BRITISH STANDARD

BS 3381:1989

Specification for

Spiral wound gaskets for steel flanges to BS 1560

UDC 621.643.412-762.445

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/15, upon which the following bodies were represented:

British Chemical Engineering Contractors' Association
British Compressed Gases Association
British Fluid Power Association
British Foundry Association
British Gas plc
British Malleable Tube Fittings Association
British Maritime Technology
British Non-ferrous Metals Federation
British Pump Manufacturers' Association
British Steel Industry
British Valve and Actuator Manufacturers' Association Ltd.
Combustion Engineering Association
Copper Development Association
Department of Trade and Industry (National Engineering Laboratory)
Ductile Iron Producers' Association
Electricity Supply Industry in England and Wales
Energy Industries Council
Engineering Equipment and Materials Users' Association GAMBICA (BEAMA Ltd.)
High Pressure Pipework Consultative Committee
Institution of Gas Engineers
Institution of Mechanical Engineers
Institution of Production Engineers
Institution of Water and Environmental Management (IWEM)
Water Authorities' Association

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

British Railways Board
Health and Safety Executive

This British Standard, having been prepared under the direction of the Piping Systems Components Standards Policy Committee, was published under the authority of the Board of BSI and comes into effect on 31 January 1990

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The following BSI references relate to the work on this standard:
Committee reference PSE/15
Draft for comment 87/76410 DC

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Amendments issued since publication

Amd. No.	Date of issue	Comments

Contents

Foreword

This British Standard has been prepared under the direction of the Piping Systems Components Standards Policy Committee and supersedes BS 3381:1973, which is withdrawn.

This revision takes into account related international work being carried out by Subcommittee 10, Metallic flanges and their joints, of Technical Committee 5, Ferrous metal pipes and metallic fittings, of the International Organization for Standardization (ISO). On this basis the terminology in this standard is in accordance with that given in ISO standards.

The essential differences between this edition and BS 3381:1973 are as follows:

a) the format of the standard has been changed to provide a basic specification together with a series of options in **4.1**, which the purchaser may select when ordering;

b) inner rings are now mandatory for gaskets having Class designations 900, 1 500 and 2 500 and gaskets of all Class designations containing polytetrafluoroethylene (PTFE) filler material;

c) application notes have been omitted.

The dimensions of spiral wound gaskets for tongue and groove flanges and spigot and recess flanges to BS 1560-3.1 are not included in this standard. However, such gaskets may be available for these types of flanges and the purchaser is advised to consult the manufacturer as to their availability.

Gaskets made to this British Standard 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, St. Andrew's House, 22-28 High Street, Epsom, Surrey KT19 8AH, 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 of the Asbestos (Prohibitions) Regulation 1985[1)] made under the Health and Safety at Work etc. Act 1974, which prohibit the supply of products containing amosite or crocidolite and set 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.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 6, 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)] Parallel regulations for Northern Ireland came into force on 6 March 1986.

1 Scope

This British Standard specifies the materials, dimensions, marking and packaging of spiral wound gaskets for use with flat face and raised face steel flanges complying with BS 1560-3.1 for Class designations 150, 300, 600, 900 and 1 500 for nominal size designations up to and including 24, and for Class designation 2 500 up to and including nominal size 12.

NOTE 1 The titles of the publications referred to in this standard are listed on the inside back cover.

NOTE 2. Dimensions of other types of gaskets for use with flanges complying with BS 1560-3.1, BS 1560-3.2 and BS 1560-3.3 are given in BS 7076-1 to BS 7076-4.

NOTE 3 Dimensions of spiral wound gaskets for use with flanges to BS 4504-3.1 are given in BS 4865-2.

NOTE 4 To assist the purchaser, information that should be supplied by the purchaser when making an enquiry or order for gaskets complying with this standard is given in Appendix A.

2 Gasket designs

2.1 General

Gaskets for which dimensions are specified shall be of one of the designs shown in Figure 1.

NOTE 1 Figure 2 shows a typical design of a spiral wound gasket for use with type A or type B flanges.

NOTE 2 Type A and type B flange facings are illustrated in BS 1560-3.1.

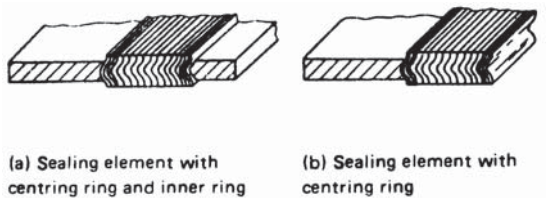

Figure 1 — Spiral wound gaskets

2.2 Sealing element

2.2.1 *Construction.* The sealing element shall be constructed of alternate plies of continuous preformed metal strip and filler material. The filler material shall be above the windings of the metal strip at the gasket contact surfaces.

