BRITISH STANDARD

BS 4371:1991

Specification for

Fibrous gland packings

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Piping Systems Components Standards Policy Committee (PSE/-) to Technical Committee PSE/2, upon which the following bodies were represented:

Asbestos Information Centre Ltd
British Adhesives and Sealants Association
British Compressed Gases Association
British Gas plc
British Pump Manufacturers' Association
British Railways Board
Energy Industries Council
Engineering Equipment and Materials Users' Association
Institution of Gas Engineers
Institution of Water and Environmental Management
Liquefied Petroleum Gas Industry Technical Association (UK)
Water Services Association of England and Wales

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Contents

Foreword

This British Standard has been prepared under the direction of the Piping Systems Components Standards Policy Committee and supersedes BS 4371:1968 which is withdrawn. Three types of packing (types D, F and G) that were in the original specification are now obsolete and, therefore, are omitted from this standard. (To avoid confusion, these three designations have not been reallocated in this standard.) Five additional types have been included to cover developments since the initial publication.

Certain of the packings contain polytetrafluoroethylene (PTFE) which, when heated to elevated temperatures, may produce fumes which give unpleasant effects if inhaled. Care should be taken to avoid contaminating tobacco with PTFE.

The method of designating density of yarns in this specification is in accordance with BS 947.

Fibrous gland packing may contain asbestos. The manufacture of all asbestos based products is covered by the requirements of the Control of Asbestos at Work Regulations 1987, introduced on 1 March 1988. These set out comprehensive provisions covering work activities involving exposure to asbestos. Advice on how to comply with these regulations can be obtained from the manufacturers of the material, from the Asbestos Information Centre Ltd., Derby Road, Widnes, Cheshire WH8 9ND from the local area office of the Health and Safety Executive or from the Environmental Health Department of the Local Authority.

Particular note has to be taken of the Asbestos Products (Safety) Regulations 1985, made under the Consumer Safety Act 1978 and the Health and Safety at Work etc. Act 1974, which sets out requirements for the labelling of all products containing asbestos.

All the above legislation implements European Directives.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations. In particular attention is drawn to the Control of Asbestos at Work Regulations 1987, and the Asbestos Products (Safety Regulations) 1985 and the Health and Safety at Work etc. Act 1974.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 10, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This British Standard specifies the description, materials, lubricants, size, mass, packaging and marking of nine types of fibrous gland packings. Tests are specified for the determination of lubricant content, size, mass and ignition loss (see Appendix A).

NOTE 1 This standard does not specify electrical cable gland packings.
NOTE 2 Table 1 gives guidance on the normal usage of the nine types of fibrous gland packings specified in this standard. The purchaser should state in his enquiry or order the type of packing (see Appendix B).
NOTE 3 The titles of the publications referred to in this standard are listed on the inside back cover.
NOTE 4 The information to be supplied by the purchaser at the time of enquiry and/or order is given in Appendix B.

