IS 3677 (1985): Unbonded Rock and Slag Wool for Thermal Insulation [CHD 27: Thermal Insulation]

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IS : 3677 - 1985
(Superseding IS:5696-1970)
(Reaffirmed 2010)

# *Indian Standard*

# SPECIFICATION FOR UNBONDED ROCK AND SLAG WOOL FOR THERMAL INSULATION

## *(Second Revision)*

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**BUREAU OF INDIAN STANDARDS**
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

**Gr 3** ***May*** **1989**

# AMENDMENT NO. 1 SEPTEMBER 2000
# TO
# IS 3677 : 1985 SPECIFICATION FOR UNBONDED ROCK AND SLACK WOOL FOR THERMAL INSULATION

*( Second Revision )*

( *Page 9, clause* **A-2.1** ) — Substitute the following for the existing clause:

**'A-2.1** Tests for the conformity to the requirements of the specification shall be done on each lot separately. The material to be selected from a lot shall be in accordance with Table 1.

**Table 1 Number of Bags/Mats to be Selected for Sampling**
*( Clause* A-2.1 )

| Class No. of IS 3677 | Lot Size (*N*) Up to 200 | 201 to 300 | 301 to 500 | 501 to 800 | 801 to 1300 | 1301 and above |
|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| | No. of slabs to be selected *(n)* | | | | | |
| 4.2 | 5 | 6 | 7 | 8 | 9 | 10 |
| 4.3 | 5 | 6 | 7 | 8 | 9 | 10 |
| 4.4 | One for each density for all lot size | | | | | |
| 4.5 | do | | | | | |
| 4.6 | do | | | | | |
| 4.7 | do | | | | | |
| 4.8 | do | | | | | |
| 4.9 | 5 | 6 | 7 | 8 | 9 | 10 |
| 4.10 | 5 | 6 | 7 | 8 | 9 | 0 |

**Table 1** ***(Concluded)***

| | |
|---|---|
| 4.11.1 | One for each density for all lot size |
| 4.11.2 | do |
| 4.11.3 | do |
| 4.11.4 | do |
| 4.11.5 | do |
| 4.11.6 | do |
| 4.11.7 | do |
| 4.11.8 | do |
| 4.11.9 | do |
| 4.11.10 | do |
| 4.11.11 | do |

( CHD 27 )

Reprography Unit, BIS, New Delhi, India

IS : 3677 - 1985
(Superseding IS : 5696-1970)

# *Indian Standard*
# SPECIFICATION FOR UNBONDED ROCK AND SLAG WOOL FOR THERMAL INSULATION
# *(Second Revision)*

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# *Indian Standard*

## SPECIFICATION FOR UNBONDED ROCK AND SLAG WOOL FOR THERMAL INSULATION

## ( *Second Revision* )

## 0. FOREWORD

**0.1** This Indian Standard ( Second Revision ) was adopted by the Indian Standards Institution on 20 January 1985, after the draft finalized by the Thermal Insulation Materials Sectional Committee had been approved by the Chemical Division Council.

**0.2** This standard was first published in 1966 and had covered only rock and slag wool mats, while loose rock and slag wool was covered separately in IS : 5696-1970*. While revising these standards for the first time in 1973, the Committee then decided that, since the basic material was the same in both the cases, these should be issued as one standard. Consequently the first revision of IS : 3677 covered the material in both loose and mat forms, and IS : 5696-1970* was withdrawn.

**0.2.1** In this second revision the use of alternate metallic wire diameter for stitching of mats is provided, the type of metallic cage is elaborated, the thermal conductivity at a higher temperature (250°C mean temperature) is specified and the use of alternate widths is also permitted.

**0.3** The unbonded rock wool and slag wool may be used either in the form of loose rock and slag wool as filling material where bulk insulation is needed and are commonly applied by hand packing, or in the form of stitched mats. The mats may be faced on one or both sides with a confining medium. The confining media may be of metallic cage ( wire netting, expanded metal and metallic lath ), hessian cloth, scrim cloth, kraft paper or glass tissue. Mats made of rock or slag wool covered in this standard may or may not be reinforced with a confining media.