NOTE The profile of the metal strip used in the winding is chosen by the manufacturer.

2.2.2 *Metal winding.* At least three initial turns and three final turns of the metal strip shall be wound without filler material and shall be firmly secured by welding.

The extremity of the metal winding around the inner circumference of the gasket shall be welded with a minimum of three spot welds within a distance of 75 mm. Alternatively, the metal windings shall be welded around the entire inner circumference with a maximum spacing between spot welds of 75 mm.

The metal winding at the outside of the gasket shall be welded with a minimum of three welds, and the last three welds shall be within a distance of 40 mm. In addition, up to four wraps of metal winding are permitted beyond the last weld to ensure a proper fit in the centring ring, when appropriate.

2.3 Centring ring

The centring ring shall be in one piece. The degree of clearance between the sealing element and the centring ring shall be such that the sealing element will not fall out of the ring during normal handling.

2.4 Inner ring

The inner ring shall be in one piece.

2.5 Gasket compression

For gaskets including compressed fibre jointing or expanded graphite filler materials, the design shall be such that a uniform bolt stress of 210 N/mm^2 (on the nominal root diameter of the flange bolts) in the flanged joint will compress the gasket to a thickness of 3.4 ± 0.25 mm. In addition, the gasket thickness shall recover a minimum of 0.25 mm within 1 h of the compressive test load being released.

NOTE If a compression test is carried out on gaskets containing other filler materials, e.g. PTFE, it is not necessarily possible to achieve the compressed gasket thickness of 3.4 ± 0.25 mm.

3 Gasket types

Gaskets shall be of one of the following types:

a) sealing element with centring ring and inner ring;

b) sealing element with centring ring only.

All gaskets shall have a centring ring. All Class 900, 1 500 and 2 500 gaskets and all gaskets containing PTFE filler material shall have an inner ring.

NOTE The use of an inner ring is recommended for all Class designations and the purchaser should specify on the enquiry and/or order if an inner ring is required for Class 150, 300 and 600 gaskets (see Appendix A).

4 Materials

4.1 Optional requirements

4.1.1 *General.* If the purchaser does not indicate his wish to implement any of the options included in **4.1.2** to **4.1.5** at the time of the enquiry and order, the manufacturer shall comply with **4.2** to **4.5**.

