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भारतीय मानक मसौदा

नॉन- एस्बेस्टोस दुरमुच परिवर्धन संधि — विशिष्टि

DRAFT Indian Standard

Non-Asbestos Beater Addition Jointing — Specification

ICS 55.040

**Gasket and Packing Sectional
Committee, MED 30**

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FOREWORD

(Formal clause will be added later)

This standard provides the requirements and test methods for the determination of properties of non-asbestos fiber jointing sheets manufactured by the beater process.

Non-asbestos beater addition jointing sheets, a high-performance gasket material, are used in various applications, including automotive industry, industrial applications, elevated temperature sealing applications, low operating pressure applications, heavy-duty applications, including compressors and diesel engines, etc.

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)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

DRAFT *Indian Standard*

Non-Asbestos Beater Addition Jointing — Specification

1 SCOPE

This standard specifies the requirements for non-asbestos fiber jointing sheet manufactured by the beater process.

2 TERMINOLOGY

For the purpose of this standard the following definitions shall apply.

2.1 Asbestos — Asbestos is a collective name given to naturally occurring fibrous silicate material. The most commonly used is chrysotile fiber.

2.2 Beater Addition Product — Gasket material manufactured by a paper-making process.

2.3 Compressibility — Percentage reduction of thickness under a compressive pressure, applied at a constant rate, at room temperature.

2.4 Gasket — Deformable material (or combination of materials) intended to be clamped between flanges to prevent leakage of contained fluid.

2.5 Oil Resistance — This is an attribute of the gasket that checks the absorption of oil or change in thickness or swelling of the gasket material In an extended period of time when completely submerged in the fluid. Lower the oil resistance percent better is the resistance of the gasket material in oil-based application.

2.6 Recovery — Increase of thickness over the compressed thickness, once the compressive load has been removed.

2.7 Tensile Strength — Breaking tensile force divided by the original cross-sectional area.

3 TYPES

The non-asbestos beater addition jointing sheets are two types:

- a) Type-A — Type-A is used as facing material in cylinder head gaskets; and
- b) Type-B — Type-B is used as cellulose based soft gaskets materials.

4 FINISH

The surface shall be reasonably smooth and free from lumps and indentations.

5 DIMENSIONS

5.1 Size

The length and the width of the sheet shall be as specified by the purchaser.

5.2 Thickness

The sheets shall have a permissible variation of nominal thickness as provided in Table 1.

Table 1 Thickness of Sheets

(Clause 5.2)

Sl No.	Nominal Thickness	Minimum Permissible Thickness	Maximum Permissible Thickness
	mm	mm	mm
(1)	(2)	(3)	(4)
i)	0.25	0.20	0.30
ii)	0.30	0.25	0.35
iii)	0.40	0.35	0.45
iv)	0.50	0.45	0.55
v)	0.60	0.54	0.66
vi)	0.70	0.63	0.77
vii)	0.75	0.67	0.83
viii)	0.80	0.72	0.88
ix)	1.00	0.90	1.10
x)	1.20	1.08	1.32
xi)	1.50	1.37	1.63

NOTE — The above thickness tolerances are permissible variations applicable to a given lot of sheets or gaskets. Where other thicknesses of sheets are necessary due to application, the tolerance on the individual sheet shall be as agreed to between the purchaser and the supplier.

5.3 The thickness of the unconditioned specimens shall be measured with a suitable measuring instrument with an accuracy of 0.01 mm with a contact gauge diameter of 6.3 mm.

6 CONDITIONING OF TEST PIECE

6.1 Type-A

The conditioning of the specimens shall be carried out prior to all the tests as given below:

6.1.1 Clean cut test pieces are conditioned by placing them in an oven at a temperature of $(100 \pm 2) ^\circ\text{C}$ for 1 h.

6.1.2 The test piece/pieces shall then be allowed to cool to room temperature for at least 1 h before the tests are carried out in a desiccator containing anhydrous calcium chloride.

6.1.3 Sulfuric acid shall never be used in the desiccator for beater addition jointings.

6.2 Type-B

The conditioning of the specimens shall be carried out prior to all the tests as given below:

6.2.1 Place specimens in desiccators containing anhydrous calcium chloride for preconditioning at $20 ^\circ\text{C}$ to $30 ^\circ\text{C}$ for 4 h.