**0.4** Unbonded rock and slag wool can be used with suitable facing material for the temperature range of 700°C to — 200°C.

*Specification for loose mineral wool ( rock wool and slag wool ).

**0.5** 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 : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

## 1. SCOPE

**1.1** This standard prescribes the requirements and the methods of sampling and test for unbonded rock and slag wool for thermal insultion.

## 2. TERMINOLOGY

**2.1** For the purpose of this standard, the definitions of terms, symbols and units given in IS : 3069-1965† shall apply.

## 3. TYPES

**3.1** The unbonded rock and slag wool shall be of two types, namely:

Type 1 — Loose rock and slag wool, and

Type 2 — Stitched rock and slag wool mats.

## 4. REQUIREMENTS

### 4.1 Description

**4.1.1** *Type 1* — Type 1 shall be a fluffy, light weight material.

**4.1.2** *Type 2* — Type 2 material shall be in the form of stitched mats provided with a confining media on one or both sides.

**4.1.2.1** If the confining medium provided is of metallic cage, it shall be attached to the mat either by stabbing at not more than 250 mm centres or by stitching at not more than 250 mm along the width and 150 mm along the length with twine or metallic wire of 0.7 mm or 0.56 mm diameter or as agreed to between the purchaser and the supplier.

NOTE — The metallic cage is of GI hexagonal wire-netting ( *see* IS : 3150-1962‡ ) and of 0.63 mm wire diameter with a mesh of 13 or 19 mm or as agreed to between the buyer and the supplier.

**4.1.2.2** If the confining medium provided is of hessian cloth, scrim cloth, kraft paper or glass tissue, it shall be stitched to the mat with a suitable twine.

NOTE — Since the twine is intended for handling purposes, it may not stand the maximum temperature for that type of mat.

*Rules for rounding off numerical values ( *revised* ).

†Glossary of terms, symbols and units relating to thermal insulation materials.

‡Hexagonal wire netting for general purposes ( *second revision* ).

**4.2 Apparent Density** — The apparent density of Type 2 of the material shall be as agreed to between the purchaser and the supplier. A tolerance of ± 15 percent shall be allowed on the manufacturer's declared value when tested in accordance with the method prescribed in **8** of IS : 3144-1981*.

**4.3 Apparent Density Under Specified Load** — The apparent density under specified load of both types of the material shall be not more than the following values, when determined by the method prescribed in **9** of IS : 3144-1981*. The test shall be carried out after thoroughly fluffing the material. Consistency of results can be obtained only at the manufacturer's end since deviation in results occurs due to transportation, storage and handling:

| *Load* kg/cm$^2$ | *Apparent Density Under Specified Load, Max* | |
|---|---|---|
| | At Factory kg/m$^3$ | At Site kg/m$^3$ |
| 0.01 | 95 | 115 |
| 0.02 | 105 | 130 |
| 0.05 | 136 | 165 |
| 0.07 | 150 | 185 |
| 0.10 | 165 | 200 |

**4.4 Shot Content** — The shot content, when sieved through the prescribed sieve, shall be not more than the values given below. The method for the determination of shot content shall be as prescribed in **12** of IS : 3144-1981*. Any shot present shall not be greater than 5 mm in any dimension:

| *IS Sieve* ( *see* IS : 460 ( Part 1 )-1978† ) | *Shot Content, Percent by Mass, Max* |
|---|---|
| 500-micron | 5 |
| 250-micron | 10 |

**4.5 Moisture Absorption** — The material shall not gain in mass by more than 2 percent when tested by the method prescribed in **14** of IS : 3144-1981*.

**4.6 Incombustibility** — The material shall be rated as incombustible when it passes the test as prescribed in **15** of IS : 3144-1981*.

*Methods of test for mineral wool thermal insulation materials *(first revision* ).
†Specification for test sieves Part 1 Wire cloth test sieves ( *second revision* ).

