apparent water absorption, horizontal burning, closed cell content and thermal conductivity.

2. Requirements have been specified regarding description, apparent density, apparent density under specified load, shot content, moisture absorption, incombustibility, thermal conductivity or *k*-value, sulphur content, width and thickness.
3. Some optional requirements have also been specified for moisture content, resistance to micro-organisms, odour emission test, oil content, carbon content, resistance to vibration, resistance to jolting, heat resistance, fibre diameter, alkalinity and corrosive attack.

10. IS 4671 : 2018 Expanded Polystyrene Insulation Purposes — Specification

Scope : This standard prescribes the requirements and the methods of sampling and test for expanded polystyrene in the form of rough shapes, finished boards and blocks, and pipe sections/segments for thermal insulation primarily for use in refrigeration and building applications in the temperature range –150° to 80°C.

Key Provisions:

1. Two types are defined based upon extinguishing properties; non-self-extinguishing type and self-extinguishing type.
2. Requirements have been specified regarding bulk density, dimensions, thickness and its tolerance, thermal Conductivity, compressive strength, cross-breaking strength, water vapour permeance, thermal stability and moisture absorption.
3. Special requirement for Flammability has been specified for Type 2 material Only.

11. IS 6598 : 2018 Cellular Concrete for Thermal Insulation — Specification

Scope : This standard prescribes the requirements and the methods of sampling and test for cellular concrete for thermal insulation.

Key Provisions:

1. Two types and three grades are defined.
3. Requirements have been specified regarding description, density, crushing strength, capillary absorption, thermal conductivity and dimension tolerances.

12. IS 7509 : 2024 Thermal Insulating Cements — Specification

Scope : This standard prescribes requirements and method of sampling and test for thermal insulating cements for use at temperatures up to 950 °C.

Key Provisions:

1. Three types are defined depending upon the use of temperature; type 350, type 750 and type 950.
2. Requirements have been specified regarding Service temperature, consistency, dry covering capacity, compressive strength, volume change upon drying, linear shrinkage, dry adhesion to steel and thermal conductivity.

13. IS 8154 : 2024 Preformed Calcium Silicate Insulation Temperatures up to 650 °C — Specification

Scope : This standard prescribes requirements and methods of sampling and test for preformed calcium silicate insulation intended for use on surface which reach temperatures up to 650 °C.

Key Provisions:

Requirements have been specified regarding material, bulk density, compressive strength, flexural strength, heat resistance, thermal conductivity, moisture content, alkalinity, standard shapes, sizes, and dimensional tolerances, shapes, flat blocks, bevelled lags, pipe sections, curved segments, sizes, flat blocks and uniformity.

14. IS 8183 : 2024 Bonded mineral wool – Specification

Scope : This standard covers the requirements, methods of sampling and test for mineral fiber (rock, slag, glass), semi-rigid and rigid board intended for the use as thermal insulation.

Key Provisions:

1. Requirements have been specified regarding description, bulk density, recovery after compression, shot content, moisture content and moisture absorption, incombustibility, thermal conductivity, sulphur content, dimensions, dimensional tolerances, fibre diameter and linear shrinkage.
2. Some optional requirements have also been specified for resistance to micro-organisms, odour emission test, resistance to vibration, resistance to jolting, heat resistance, alkalinity and leachable chloride content.

15. IS 9428 : 2024 Preformed Calcium Silicate Insulation (For Temperature up to 950 °C) — Specification

Scope : This standard prescribes requirements and methods of sampling and test for preformed calcium silicate insulation intended for use with surfaces with reach temperature up to 950 °C.

Key Provisions:

Requirements have been specified regarding bulk density, compressive strength, flexural strength, heat resistance, thermal conductivity, moisture content, alkalinity, standard shapes, sizes, and dimensional tolerances, shapes, flat blocks, bevelled lags, pipe sections, curved segments, sizes, curved segments (radiused and bevelled logs), dimensional tolerances and uniformity.

16. IS 9742 : 2024 Sprayed Mineral Wool Thermal Insulation – Specification

Scope : This standard prescribes requirements and methods of sampling and test for sprayed mineral wool thermal insulation**.**

Key Provisions:

1. Requirements have been specified regarding density, compressive strength, thermal conductivity, heat resistance, incombustibility, fire protection, thickness and corrosion protection.
2. some optional requirements have also been specified for resistance to vibration and resistance to jolting.

17. IS 9743 : 2020 Thermal Insulation Finishing Cement – Specification

Scope : This standard prescribes the requirements for thermal insulation finishing cements, prepared by mixing with water for application to insulating materials after they have been applied at site to the plant or piping systems.

This standard does not prescribe requirements for setting time.

Key Provisions:

1. Four types are defined.
2. Requirements have been specified regarding description, bulk density, wet covering capacity, dry covering capacity, volume change upon drying, inertness, compressive strength, flexural strength, resistance to impact, heat resistance, consistency of wet mixed material, moisture content, thermal conductivity and linear shrinkage.

18. IS 9842 : 2024 Preformed Fibrous Pipe Insulation – Specification

Scope : This standard prescribes requirements and methods of sampling and test for preformed fibrous pipe sections for thermal insulation.

Key Provisions:

1. Requirements have been specified regarding description, bulk density, shot content, moisture content and moisture absorption, incombustibility, thermal conductivity, dimensions, dimensional tolerance, linear shrinkage, heat resistance, recovery after compression, sulphur content and fibre diameter,
2. Some requirements have also been specified for alkalinity, resistance to micro-organism, odour emission test and leachable chloride content.