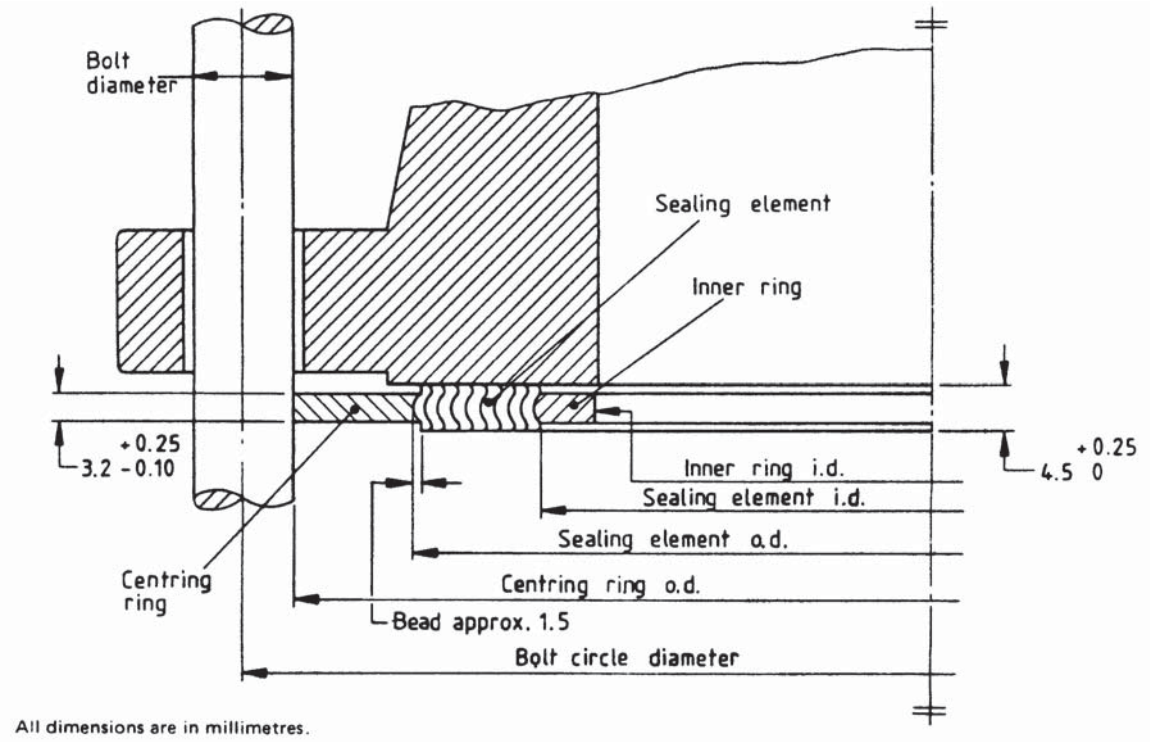

Figure 2 — Typical design of metallic spiral wound gaskets

4.1.2 *Metal winding material.* The material used for the metal winding shall be selected by the purchaser.

4.1.3 *Filler material.* The material used for the filler shall be selected by the purchaser.

4.1.4 *Centring ring material.* The material used for the centring ring shall be selected by the purchaser.

4.1.5 *Inner ring material.* The material used for the inner ring shall be selected by the purchaser.

4.2 Metal winding

The material used for the metal winding in the sealing element shall be stainless steel, grade 304S16 or grade 316S11 to BS 1449-2.

NOTE 1 See **4.1.1** and **4.1.2**.

NOTE 2 The selection of the material used for the metal winding should take into account the operating conditions and it is recommended that the selection of gaskets for any particular application is made in consultation with the gasket supplier (see Appendix A).

4.3 Filler material

The filler material shall be an asbestos or a non-asbestos compound that is suitable for use with oil, water, steam, air and gas over the pressure/temperature range of the appropriate class designations for which the gaskets are supplied.

NOTE 1 See **4.1.1** and **4.1.3**.

NOTE 2 Asbestos compound filler will be supplied unless otherwise specified by the purchaser. Other filler materials include expanded graphite, polytetrafluoroethylene (PTFE) and non-asbestos fibre compounds and the manufacturer should be consulted regarding the availability of gaskets containing these materials (see Appendix A).

NOTE 3 Attention is drawn to the fact that other filler materials may affect the pressure and temperatures at which a flanged joint can be used (see Appendix A).

WARNING. Spiral wound gaskets may contain asbestos. 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).

4.4 Centring ring

The centring ring shall be made of carbon steel.

NOTE See **4.1.1** and **4.1.4**.

4.5 Inner ring

The inner ring shall be made of a material selected by the manufacturer.

NOTE See **4.1.1** and **4.1.5**.

5 Dimensions

5.1 Gaskets for type A or type B flange facings shall have dimensions as given in Table 1 and the overall thickness, including filler, shall be as given in Figure 2.

5.2 The thickness of the metal strip used in the windings of the sealing element shall be 0.20 ± 0.03 mm.

6 Marking

6.1 The centring ring shall be marked by a steel stamp(s), using symbols approximately 3 mm high, with the following information:

a) the nominal size;

b) the class designation;

c) the temperature limitation, if applicable (in °C);

d) the metal winding material identification symbol as given in Table 2;

e) the manufacturer's filler material identification;

f) the manufacturer's name or trade mark.

Example: 3-150-500
316S11
1234
XYZ

6.2 A gasket suitable for use with more than one class designation shall be marked accordingly.

Example: 3-300/600-560
316S11
1234
XYZ

6.3 Gaskets shall be labelled either individually or on the packaging containing the gasket(s) with the number of this British Standard[2)], i.e. BS 3381.

7 Packaging for transit and storage

The gaskets shall be enclosed in moisture resistant wrappings and packed in such a way as to prevent damage in transit or during storage.

[2)] Marking BS 3381 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.

Table 1 — Spiral wound gasket dimensions for Class designations 150, 300, 600, 900, 1 500 and 2 500