**4.6.1** The loss in total mass, when determined by this test, shall not exceed 5 percent.

**4.7 Thermal Conductivity or *k*-Value** — The thermal conductivity or *k*-value of the material at specified apparent densities shall not exceed the following values when determined in accordance with the method prescribed in IS : 3346-1980*.

| *Mean Temperature* | *Thermal Conductivity ( k-Value ) of Material at Different Apparent Densities* | | | |
|---|---|---|---|---|
| | 200 kg/m$^3$ | 150 kg/m$^3$ | 120 kg/m$^3$ | 100 kg/m$^3$ |
| ( 1 ) | ( 2 ) | ( 3 ) | ( 4 ) | ( 3 ) |
| °C | mW/cm deg | mW/cm deg | mW/cm deg | mW/cm deg |
| 50 | 0.42 | 0.46 | 0.48 | 0.50 |
| 100 | 0.50 | 0.52 | 0.54 | 0.56 |
| 150 | 0.60 | 0.62 | 0.66 | 0.68 |
| 200 | 0.72 | 0.75 | 0.78 | 0.80 |
| 250 | 0.83 | 0.88 | 0.89 | 1.02 |

**4.8 Sulphur Content** — The material, after removal of the confining media, if any, shall not contain more than 0.6 percent of sulphur when determined by the method as prescribed in **18** of IS : 3144-1981†.

**4.9 Width** — Type 2 material shall be supplied in width of 90 ± 5 cm or any other width mutually agreed upon between the buyer and the supplier. The method for the determination of width shall be as prescribed in **5** of IS : 3144-1981†.

**4.10 Thickness** — Type 2 material shall be supplied in thicknesses of 25, 40, 50, 60, 75, 90 and 100 mm or as agreed upon between the purchaser and the supplier. They are usually supplied in thickness substantially in excess of nominal thickness in order to ensure the right thickness after application as they get compressed during application. The usual tolerance allowed is—5 mm. The method for the determination of thickness shall be as prescribed in **6** of IS : 3144-1981†.

**4.11 Optional Requirements** — If required by the purchaser, the bonded rock and slag wool shall also comply with the optional requirements given in **4.11.1** to **4.11.11.**

**4.11.1** *Moisture Content* — The unbonded rock and slag wool as received, shall not contain more than 2 percent moisture when determined by the method as prescribed in **13** of IS : 3144-1981†.

*Method for the determination of thermal conductivity of thermal insulation materials ( two slab, guarded ) hot-plate method *(first revision )*.

†Methods of test for mineral wool thermal insulation materials ( *first revision* ).

**4.11.2** *Resistance to Micro-organisms* — The unbonded rock and slag wool shall not show any mould or bacterial growth when tested by the method as prescribed in **16** of IS : 3144-1981*.

**4.11.3** *Odour Emission Test* — There shall be no apparent difference in odour of the butter when compared with the blanks and tested by the method as prescribed in **17** of IS : 3144-1981*.

**4.11.4** *Oil Content* — Oil content shall be as agreed to between the purchaser and the supplier but it shall be not more than 2 percent when determined by the method prescribed in **19** of IS : 3144-1981*.

**4.11.5** *Carbon Content* — The unbonded rock and slag wool shall not contain more than 0.3 percent of total carbon when determined by the method as prescribed in **20** of IS : 3144-1981*.

**4.11.6** *Resistance to Vibration* — The unbonded rock and slag wool shall show not more than 1 percent by height of settlement when tested by the method as prescribed in **21.1** of IS : 3144-1981*.

**4.11.7** *Resistance to Jolting* — The unbonded rock and slag wool shall show not more than 3 percent by height of settlement, or as agreed to between the purchaser and the supplier, when tested by the method as prescribed in **21.2** of IS : 3144-1981*.

**4.11.8** *Heat Resistance* — The material shall not suffer visible deterioration in the fibrous structure when heated to the maximum recommended temperature of use when tested by the method as prescribed in **11** of IS : 3144-1981*.

NOTE — Any colour changes shall not be considered as visible deterioration in the fibrous structure.

