

BUREAU OF INDIAN STANDARDS

DRAFT FOR COMMENTS ONLY

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भारतीय मानक मसौदा

**थर्मल इन्सुलेशन — गोलाकार पाइपों के लिए थर्मल इन्सुलेशन
के स्थिर-अवस्था थर्मल ट्रांसमिशन गुणों का निर्धारण**

Draft Indian Standard

**Thermal insulation — Determination of steady-state thermal
transmission properties of thermal insulation for circular pipes**

(ICS 27.220.00)

Thermal Insulation Sectional Committee, CHD 27

Last Date for Comments: 27th April 2024

Thermal Insulation Materials Sectional Committee, CHD 27

NATIONAL FOREWORD

(Formal clauses shall be added later)

The thermal transmission properties of pipe insulation generally have to be determined using pipe test apparatus rather than flat specimen apparatus such as the guarded hot plate or the heat flow meter apparatus, if results are to be representative of end-use performance. Insulation material formed into flat sheets often has different internal geometry from that of the same material formed into cylindrical shapes. Furthermore, properties often depend significantly upon the direction of heat flow in relation to inherent characteristics such as fibre planes or elongated cells: thus flat specimen one-dimensional heat flow measurements may not necessarily be representative of the two-dimensional radial heat flow encountered in pipe insulation.

Another consideration is that commercial insulations for pipes are often made with the inside diameter slightly larger than the outside diameter of the Pipe, otherwise manufacturing tolerances may result in an imperfect fit on the Pipe, thus creating an air gap of variable thickness. In those cases where end-use performance data rather than material properties are to be determined, the insulation is mounted on the test pipe in the same loose manner so that the effect of the air gap will be included in the measurements.

This would not be the case if properties were determined in a flat plate apparatus where good plate contact is required.

Still another consideration is that natural convection currents around insulation installed on a pipe will cause non-uniform surface temperatures. Such conditions will not be duplicated in a flat plate apparatus with uniform plate temperatures.

Comparison tests on apparently similar material using both pipe apparatus and flat plate apparatus have shown varying degrees of agreement of measured thermal transmission properties. It appears that better agreement is often obtained for heavier density products which tend to be more uniform, homogeneous and sometimes more isotropic. For those materials which have repeatedly shown acceptable agreement in such comparisons, the use of data from flat plate apparatus to characterize pipe insulation may be justified. As a general rule, when such agreement has not been shown, the pipe test apparatus shall be used to obtain thermal transmission data for pipe insulations.

The text of ISO Standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

- a) Wherever the words 'International Standard' appears referring to this standard, they should be read as 'Indian Standard'.
- b) Comma (,) has been used as a decimal marker, while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

In this adopted standard, the reference appears to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards, which are to be substituted in their respective places, are listed below along with their degree of equivalence for the editions indicated:

<i>International Standards/ documents</i>	<i>Corresponding Indian Standard</i>	<i>Degree of Equivalence</i>
ISO 8301: 1991 Determination of steady state thermal resistance and related properties — Heat flow meter apparatus	IS 9489 : 2018 Method of test for thermal conductivity of thermal insulation materials by means of heat flow meter	Not Equivalent
ISO 8302: 1991 Thermal insulation — Determination of steady-state thermal resistance and related properties — Guarded hot plate apparatus	IS 3346 : 1980 Method for the determination of thermal conductivity of thermal insulation materials (Two Slab, Guarded Hot - Plate Method) (First Revision)	Not Equivalent

In this adopted standard, reference appears to certain International Standards for which Indian Standards do not exist. So, the technical committee has reviewed the provisions of the following International Standards/ documents referred in this adopted standard and has decided that they are acceptable for use in conjunction with this Standard:

<i>International Standard</i>	<i>Title</i>
ISO 7345: 1987 ¹	Thermal insulation — Physical quantities and definitions.
NOTE — ¹ ISO 7345: 1987 has been revised as ISO 7345: 2018.	

In this adopted standard, reference appears to certain International Standards/documents where the standard atmospheric conditions to be observed are stipulated which are not applicable to tropical/subtropical countries. The applicable standard atmospheric conditions for Indian conditions are $(27 \pm 2) ^\circ\text{C}$ and (65 ± 5) percent relative humidity and shall be observed while using this standard.

In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2: 2022 'Rules for rounding off numerical values (*second revision*)'.