Table 1 — Types of fibrous gland packing

Designation	General description	Further description and application
Type A	Lubricated, plaited or braided cotton packing.	Cotton packing with a mineral hydrocarbon lubricant. Temperature limit 85 °C. Typical duties: Centrifugal pumps, sludge pumps, water pumps.
Type B	Lubricated, plaited or braided bast fibre packing.	Bast fibre packing with a percentage of tallow. Temperature limit 85 °C. Typical duties: Reciprocating pumps, hydraulic equipment.
Type C	Lubricated, plaited or braided asbestos packing.	Asbestos packing with a mineral oil content. Temperature limit 300 °C. Typical duties: Rotary and reciprocating shafts, steam, boiler feed pumps, process liquor pumps, caustic pumps, mild chemical duties, gas valves, condensate pumps, evaporators, compressed air valves.
Type E	Plaited or braided asbestos packing, metallic wire reinforced.	Wire reinforced asbestos packing treated with a binder and, if required, further lubricated with mica or graphite. Temperature limit 510 °C. Typical duties: Dry heat applications, boiler stop valves, (not suitable for acid or alkali service).
Type H	Lubricated, PTFE dispersion impregnated plaited or braided asbestos yarn packing.	An asbestos packing impregnated with PTFE and a mineral oil lubricant. Temperature limit 260 °C. Typical duties: Rotary pumps. For general chemical service including alkalis and certain acids.
Type J	Lubricated, PTFE dispersion impregnated plaited or braided aramid yarn packing.	An aramid yarn packing impregnated with PTFE and silicone oil lubricant. Temperature limit 260 °C. Typical duties: Rotary and reciprocating pumps, and valves, and suitable for service with many chemicals including weak acids and alkalis, solvents and abrasives.
Type K	Lubricated, PTFE dispersion impregnated plaited or braided PTFE yarn packing.	A PTFE yarn packing impregnated with PTFE dispersion and silicone oil lubricant. Temperature limit 260 °C. Typical duties: Service with highly corrosive chemicals on rotary pumps, reciprocating pumps and valves (except strong oxidizing agents and molten alkali metals).
Type L	Lubricated, plaited or braided packing of blended graphite and PTFE yarn.	A blended PTFE and graphite yarn packing with additional PTFE and silicone oil lubricant. Temperature limit 260 °C. Typical duties: Valves and rotary pumps handling a wide range of media (except strong oxidizing agents and molten alkali metals).
Type M	Loose fibre packing (non-asbestos).	A loose (non-asbestos) fibre packing for caulking of stuffing boxes. Temperature limit 450 °C. Typical duties: Cocks and valves.
NOTE Types D, F and G are obsolete. WARNING NOTE. Materials containing asbestos are subject to legislation that requires precautions to be taken when handling them to ensure that they do not constitute a hazard to health (see foreword).		

2 Shape and cross section

2.1 The packing shall be provided in length form unless requested as rings.

2.2 The packing shall have a square cross section.

3 Size

The cross section size of the packing, when determined in accordance with **A.4**, shall not vary from the nominal thickness in either thickness direction by more than the limits given in Table 2.

Table 2 — Cross sections and tolerances

Nominal section	Tolerance
mm	mm
≤ 9	± 0.5
> 9 to 18	± 1.0
> 18 to 38	± 1.5
> 38 to 60	± 2.0
> 60 to 75	± 3.0
> 75	± 5.0

4 Packaging

All gland packings shall be despatched in sealed parcels and shall be protected against damage and ingress of dirt in transit.

5 Marking

Each parcel shall be clearly and legibly marked with the following information:

a) the manufacturer's name or other means of identification,

b) the number of this British Standard followed by the type of packing, e.g. "BS 4371/type A",[1)]

c) the cross section size and the length of the gland packing or number of rings.

NOTE Where relevant, warning labels and safety instructions as required by any relevant legislation should be included (see foreword).

6 Type A: Lubricated plaited cotton packing

6.1 Description

The packing shall be plaited or braided. The cotton yarn shall be uniformly impregnated prior to, or during, manufacture with either:

a) lubricant and graphite, or

b) lubricant and mica.

NOTE 1 The purchaser should state in his enquiry or order whether graphite or mica is to be used (see Appendix B).
NOTE 2 The purchaser should state in his enquiry or order the dimensions of the packing (see Appendix B).

6.2 Yarn

The yarn shall be spun from cotton having a minimum staple length of 12 mm. The single ply yarn shall not exceed 475 tex[2)].

Straight ends in the centre and/or the corners shall be of the same grade as the yarn used in the rest of the packing and shall not exceed 30 % of the mass of the packing for sizes 10 mm section and above and shall not exceed 35 % of the mass of the packing for sizes less than 10 mm section.

6.3 Lubricant

The lubricant shall be either petroleum jelly, a mixture of petroleum oil and petroleum jelly, or a lime-base grease.

The lubricant content of the packing, when determined as described in **A.2.4.1**, shall be a minimum of 40 % and a maximum of 50 % by mass of the total mass of the packing.

