

BUREAU OF INDIAN STANDARDS

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भारतीय मानक मसौदा

गैस्केट और पैकिंग नम्य ग्रेफाइट सामग्री – विशिष्टि

Draft Indian Standard

Gasket and Packing — Flexible Graphite Material — Specification

ICS 21.140

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

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FOREWORD

(Formal clause will be added later)

This draft standard specifies the general requirements for flexible graphite material intended for use in gaskets and packing. It covers applications involving water, steam, oils, acids, alkalis, and other chemicals. Flexible graphite materials are commonly used in specialized applications such as hot oil equipment, liquid gas plants, heat exchangers, glass and enamel flanges, nuclear power plants, and gas meters.

Flexible graphite is a fluid sealing material made exclusively from pure natural graphite flakes. It is resistant to heat, fire, corrosion, and aggressive chemicals.

Flexible graphite is a non-asbestos material extracted from mineral deposits in rock. After being mined, it is treated and expanded at high temperatures to form worm-like particles. These expanded graphite particles are then spread out in a smooth layer and compressed into sheet form without the use of binders or fillers. Flexible graphite exhibits no creep under constant load and remains stable across a wide temperature range, from cryogenic temperatures well below zero to temperatures exceeding the melting points of most ferrous and non-ferrous metals. BIS certification marking clause has been modified to align with the revised *Bureau of Indian Standards Act, 2016*.

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

**GASKET AND PACKING — FLEXIBLE GRAPHITE
MATERIAL — SPECIFICATION**

1 SCOPE

1.1 This standard covers the general requirements of flexible graphite suitable for gasket and packing for the use with water, steam, oils, acids, alkalis and other chemicals.

1.2 This standard does not cover reinforced flexible graphite sheets because of the effect of metal foil. The same materials can be provided with metal foil reinforcement if agreed upon by both the purchaser and the manufacturer, for applications that require reinforced sheets.

2 REFERENCES

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

<i>IS No.</i>	<i>Title</i>
IS 1608 (Part 1) : 2022 ISO 6892-1 : 2019	Metallic materials — Tensile testing Part 1 Method of test at room temperature (<i>fifth revision</i>)
IS 2712 : 2024	Gaskets and packings — Compressed asbestos fibre jointing — Specification (<i>fourth revision</i>)
IS 11321 : 1985	Specification for graphite for graphite crucibles
IS 14852 : 2000	Flaky graphite for refractory industry — Specification
ISO 204 : 2023	Metallic materials — Uniaxial creep testing in tension — Method of test

3 TERMINOLOGY

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

3.1 Gasket

A gasket is a sealing device made from deformable material, typically shaped as a ring or sheet. It creates a pressure-tight seal between stationary components by relying on compression to prevent leaks of gas or liquid. Gaskets are designed to withstand pressure, temperature fluctuations, and, in some cases, electrical or electromagnetic forces.

3.2 Flexible Graphite

Flexible graphite is a fluid-sealing material made exclusively from pure natural graphite flake. It is resistant to heat, fire, corrosion, and aggressive chemicals.

4 MATERIAL

4.1 Material Grades

Flexible graphite material, available in cut sheets or rolls, is classified into four grades:

- a) Nuclear Grade (GTA);
- b) Industrial Grade (GTB);
- c) Special Grade (GTS); and
- d) Low Oxidation Grade (GTO).

4.2 The properties and applications of each grade are detailed in Table 1.

Table 1 Material Grades and Applications

(Clause 4.2)

SI No.	Grade	Properties	Application
(1)	(2)	(3)	(4)
i)	GTA (Nuclear Grade)	This special grade of graphite features an extremely low ash content and has a minimum purity of 99.60 percent, meeting standard nuclear grade specifications. It contains no binders or resins and is available in sheets or rolls.	Low Sulphur for nuclear application.
ii)	GTB (Industrial Grade)	This grade has a minimum graphite content of 98 percent and a maximum of 50 ppm leachable chloride. It is recommended for gasket applications up to 1649 °C in non-oxidizing atmospheres. The material is provided as a monolithic sheet with no binders or resins, relying on a mechanical bond. Available in sheets or rolls.	Suitable for virtually all chemical services. It can be used as facing material for flat gaskets and as filler material for spiral wound gaskets. Popularly used.
iii)	GTS (Special Grade)	This grade contains a minimum of 98 percent graphite and a maximum of 50 ppm leachable chloride. Available in sheets or rolls.	It is used in the nuclear industry and other specialized fields. Low sulphur and low chloride for specific requirement
iv)	GTO (Low Oxidation Grade)	Recommended for gasket applications up to 550 °C in oxidizing atmospheres. Percent of weight loss is low. Available in sheets or rolls.	Low oxidation