**4.11.9** *Fibre Diameter* — The average fibre diameter of the wool shall not be more than 7 microns when determined by the method as prescribed in **23** of IS : 3144-1981*.

**4.11.10** *Alkalinity* — The *p*H of the solution of the material shall be between 7.0 and 10.0 when tested in accordance with the method prescribed in **24** of IS : 3144-1981*.

**4.11.11** *Corrosive Attack* — The material shall not cause corrosion of the surface on which it is applied.

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 steels, there is a possibility of stress corrosion at elevated temperature.

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*Methods of test for mineral wool thermal insulation materials *(first revision)*.

If such an instance arises, suitable measures should be taken during the application of insulation, for example, aluminium foil should be wrapped around the surface to be insulated before the application of insulation or an anticorrosive paint should be applied prior to the application of insulation.

## 5. PACKING AND MARKING

**5.1 Packing** — The material shall be packed in hessian bags or polyethylene bags or as agreed to between the purchaser and the supplier.

**5.2 Marking** — The packages shall be legibly and indelibly marked with the following information:

a) Name of the manufacturer and recognized trade-mark, if any;

b) Type of the material;

c) Apparent density of the material;

d) Lengthy width and thickness of the material for Type 2;

e) Details of the confining media, if any; and

f) Batch number.

**5.2.1 The packages may also be marked with the ISI Certification Mark.**

NOTE — The use of the Standard Mark is governed by the provisions of the Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The Standard Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well defined system of inspection, testing and quality control which is devised and supervised by BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

## 6. SAMPLING

**6.1** Representative samples of the material shall be drawn and their conformity determined in accordance with the method prescribed in Appendix A.

# APPENDIX A

( *Clause* 6.1 )

## SAMPLING OF UNBONDED ROCK AND SLAG WOOL

### A-1. SAMPLING

**A-1.1 Lot** — All the materials ( bags for Type 1 and mats for Type 2 ) produced under essentially the same conditions of manufacture and of one type shall be grouped and each such group shall constitute a separate lot.

NOTE — The purchaser and the supplier may mutually agree to term material manufactured during a certain period as a lot. It is recommended that an 8-hour production under essentially same conditions may be termed as a lot.

### A-2. DETERMINATION OF LOT SIZE

**A-2.1** Test for the conformity to the requirements of the specification shall be done on each lot separately. The materials to be selected from a lot shall depend upon the size of the lot and shall be in accordance with col 1 and 2 of Table 1.

**TABLE 1 NUMBER OF BAGS/MATS TO BE SELECTED FOR SAMPLING**

| LOT SIZE | NO. OF BAGS/MATS TO BE SELECTED |
|---|---|
| *N* | *n* |
| (1) | (2) |
| Up to 200 | 5 |
| 201 „ 300 | 6 |
| 301 „ 500 | 7 |
| 501 „ 800 | 8 |
| 801 „ 1 300 | 9 |
| 1 301 and above | 10 |

**A-2.2** These bags/mats shall be selected at random from the lot and to ensure the randomness of selection, random number tables* shall be used. In case such a table is not available, the following procedure may be adopted:

Starting from any bag/mat in the lot, count them as 1, 2, 3,....., up to *r* and so on, where *r* is the integral part of *N/n* ( *N* being the lot size and *n* being the number of bags/mats to be selected ). Every *r*th bag/mat thus counted shall be withdrawn from the lot to give samples for tests.

**See* IS : 4905-1968 Methods for random sampling.

## A-3. NUMBER OF TESTS

**A-3.1** From each of the bags/mats selected according to **A-2.2,** test specimens necessary for carrying out the various tests specified in this standard shall be taken, care being exercised to exclude some amount of wool from the top of the bag/mat.

**A-3.2** Tests for the determination of all characteristics specified in this standard shall be conducted on each of the test specimens drawn from the bag/mat as obtained under **A-3.1.**

**A-3.3 Criteria for Conformity** — The lot shall be declared as conforming to the requirements of this specification if the different test results obtained under **A-3.2** meet the corresponding requirements given in the standard individually.

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