The graphite or mica content of the packing, as appropriate, when determined as described in **A.2.4.2**, shall be a minimum of 5 % and a maximum of 15 % by mass.

6.4 Mass

The mass in grams per metre of packing, when determined as described in **A.5**, shall be not less than $1.00S^2$, where S is the nominal cross section width of the packing in mm.

[1)] Marking BS 4371 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is therefore solely the responsibility of the person making the claim. Such a declaration is not to be confused with third party certification of conformity which may also be desirable.

[2)] 1 tex = 10^{-6} Kg/m.

7 Type B: Lubricated plaited bast fibre packing

7.1 Description

The packing shall be plaited or braided. The bast fibre yarn shall be uniformly impregnated prior to, or during, manufacture with either:

a) lubricant and graphite, or

b) lubricant and mica.

NOTE 1 The purchaser should state in his enquiry or order whether graphite or mica is to be used (see Appendix B).
NOTE 2 The purchaser should state in his enquiry or order the dimensions of the packing (see Appendix B).

7.2 Yarn

The yarn shall be spun from bast fibre tow. The single ply yarn shall not exceed:

up to and including 12 mm square	: 825 tex
above 12 mm up to and including 22 mm square	: 1 650 tex
above 22 mm square	: 3 300 tex

Straight ends in the centre and/or the corners shall be of the same grade as the yarn used in the rest of the packing and shall not exceed 30 % of the mass of the packing for sizes 10 mm section and above and shall not exceed 35 % of the mass of the packing for sizes less than 10 mm section.

7.3 Lubricant

The lubricant of the packing shall consist of refined mutton tallow with a percentage of free acid (expressed as oleic acid) not exceeding 2 % by mass of the total mass of the packing at the time of manufacture, or a combination of such tallow and a mineral lubricant.

The tallow content or combined tallow/mineral lubricant content of the packing, when determined as described in **A.2.4.1**, shall be a minimum of 35 % and a maximum of 45 % by mass of the total mass of the packing.

The graphite or mica content of the packing, as appropriate, when determined as described in **A.2.4.2**, shall be a minimum of 5 % and a maximum of 15 % by mass of the total mass of the packing.

7.4 Mass

The mass in grams per metre of packing, when determined as described in **A.5**, shall be not less than $1.00S^2$, where S is the nominal cross section width of the packing in millimetres.

8 Type C: Lubricated plaited or braided asbestos packing

8.1 Description

The packing shall be plaited or braided. The asbestos fibre yarn shall be uniformly impregnated prior to, or during, manufacture with either:

a) mineral lubricating oil and graphite, or

b) mineral lubricating oil and mica.

NOTE 1 The purchaser should state in his enquiry or order whether graphite or mica is to be used (see Appendix B).
NOTE 2 The purchaser should state in his enquiry or order the dimensions of the packing (see Appendix B).

WARNING. Materials containing asbestos are subject to legislation that requires precautions to be taken when handling them to ensure that they do not constitute a hazard to health (see foreword).

8.2 Yarn

The yarn shall be spun from long, white chrysotile asbestos fibre, having an abestos content of not less than 85 % by mass. The single ply yarn excluding that in the central core shall not exceed:

up to and including 10 mm section	: 620 tex
above 10 mm up to and including 15 mm section	: 825 tex
above 15 mm section	: 1 240 tex

Straight ends in the centre and/or the corners shall be of the same grade as the yarn used in the rest of the packing. The straight ends used in the centre and/or the corners shall not exceed 30 % of the mass of the packing for sizes 10 mm section and above and shall not exceed 35 % of the mass of the packing for sizes less than 10 mm section.

8.3 Lubricant

The lubricant shall consist of a mineral hydrocarbon oil with the following characteristics:

open flash point	: 205 °C minimum
viscosity at 38 °C	: 1 Pa·s minimum[a]

[a] 1 Pa·s is equivalent to 1 000 cPs.