6.2.2 It is then kept in a humidity chamber with a gentle mechanical circulation of the air and conditioned for at least 20 h at 20 to $30 ^\circ\text{C}$ and 50 to 55 percent relative humidity.

7 DENSITY

The range of density of the jointing shall be between 0.8 g/cm^3 to 1.3g/cm^3 , unless higher value of density is specified by the purchaser.

8 TEST METHOD

8.1 Tensile Strength

8.1.1 *Type-A*

The minimum tensile strength when tested in accordance with Annex A shall be 2 MPa.

8.1.2 *Type-B*

The minimum tensile strength when tested in accordance with Annex A shall be 6 MPa.

8.2 Compressibility

8.2.1 *Type-A*

When tested in accordance with Annex B the compressibility value shall comply with the following:

Min – 15 %
Max – 50 %

8.2.2 Type-B

When tested in accordance with Annex C the compressibility value shall comply with the following:

Min – 10 %
Max – 40 %

8.3 Recovery

When tested in accordance with Annex B (for Type-A) and Annex C (for Type-B) the recovery value shall comply with the following:

Min – 20 %

8.4 Resistance to Oil, Fuel, and Water

8.4.1 Type-A —The method of the test shall be as per Annex D.

8.4.2 Type-B —The method of the test shall be as per Annex E.

9 SAMPLING

The sample size shall be as specified in Table 2.

Table 2 Sampling

(Clause 9)

SI No.	Test	Group A lot size Up to 250 kg	Group B lot size 251-500 kg	Group C lot size 501-1 000kg	Group D lot size Over 1 000kg
(1)	(2)	(3)	(4)	(5)	(6)
i)	Thickness	1	2	4	5
ii)	Density	1	2	3	4
iii)	Tensile strength	2	3	5	6
iv)	Compressibility	1	2	3	4
v)	Recovery	1	2	3	4
vi)			Thickness change		
vii)	Oil	1	1	2	3

viii)	Fuel	1	1	2	3
ix)	Water	1	1	2	3

10 MARKING

10.1 Each sheet shall be as identified by the following information on a label pasted in one corner:

- a) Manufacturers name and address;
- b) Type, and
- c) Thickness.

10.2 BIS Certification Marking

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act, 2016* and the Rules and Regulations framed thereunder, and the product(s) may be marked with the Standard Mark.

11 PACKING

Beater addition jointings may be supplied in sheet or in rolls and shall be suitably packed to prevent damage in transit.

ANNEX A

(Clauses 8.1)

TEST FOR TENSILE STRENGTH

A-1 The test shall be carried out on six test pieces.

A-2 Each test piece shall be 230 mm long and 25 mm wide. The test pieces shall be cut from the sheet preferably with a die punch, in such a manner that the longest axis is at right angles to the grain direction.

A-3 The test pieces shall have clean and uniform edges. Samples with dents, uneven cut, or any other deformity shall be discarded.

A-4 Immediately on removal from the desiccator, the thickness of each test piece shall be measured with a micrometer at about four places within 50 mm on both sides of the center. The smallest dimensions shall be taken as the thickness.

A-5 After measurement, each test piece shall be gripped between the jaws of a suitable tensile testing machine, the distance between the jaws being approximately 100 mm.

A-6 The rate of traverse of the moving jaw of the machine shall be 230 mm/min.

A-7 In case the test piece breaks at the jaw, the reading should not be taken into consideration.

A-8 The tensile strength shall be determined as:

$$\frac{\text{Breaking load}}{\text{Cross – section area of the test piece}}$$

A-9 About 4 readings shall be available to obtain the average tensile strength.

A-10 ACCEPTABILITY CRITERIA

A-10.1 The average of the six readings obtained on the specimens as described above shall meet the minimum requirement of the specified value of tensile strength given in the specification of every Beater jointing material. The maximum permissible number of individual readings not meeting the minimum requirement of the specified value shall be 3.

A-10.2 When the sheets for testing tensile strength are drawn based on lot size given in Annex D the permissible number of sheets failing to meet the minimum requirement of the specified value is given below:

<i>Sl No.</i>	<i>Lot size group</i>	<i>Rejection No. (R)</i>
(1)	(2)	(3)
i)	A	0
ii)	B	1
iii)	C	1
iv)	D	2

If the total number of non-conforming sheets is greater than the corresponding rejection number *R* given in the above table, the lot shall be rejected.