Nominal size	Centring ring outside diameter[a]						Sealing element outside diameter (maximum)	Sealing element inside diameter for gasket with inner ring (minimum)			Inner ring inside diameter (minimum)
	Class designation							Class Designation			
	150	300	600	900	1 500	2 500		150	300 to 1 500	2 500	
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
½	47.6	54.0	54.0	63.5	63.5	69.9	32.2	[b]18.7	[b]18.7	18.7	14.3
¾	57.2	66.7	66.7	69.9	69.9	76.2	40.1	[b]26.6	[b]25.0	25.0	20.6
1	66.7	73.0	73.0	79.4	79.4	85.7	48.0	[b]32.9	[b]31.4	31.4	27.0
1¼[c]	76.2	82.6	82.6	88.9	88.9	104.8	60.7	[b]45.6	[b]44.1	39.3	34.9
1½	85.7	95.3	95.3	98.4	98.4	117.5	70.3	53.6	[b]50.4	47.2	41.3
2	104.8	111.1	111.1	142.9	142.9	146.1	86.1	69.5	66.3	58.3	52.4
2½[c]	123.8	130.2	130.2	165.1	165.1	168.3	98.8	82.2	79.0	69.5	63.5
3	136.5	149.2	149.2	168.3	174.6	196.9	121.1	101.2	94.9	91.7	77.8
4	174.6	181.0	193.7	206.4	209.6	235.0	149.6	126.6	120.3	117.1	103.2
5[c]	196.9	215.9	241.3	247.7	254.0	279.4	178.2	153.6	147.2	142.5	128.5
6	222.3	250.8	266.7	288.9	282.6	317.5	210.0	180.6	174.2	171.1	154.0
8	279.4	308.0	320.7	358.8	352.4	387.4	263.9	231.4	225.0	215.5	203.2
10	339.7	362.0	400.1	435.0	435.0	476.3	317.9	286.9	280.6	269.5	254.0
12	409.6	422.3	457.2	498.5	520.7	549.6	375.1	339.3	333.0	323.5	303.2
14	450.9	485.8	492.1	520.7	577.9	—	406.8	371.1	364.7	—	342.9
16	514.4	539.8	565.2	574.7	641.4	—	464.0	421.9	415.5	—	393.7
18	549.3	596.9	612.8	638.2	704.9	—	527.5	475.9	469.5	—	444.5
20	606.4	654.1	682.6	698.5	755.7	—	578.3	526.7	520.3	—	495.3
24	717.6	774.7	790.6	838.2	901.7	—	686.2	631.4	625.1	—	596.9

[a] Tolerance is $^{+0}_{-0.8}$ mm.

[b] These gasket dimensions are not suitable for use with slip-on screwed flanges.

[c] The use of these sizes for new construction should be avoided.

Table 2 — Symbols for material markings

Metal winding material	Marking symbol[a]
Grade 304S16 to BS 1449-2	304S16
Grade 316S11 to BS 1449-2	316S11
Nickel-copper alloy	Ni-Cu
Nickel	Ni

[a] Where other materials are used, industry-recognized symbols should be used, and as far as possible symbols should be taken from published standards.

Appendix A Information to be supplied by the purchaser

Before ordering a gasket it is recommended that the selection of the gasket type be made in consultation with the gasket supplier. The selection of gasket type should take account of the operating conditions, the type of flange facing, the properties of the gasket materials and the flange bolt loading. The purchaser should supply the following information when ordering gaskets:

a) the number of this British Standard, i.e. BS 3381;

b) the type of gasket (see clause **3**);

c) the nominal size and class designation (see Table 1);

d) whether an inner ring is required for Class 150, 300 and 600 gaskets (see clause **3**);

e) the specific material for the metal winding, if required (see **4.2**);

f) the specific filler material if other than that specified in **4.3**;

g) the specific centring ring material, if required (see **4.4**);

h) the specific inner ring material, if required (see **4.5**).

i) expected operating conditions for which the gasket will be used.

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Publications referred to

BS 1449, *Steel plate, sheet and strip.*
BS 1449-2, *Specification for stainless and heat-resisting steel plate, sheet and strip.*
BS 1560, *Circular flanges for pipes, valves and fittings (Class designated).*
BS 1560-3, *Steel, cast iron and copper alloy flanges.*
BS 1560-3.1, *Specification for steel flanges.*
BS 1560-3.2, *Specification for cast iron flanges.*
BS 1560-3.3, *Specification for copper alloy and composite flanges.*
BS 4504, *Circular flanges for pipes, valves and fittings (PN designated).*
BS 4504-3, *Steel, cast iron and copper alloy flanges.*
BS 4504-3.1, *Specification for steel flanges.*
BS 4865, *Dimensions of gaskets for flanges to BS 4504.*
BS 4865-2, *Specification for spiral wound gaskets for use with steel flanges.*
BS 7076, *Dimensions of gaskets for flanges to BS 1560.*
BS 7076-1, *Specification for non-metallic flat gaskets.*
BS 7076-2, *Specification for metallic ring-joint gaskets for use with steel flanges.*
BS 7076-3, *Specification for non-metallic envelope gaskets.*
BS 7076-4, *Specification for corrugated, flat or grooved metallic and filled metallic gaskets .*

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