The mineral hydrocarbon oil shall contain not more than 25 % additives to improve oil performance.

The mineral oil content of the packing, when determined as described in **A.2.4.1**, shall be a minimum of 23 % and a maximum of 33 % by mass of the total mass of the packing.

The graphite or mica content of the packing, as appropriate, when determined as described in **A.2.4.2**, shall be a minimum of 5 % and a maximum of 15 % by mass.

8.4 Mass

The mass in grams per metre of packing, when determined as described in **A.5**, shall not be less than $1.35S^2$, where S is the length of the nominal cross section width of the packing in millimetres.

8.5 Ignition loss on dried lubricant-free material

The ignition loss, after drying and extraction of the lubricant, shall not exceed 28 % by mass when determined by the method described in **A.2.4.3**.

9 Type E: Plaited or braided asbestos packing, metallic wire reinforced

9.1 Description

The packing shall be constructed from wire-reinforced asbestos yarn with a plaited, braided or stranded centre built up to the size required by means of plaited or braided covers.

WARNING. Materials containing asbestos are subject to legislation that requires precautions to be taken when handling them to ensure that they do not constitute a hazard to health (see foreword).

9.2 Yarn

The yarn shall be spun from long, white, chrysotile asbestos fibre, having a asbestos content of not less than 85 % by mass. The count of the single ply used in the covers shall be not coarser than 1 100 tex.

Straight ends in the centre and/or the corners shall be of the same grade as the yarn used in the rest of the packing and shall not exceed 30 % of the mass of the packing for sizes 10 mm section and above and shall not exceed 35 % of the mass of the packing for sizes less than 10 mm section.

9.3 Wire

The size of wire shall be 36, 38 or 41 SWG and the material shall be selected from Table 3.

Table 3 — Materials for wire

Material	Relevant British Standard
Brass	BS 2873 } any grade
Monel	BS 3075 } any grade
Inconel	BS 3075 } any grade
Stainless steel	BS 970-1 grade 310 S31 or grade 321 S31

NOTE The packing may contain a corrosion inhibitor.

9.4 Lubricant

The yarn shall be treated with a suitable latex and/or mineral lubricant. The total latex and mineral lubricant of the packing when determined as described in **A.2.4.1**, shall be not greater than 5 % by mass.

The yarn shall be treated by evenly distributing over the surface of the packing either:

a) mica, or

b) graphite.

NOTE The purchaser should state in his enquiry or order the dimensions of the packing and whether mica or graphite is to be applied (see Appendix B).

The mica or graphite content of the packing, when determined as described in **A.2.4.2**, shall be not less than 2 % by mass.

9.5 Mass

The mass in grams per metre of packing, when determined as described in **A.5**, shall be not less than $1.10S^2$, where S is the nominal cross section width of the packing in mm.

9.6 Ignition loss on dried material

The ignition loss, when determined as described in **A.2.4.3**, shall not exceed 25 % by mass.

10 Type H: Lubricated PTFE dispersion impregnated plaited or braided asbestos yarn packing

10.1 Description

The packing shall be plaited or braided from asbestos yarns, impregnated with PTFE dispersion and a refined petroleum oil.

WARNING. Materials containing asbestos are subject to legislation that requires precautions to be taken when handling them to ensure that they do not constitute a hazard to health (see foreword).

NOTE The purchaser should state in his enquiry the dimensions of the packing (see Appendix B).

10.2 Yarn

The yarn shall be spun from long white chrysotile asbestos fibre having an asbestos content of not less than 85 % by mass. The single ply shall not exceed:

up to and including	10 mm section: 1 500 tex
above	10 mm section: 2 200 tex

Straight ends in the centre and/or the corners shall be of the same grade as the yarn used in the rest of the packing and shall not exceed 30 % of the mass of the packing for sizes 10 mm section and above and shall not exceed 35 % of the mass of the packing for sizes less than 10 mm section.