ANNEX B

(Clause 8.2.1 and 8.3)

TEST FOR COMPRESSIBILITY AND RECOVERY FOR TYPE-A

B-1 The test shall be carried out on four test pieces to obtain the average result.

B-2 The size of the test piece shall be 50 × 50 mm and the thickness as per Table 1.

B-3 APPARATUS

B-3.1 Anvil

A hardened and ground surface of a minimum diameter of 32 mm.

B-3.2 Penetrator

A steel cylinder with the end hardened and ground and of (6.4 ± 0.025) mm diameter. The penetrator is guided in its descent so that the surface remains parallel to the anvil.

B-3.3 Dial

A micrometer indicator dial reading to 0.01 mm.

B-3.4 Pre-load

A pre-load of 22.2 N (2.26 kg) which includes the weight of the penetrator to an accuracy of ± 1 percent.

B-3.5 Loading Device

A device for applying a major load of 1 090.00 N (111.11 kg) to an accuracy of ± 1 percent which is in addition to the pre-load.

B-4 TEST METHOD

B-4.1 Each test specimen or set of plied test specimens is centered on the anvil and the pre-load is applied gently and held for 15 s when the thickness of the specimen under pre-load is read to the nearest 0.002 mm and recorded (*P*).

B-4.2 The major load is then applied in a slow uniform manner so that the total load is applied within 10 s. The total load is maintained for 60 s when the compressed thickness of the specimen is read to the nearest 0.002 mm and recorded (*M*)

B-4.3 The major load is then immediately removed, leaving the pre-load, and after a period of 60 s the recovered thickness of the specimen under the original pre-load is read to the nearest 0.002mm and recorded (*R*).

B-5 CALCULATION

B-5.1 Compressibility, percent = $\frac{P-M}{P} \times 100$

B-5.2 Recovery, percent = $\frac{R-M}{P-M} \times 100$

B-6 ACCEPTABILITY CRITERIA

B-6.1 The average of four readings obtained on the specimens as described above shall meet the minimum requirements of the specified values of compressibility and recovery given in the specifications for every Beater jointing material. The individual value of compressibility obtained shall not go beyond -4 percent of the minimum value and + 4 percent of the maximum value. The individual value of recovery obtained shall not go beyond -5 percent of the minimum value.

B-6.2 When the number of sheets for testing compressibility are drawn on the basis of lot sizes given in Annex D the permissible number of sheets failing to meet the minimum requirement of the specified value is given below:

<i>Sl No.</i>	<i>Lot size group</i>	<i>Rejection No. (R)</i>
(1)	(2)	(3)
i)	A	0
ii)	B	1
iii)	C	1
iv)	D	2

If the total number of non-conforming sheets is greater than the corresponding rejection number *R* given in the above table, the lot shall be rejected.

ANNEX C

(Clause 8.2.2 and 8.3)

TEST FOR COMPRESSIBILITY AND RECOVERY FOR TYPE-B

C-1 The test shall be carried out on four test pieces to obtain the average result.

C-2 The size of the test piece shall be 50×50 mm and the thickness as received.

C-3 APPARATUS

C-3.1 Anvil

A hardened and ground surface of a minimum diameter of 32 mm.

C-3.2 Penetrator

A steel cylinder with the end hardened and ground and of (6.4 ± 0.025) mm diameter. The penetrator is guided in its descent so that the surface remains parallel to the anvil.

C-3.3 Dial

A micrometer indicator dial reading to 0.01 mm.

C-3.4 Pre-load

A pre-load of 4.4 N (0.448 kg) includes the weight of the penetrator to an accuracy of ± 1 percent.

C-3.5 Loading Device

A device for applying a major load of 218 N (22.22 kg) to an accuracy of ± 1 percent which is an addition to the pre-load.

C- 4 Test Method

C- 4.1 Each test specimen or set of plied test specimens is centered on the anvil and the pre-load is applied gently and held for 15 s when the thickness of the specimen under pre-load is read to the nearest 0.002 mm and recorded (*P*).

C-4.2 The major load is then applied in a slow uniform manner so that the total load is applied within 10 s. The total load is maintained for 60 s, when the compressed thickness of the specimen is read to the nearest 0.002 mm and recorded (*M*).

C-4.3 The major load is then immediately removed, leaving the pre-load, and after a period of 60 s the recovered thickness of the specimen under the original pre-load is read to the nearest 0.002 mm and recorded (*R*).