Indian Standards on Test methods for Thermal Insulating Materials

1. IS 11129 : 2018 Method of test for tumbling friability of preformed block - Type thermal insulation (First Revision)

This standard prescribes the method for determination of loss of mass of preformed block-type thermal insulation as a result of a combination of abrasion and impact produced by a laboratory tumbling mechanism.

2. IS 14656 : 1999 (Reaffirmed in 2022) Ceramic fibre products - Methods of test

This standard prescribes the methods of test for ceramic fibre products. This standard does not cover the method for determination of thermal conductivity, as determination of thermal conductivity of thermal insulation materials is covered by IS 3346.

Key Provisions:
The requirements which are covered under the standard for their determination are:

a) Fibre Diameter;
b) Shot Content;
c) Tensile Strength;
d) Thermal Shrinkage;
e) Compressibility and Resiliency;
f) Bulk Density; and
g) Leachable Chloride Content.

3. IS 3346 : 1980 (Reaffirmed in 2022) Method for the determination of thermal conductivity of thermal insulation materials (Two Slab, Guarded Hot - Plate Method) (First Revision)

This standard prescribes the general procedures for determining the thermal conductivity of dry specimens of thermal insulating materials, building and other materials provided that:

a) the materials are homogeneous and sufficiently uniform with regard to their aggregates and pores;
b) the thermal conductance of the specimen does not exceed 60 W/ msK; and
c) the two specimens used for test are identical in thickness and density within 2 percent.

4. IS 5688 : 2018 Methods of Test for Preformed Block-Type and Pipe-Covering Type Thermal Insulation (Second Revision)

This standard prescribes the methods of test for preformed block-type and non-fibrous pipe-covering type thermal insulation.

Key Provisions:
The requirements which are covered under the standard for their determination are:

a) Density;
b) Flexural Strength;
c) Compressive Strength;
d) Linear Shrinkage; and
e) Resistance to Breakage.

5. IS 5724 :2018 Thermal insulating cements - Methods of test (First Revision)

This standard prescribes the methods of test for thermal insulating cements.

Key Provisions:
The requirements which are covered under the standard for their determination are:

a) Consistency of wet-mixed thermal insulating cement;
b) Covering Capacity and Volume change upon drying;
c) Compressive Strength;
d) Linear Shrinkage; and
e) Adhesion.

6. IS 9403 : 2018 Method of test for thermal conductance and transmittance of built - Up Section by means of guarded hot box (First Revision)

This standard prescribes a method, known as the guarded hot box method, for the measurement of the thermal conductance and thermal transmittance of panels.

7. IS 9490 : 2018 Method for determination of thermal conductivity of thermal insulation materials (Water Calorimeter Method) (First Revision)

This standard prescribes the general procedures and design of equipment for determining the thermal conductivity of dry samples of thermal insulating materials, provided that:

a) the materials are sufficiently uniform with regard to their aggregates and pores; and
b) the thermal conductivity of the material does not exceed 1.5 W/mK.

The equipment described in this standard is suitable for hot face temperature between 675 K and 1 275 K.

8. IS 9489 : 2018 Method of Test for Thermal Conductivity of Thermal Insulation Materials by Means of Heat Flow Meter (First Revision)

This standard prescribes the general procedure for the determination of thermal conductivity, by means of a heat flow meter, of homogeneous insulating materials.

For practical purposes this method is limited to the determination of thermal conductivity of specimens having conductivity not in excess of 0.29 W/mK.

For this method, the suggested limiting temperatures of the surfaces to be in contact with the heat flow meter are 225 K and 825 K. These limits may be extended in both directions, but shall be governed both by the materials of construction and by the calibration procedures.

9. IS 3144 : 2024 Mineral Wool Thermal Insulation Materials - Method of Test (Third Revision)

This standard prescribes the methods of test for mineral wool thermal insulation materials.

Key Provisions:
The requirements which are covered under the standard for their determination are:

a) Length, Width and Thickness;
b) Resistance to Compression;
c) Bulk Density;
d) Maximum Recommended Temperature;
e) Shot Content;
f) Moisture Content;
g) Moisture Absorption;
h) Incombustibility Test;
i) Resistance to Micro-Organisms;
j) Odour Emission test;
k) Sulphur;
l) Oil Content;
m) Total Carbon;
n) Settling due to Vibration and Jolting;
o) Fibre Diameter;
p) Alkalinity;
q) Chloride Content; and
r) Organic Matter.

10. IS 18973 : 2024 Thermal insulation - Determination of steady-state thermal transmission properties of thermal insulation for circular pipes

This standard specifies a method for the determination of steady- state thermal transmission properties of thermal insulations for circular pipes generally operating at temperatures above ambient. It specifies apparatus performance requirements, but it does not specify apparatus design.

11. IS 13286 : 2025 Surface Spread of Flame for Thermal Insulation Materials - Methods of Test (First Revision)

This standard prescribes the methods of test for determining surface spread of flame for thermal insulation materials.

Two methods of tests have been prescribed for determining the tendency of thermal insulation materials to support the spread of flame across their surface, namely, a large-scale test for

exposed surfaces of walls and ceilings and a small scale surface spread of flame test suitable for preliminary testing for development and quality control purposes.