10.3 PTFE impregnation

The asbestos packing shall be impregnated with an aqueous PTFE dispersion containing no fillers or additives other than those incorporated by the dispersion manufacturer to ensure product stability. The PTFE content of the dried and lubricant-free packing shall be a minimum of 26 % and a maximum of 36 % by mass when determined in accordance with **A.3**.

10.4 Lubricant

The lubricant shall be a high purity petroleum oil.

The lubricant content of the packing when determined as described in **A.2.4.1** shall be a minimum of 18 % and a maximum of 24 % by mass of the total mass of the packing.

10.5 Mass

The mass in grams per metre of packing when determined as described in **A.5** shall be not less than $1.5S^2$, where S is the nominal cross section width of the packing in mm.

11 Type J: Lubricated, PTFE dispersion impregnated plaited or braided aramid yarn packing

11.1 Description

The packing shall be plaited or braided from lubricated, PTFE dispersion impregnated, aramid yarns.

NOTE The purchaser should state in his enquiry or order the dimensions of the packing (see Appendix B).

11.2 Yarn

The yarn shall be of aramid (polyphenylene-terephthalamide) fibres or filaments.

Straight ends in the centre and/or the corners shall be of the same grade as the yarn used in the rest of the packing and shall not exceed 30 % of the mass of the packing for sizes 10 mm section and above and shall not exceed 35 % of the mass of the packing for sizes less than 10 mm section.

11.3 PTFE impregnation

The PTFE dispersion shall contain no fillers or additives other than those incorporated by the dispersion manufacturer to ensure product stability.

The PTFE content of the dried and lubricant-free packing shall be a minimum of 35 % and a maximum of 53 % by mass of the total mass of the packing.

NOTE It is only possible to measure this at the time of manufacture, and it is not possible to measure the amount of PTFE in a piece of completed packing.

11.4 Lubricant

The lubricant shall be a silicone based oil. The lubricant content of the packing shall be a minimum of 14 % and a maximum of 26 % by mass when determined as in **A.2.4.1**.

11.5 Mass

The mass in grams per metre of packing when determined as described in **A.5** shall be not less than $1.3S^2$, where S is the nominal cross section width of the packing in mm.

12 Type K: Lubricated, PTFE dispersion impregnated plaited or braided PTFE yarn packing

12.1 Description

The packing shall be plaited or braided from lubricated, PTFE dispersion impregnated, PTFE yarns.

NOTE The purchaser should state in his enquiry or order the dimensions of the packing (see Appendix B).

12.2 Yarn

The yarn shall be of PTFE fibres or filaments.

Straight ends in the centre and/or the corners shall be of the same grade as the yarn used in the rest of the packing and shall not exceed 30 % of the mass of the packing for sizes 10 mm section and above and shall not exceed 35 % of the mass of the packing for sizes less than 10 mm section.

12.3 PTFE impregnation

The PTFE dispersion shall contain no fillers or additives other than those incorporated by the dispersion manufacturer to ensure product stability. The PTFE dispersion content of the dried and lubricant-free packing shall be a minimum of 30 % and a maximum of 48 % by mass of the total mass of the packing.

NOTE It is only possible to measure this at the time of manufacture, and it is not possible to measure the amount of PTFE in a piece of completed packing.

12.4 Lubricant

The lubricant shall be a silicone based oil. The lubricant content of the packing shall be a minimum of 10 % and a maximum of 20 % by mass when determined as in **A.2.4.1**.

12.5 Mass

The mass in grams per metre of packing when determined as described in **A.5** shall not be less than $1.65S^2$, where S is the nominal cross section width of the packing in millimetres.

13 Type L: Lubricated, plaited or braided packing of graphited PTFE yarn

13.1 Description

The packing shall be plaited or braided from a lubricated yarn composed of PTFE and graphite.

NOTE The purchaser should state in his enquiry or order the dimensions of the packing (see Appendix B).

13.2 Yarn

The yarn shall be composed of PTFE and graphite.