5 APPLICATION

The following can be made out of flexible graphite:

- a) Graphite gasket sheet;
- b) Graphite plain sheet;
- c) Graphite sheet with 0.10 mm SS316 inserted;
- d) Graphite sheet with 0.10 mm SS304 inserted;
- e) Graphite sheet with carbon steel inserted;
- f) Graphite sheet with metal mesh inserted;
- g) Graphite sheet as cut gaskets to the size & shape required;
- h) Graphite sheet as filler material for metal jacketed gasket;
- j) Graphite sheet as sheathed filler material for metal core gasket, and
- k) Graphite tape as filler material for spirally wound metallic gasket.

6 DIMENSIONS AND TEST REQUIREMENTS

6.1 Dimensions

The dimensions for sheet thickness, width and length shall be as follows:

Sheet thickness	0.005” to 0.060” in 0.005” increments.
Sheet thickness	0.4 mm to 1mm in form of foil, above 1 mm up to 3 on sheet form.

Other thicknesses as per mutual agreement between manufacturer and customer:

Width	24”, 39.4”, and 60”.
Width	1 000 mm, 1 500 mm (other widths up to 1 500 mm as per agreement between manufacturer and customer).
Length	50’, 100’, 108’, 250’, 300’, 500’, 1 000’, 2 000’, 3 000’, and 4 000’.
Length	35 m to 80 m for foil only (other lengths of foil can be mutually agreed between manufacturer and customer).
Length	1000 mm × 1000 mm, and 1500 mm × 1500 mm for sheet (other dimensions can be mutually agreed between manufacturer and customer).

6.2 TEST REQUIREMENT

Flexible graphite in rolls or sheets specifications GTA, GTB, GTS and GTO shall confirm the requirement mentioned in the table below:

<i>Sl No.</i>	<i>Symbol Product</i>	<i>Unit</i>	<i>GTB Industrial Grade</i>	<i>GTS Special Grade</i>	<i>GTA Nuclear grade</i>	<i>GTO Low Oxidation Grade</i>
(1)	(2)	(3)	(4)	(5)	(6)	(7)

i)	Density	g/cm ³	1.0	1.0	1.0	1.0
ii)	Tensile strength [see IS 1608 (Part 1)]	Mpa	> 3.0	> 4.0	> 4.0	> 4.0
iii)	Compressibility (see IS 2712)	%	> 40	> 40	> 41	> 40
iv)	Recovery (see IS 2712)	%	> 10	> 10	> 12	> 10
v)	Creep (see ISO 204)	%	5	4.5	4	4
vi)	Carbon content (see IS 11321 and IS 14852)	%	> 98	> 99	> 99.5	> 98
vii)	Ash content (see IS 11321 and IS 14852)	%	< 2	< 1	< 0.4	< 2
viii)	Sulphur content (see IS 11321 and IS 14852)	PPM	< 1200	< 500	< 300	< 300
ix)	Chloride content	PPM	< 50	< 40	< 20	< 40
x)	Weight loss (670 °C) %/h	%	-	-	< 4	< 4
xi)	Working temperature	Oxidizing	-200 °C to 450°C	-200 °C to 450 °C	-200 °C to 500°C	-200 °C to 550 °C
xii)		Non Oxidizing	-200 °C to 3000°C	-200 °C to 3 000 °C	-200 °C to 3 000°C	-200 °C to 3000 °C

NOTE — All above mentioned properties are for density 1g/cm³.

9 MARKING

9.1 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 there under, and the product(s) may be marked with the Standard Mark.

9.2 Each sheet shall be marked with the following:

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