C-5 CALCULATION

C-5.1 Compressibility, percent = $\frac{P-M}{P} \times 100$

C-5.2 Recovery, percent = $\frac{R-M}{P-M} \times 100$

C-6 ACCEPTABILITY CRITERIA

C-6.1 The average of four readings obtained on the specimens as described above shall meet the minimum requirements of the specified values of compressibility and recovery given in the specifications for every Beater jointing material. The individual value of compressibility obtained shall not go beyond - 4 percent of the minimum value and + 4 percent of the maximum value. The individual value of recovery obtained shall not go beyond - 5 percent of the minimum value.

C-6.2 When the number of sheets for testing compressibility are drawn based on lot sizes given in Annex D the permissible number of sheets failing to meet the minimum requirement of the specified value is given below:

<i>Sl No.</i>	<i>Lot size group</i>	<i>Rejection No. (R)</i>
(1)	(2)	(3)
i)	A	0
ii)	B	1
iii)	C	1
iv)	D	2

If the total number of non-conforming sheets is greater than the corresponding rejection number *R* given in the above table, the lot shall be rejected.

ANNEX D

(Clauses 8.4.1, A-10.2, B-6.2, and C-6.2)

FLUID ABSORPTION TEST FOR TYPE-A

D-1 The test shall be carried out on 9 test pieces three for immersion in oil, three in fuel, and three in water. The test pieces shall be cleanly cut to size 50 mm × 50 mm. The test pieces may vary in dimension by ± 0.15 mm and be conditioned as described in **A-1**.

D- 2 Weigh each test piece in the air to the nearest milligram M1. Determine the thickness T1 of each test piece by taking a sufficient number of readings to provide a reliable average value. Place three test pieces in a test tube having an outside diameter of 38 mm and an overall length of 300 ml of the test liquid. Glass beads shall be used in the liquid as a bumper and to separate the specimens. After treating three test pieces in oil for 5 h at (150 ± 2) °C and the other three in fuel for 5 h at 20 °C to 30 °C and the other three in distilled water for 5 h at 20 °C to 30 °C, remove the test piece from the test liquid. Test pieces that have been treated in oil for 5 h at 150 °C shall be cooled to room temperature by transferring the test pieces to a cool clean portion of the same test liquid for 30 min to 60 min. Dip the specimens quickly into acetone, blot lightly with filter paper free of lint and foreign material. Place immediately in a tared, stoppered weighing bottle and determine the mass after test M2. Measure the thickness of each test piece as before to obtain a reliable average T2.

D-3 Percentage increase in mass = $\frac{M2-M1}{M1} \times 100$

Percentage increase in thickness = $\frac{T2-T1}{T1} \times 100$

NOTE — These tests should only be done for the material of a thickness of 0.75 mm up to and including 3 mm owing to the practical difficulty of making satisfactory and reliable measurements.

ANNEX E

(Clause 8.4.2)

FLUID ABSORPTION TEST FOR TYPE-B

E-1 The test shall be carried out on 9 test pieces three for immersion in oil, three in fuel B, and three in distilled water. The test pieces shall be cleanly cut to size 50 × 50 mm. The test pieces may vary in dimensions by ± 0.15 mm conditioned as described in **A-2**.

E-2 Weigh each test piece in the air to the nearest milligram M1. Determine the thickness T1 of each test piece by taking a sufficient number of readings to provide a reliable average value. Place three pieces in a test tube having an outside diameter of 38 mm and an overall length of 300 ml of the test liquid. Glass beads shall be used in the liquid as a bumper and to separate the specimens. After treating three test pieces in oil for 22 h at 20 °C to 30 °C and other three in fuel for 22 h at 20 °C to 30 °C and the other three in distilled water for 22 h at 20 °C to 30 °C, remove the test piece from the test liquid. Test pieces that have been treated in oil for 22 h at 20 °C to 30 °C shall be dipped the specimens quickly into acetone, blot lightly with filter paper free of lint and foreign material. Place immediately in a tared, stoppered weighing bottle and determine the mass after test M2. Measure the thickness of each test piece as before to obtain a reliable average T2.

E-3 Percentage increase in mass = $\frac{M2-M1}{M1} \times 100$

Percentage increase in thickness = $\frac{T2-T1}{T1} \times 100$

NOTE — These tests should only be done for the material of a thickness of 0.75 mm up to and including 3 mm owing to the practical difficulty of making satisfactory and reliable measurements.