Straight ends in the centre and/or the corners shall be of the same grade as the yarn used in the rest of the packing and shall not exceed 30 % of the mass of the packing for sizes 10 mm section and above and shall not exceed 35 % of the mass of the packing for sizes less than 10 mm section.

13.3 Lubricant

The lubricant shall be a silicone based oil. The lubricant content of the packing shall be a minimum of 20 % and a maximum of 35 % by mass when determined as in **A.2.4.1**.

13.4 Mass

The mass in grams per metre of packing when determined as described in **A.5** shall not be less than $1.45S^2$, where S is the nominal cross section width of the packing in millimetres.

14 Type M: Loose fibre packing (non-asbestos)

14.1 Description

The packing shall consist of a mixture of non-asbestos heat resistant fibres, lubricating solids such as graphite, suitable binder and lubricant and a corrosion inhibitor. The finished product shall have a homogeneous appearance with no unmixed agglomerates.

NOTE The purchaser should state in his enquiry or order the dimensions of the packing (see Appendix B).

14.2 Materials

The lubricant shall be a high grade petroleum jelly. The binder shall be a suitable polymer.

NOTE The lubricant may include additives to improve performance.

The combined lubricant and binder content of the packing when determined as described in **A.2.4.1** shall be a minimum of 15 % and a maximum of 25 % by mass.

Where graphite is used as a lubricating solid it shall be a flake graphite with a minimum carbon content of 90 %.

The ignition loss of the dried packing free from lubricant and binder when determined as described in **A.2.4.3** (but for 10 min at 800 ± 20 °C) shall not exceed 16 % by mass.

Appendix A Methods of test

A.1 General

NOTE When asbestos products are in the dry state, i.e. with binder or lubricant removed, they may release respirable fibres when subjected to mechanical work, e.g. cutting, unplaiting, untwisting. This work should be carried out in an enclosed cabinet connected to a suitable extraction system, e.g. a fixed system of a BS 5415 type H portable vacuum cleaner, which should also be used to clean up any deposits of fibre or dust on work bench, floor, etc.

Attention is drawn to the foreword concerning cautions in respect of asbestos and PTFE.

A.2 Determination of the grease, oil and binder content, the graphite or mica content and ignition loss

A.2.1 *Principle*

The lubricant content is determined by the loss in mass of a sample after extraction with a solvent and subsequent evaporation of the solvent. Solid lubricants are physically removed from the sample after being subjected to the extraction process.

A.2.2 *Reagent*

A.2.2.1 *Petroleum spirit* (boiling range 40 °C to 60 °C), of general laboratory reagent quality.

WARNING. Petroleum spirit is highly flammable. Take precautions to avoid ignition. Also avoid breathing the vapour and contact of the petroleum spirit with skin or eyes.

A.2.3 *Apparatus*

A.2.3.1 *Soxhlet extractor,* as specified in BS 2071 with a nominal capacity of 100 mL, with a socket joint of 34/35 size, as specified in BS 572, the cone joint of 24/29 size, as specified in BS 572 and the extraction thimble fitted with a fritted glass plate as specified in BS 1752 with a maximum pore diameter within the range 100 μm to 160 μm.

NOTE Suitable sizes of extraction thimble and condenser are given in Appendix A of BS 2071:1989.

A.2.3.2 *Condenser*

A.2.3.3 *Boiling flask,* with conical ground glass joint, size 29/32 as specified in BS 6352.

A.2.3.4 *Air circulation oven,* capable of being maintained at a temperature of 107.5 ± 2.5 °C.

A.2.3.5 *Balance,* of sufficient capacity to weigh the extraction thimble to an accuracy of 0.1 mg.

A.2.3.6 *Desiccator*

A.2.3.7 *Weighing bottle*

A.2.3.8 *Evaporating dish*

A.2.3.9 *Silica or platinum crucible*

A.2.3.10 *Muffle furnace*

A.2.4 *Procedure*

A.2.4.1 *Determination of grease, oil and binder content*

Unplait a representative length of the packing, not less than a mass of 5 g, taking care to collect all the pieces which are dislodged.

Place the extraction thimble fitted with the fritted glass plate (**A.2.3.1**) in the weighing bottle (**A.2.3.7**) and, with the lid offset, place in the circulating oven (**A.2.3.4**) at 105 °C to 110 °C for 1 h. Remove from the oven, replace the lid and place the weighing bottle containing the extraction thimble and fritted glass plate in the desiccator (**A.2.3.6**) and allow to cool to room temperature. Remove from the desiccator and weigh to the nearest 0.1 mg using the balance (**A.2.3.2**).

Transfer the prepared sample (**A.2.1**) to the extraction thimble and replace the weighing bottle with the lid offset containing the extraction thimble, fritted glass plate and the sample to the oven at 105 °C to 110 °C for 1 h. Remove the weighing bottle and contents from the oven, replace the lid and place it in the desiccator and allow it to cool to room temperature. Remove the weighing bottle containing the thimble, fritted glass plate and sample from the desiccator and weigh them to the nearest 0.1 mg using the balance.

Insert the extraction thimble fitted with the fritted glass plate and sample into the Soxhlet extractor. Pour 300 mL to 400 mL of petroleum spirit (**A.2.2**) into the boiling flask (**A.2.3.3**). Assemble the boiling flask, Soxhlet extractor and condenser (**A.2.3.2**) and subject the sample to extraction for 1 h.

Dry the evaporating dish (**A.2.3.8**) in the oven at 105 °C to 110 °C, cool to room temperature and weigh to the nearest 0.1 mg using the balance.

At the end of 1 h transfer the solution from the Soxhlet apparatus to the evaporating dish and evaporate off the solvent. Place the evaporating dish and its contents in the oven for 30 min at 105 °C to 110 °C then remove and cool it to room temperature. Weigh the evaporating dish and contents to the nearest 0.1 mg using the balance (**A.2.3.5**).

A.2.4.2 *Graphite or mica content*

Dry the extraction thimble, fritted glass plate and its contents in the oven at 105 °C to 110 °C. Carefully remove the extracted yarn from the extraction thimble and transfer it to a sheet of clean, smooth paper. Dislodge the mica or graphite flakes by gently untwisting the yarn. Return the mica or graphite flakes to the extraction thimble. Replace the thimble, fritted glass plate and contents in the weighing bottle and replace in the circulating oven for 1 h at 105 °C to 110 °C. Allow them to cool to room temperature and reweigh them. Record the mass W_5 of the weighing bottle and extraction thimble, fritted glass plate and mica or graphite flakes.

A.2.4.3 *Determination of ignition loss*

Weigh the crucible to the nearest 0.1 mg using the balance. Take approximately 2 g of yarn which has been subjected to the procedures described in **A.2.4.1** and **A.2.4.2** and remove any wire reinforcement. Place the resulting yarn in the crucible and weigh to the nearest 0.1 mg using the balance. Record the mass of the crucible and yarn. Ignite the yarn in the muffle furnace (**A.2.3.10**) for 30 min at 1 000 ± 50 °C. Remove from the furnace and place in the desiccator and allow to cool to room temperature. Remove from the desiccator and weigh to the nearest 0.1 mg using the balance.

A.2.5 ***Evaluation***

A.2.5.1 *Percentage, grease, oil and binder content*

Calculate the percentage grease, oil and binder content by mass, P, from the equation

$$P = \frac{W_4 - W_3}{W_2 - W_1} \times 100$$

where:

W_1 is the mass of the weighing bottle, extraction thimble and fritted glass plate;

W_2 is the mass of the weighing bottle, extraction thimble, fritted glass plate and sample;

W_3 is the mass of the evaporating dish;

W_4 is the mass of the evaporating dish and contents.

A.2.5.2 *Percentage graphite or mica content*

Calculate the percentage graphite or mica content, by mass, q, from the equation

$$q = \frac{W_5 - W_1}{W_2 - W_1} \times 100$$

where:

W_5 is the mass of the weighing bottle, extraction thimble, fritted glass plate and graphite or mica flakes.

A.2.5.3 *Percentage ignition loss*

Calculate the percentage ignition loss, i, from the equation

$$i = \frac{W_7 - W_8}{W_7 - W_6} \times 100$$

where:

W_6 is the mass of the crucible;

W_7 is the mass of the crucible and yarn;

W_8 is the mass of the crucible and ignited yarn.

A.3 Determination of PTFE dispersion content in asbestos packing

A.3.1 *Method of test*

Subject the asbestos packing sample to the procedure described in **A.2.4.1**. Dry the residual packing in the air circulation oven at 105 °C to 110 °C. Remove and cool them in the desiccator to room temperature. Weigh the crucible (**A.2.3.9**) to the nearest 0.1 mg using the balance.

Place the residual packing in the crucible and weigh to the nearest 0.1 mg using the balance. Record the mass of the crucible and the packing. Ignite the packing in the muffle furnace for 30 min at 1 000 ± 50 °C. Remove them from the furnace and place them in the desiccator and allow them to cool to room temperature. Remove from the desiccator and weigh to the nearest 0.1 mg using the balance.

A.3.2 *Evaluation*

Calculate the percentage PTFE dispersion content f, by mass, from the equation

$$f = \left\{1 - \frac{(W_{11} - W_9) \times 100}{(W_{10} - W_9) \times 0.855 \times A}\right\} \times 100$$

where:

W_9 is the mass of the crucible;

W_{10} is the mass of the crucible and asbestos packing;

W_{11} is the mass of the crucible and ignited asbestos packing;

A is the mean specified percentage asbestos content of the yarn in the original packing.

A.4 Determination of size

Cut a single test piece from the packing approximately 300 mm long. Measure the thickness in the two directions at a minimum of six evenly spaced positions along the length of the test piece. Measure the thickness to the nearest 0.1 mm using a suitable calliper or micrometer gauge having an anvil width of at least 3 mm. Do not apply pressure to the packing when carrying out measurements.

Report the mean value of the measurements and the maximum and minimum measurements in each thickness direction.

A.5 Determination of mass

For packing sizes up to and including 25 mm cross section size measure a 300 ± 0.2 mm length of packing. For packing with a cross section size greater than 25 mm the sample shall be such that the mass is not less than 300 g or the length less than 100 mm.

Measure the length of the sample using a suitable apparatus, to an accuracy of 0 ± 0.2 mm. Weigh the sample on a suitable balance to the nearest 0.1 mg. Divide the mass of the sample in grams by the length in metres to give the mass of the packing in grams per metre.

Appendix B Information to be supplied by the purchaser

The following information should be supplied by the purchaser in his enquiry or order:

a) type of packing (see Table 1);

b) dimensions of the packing (see **6.1**, **7.1**, **8.1**, **9.4**, **10.1**, **11.1**, **12.1**, **13.1** and **14.1**);

c) whether graphite or mica is to be used (see **6.1**, **7.1**, **8.1** and **9.4**);

d) if required as rings (see clause **2**).

blank

Publication(s) referred to

BS 572, *Specification for interchangeable conical ground glass joints.*

BS 947, *Specification for a universal system for designating linear density of textiles (Tex system).*

BS 970, *Specification for wrought steels for mechanical and allied engineering purposes.*

BS 970-1, *General inspection and testing procedures and specific requirements for carbon, carbon manganese, alloy and stainless steels.*

BS 1752, *Specification for laboratory sintered or fritted filters including porosity grading.*

BS 2071, *Specification for Soxhlet extractors.*

BS 2873, *Specification for copper and copper alloys. Wire.*

BS 3075, *Specification for nickel and nickel alloys: wire.*

BS 5415, *Safety of electrical motor-operated industrial and commercial cleaning appliances.*

BS 6352, *Specification for flasks with ground glass joints.*

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