

Gas Industry Standard

GIS/F7:2006

Specification for

**Steel welding pipe fittings, nominal size 15 mm to
450 mm inclusive, for operating pressures not greater
than 7 bar**

nationalgrid

Northern
Gas Networks 

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Foreword

Gas Industry Standards (GIS) are revised, when necessary, by the issue of new editions. Users should ensure that they are in possession of the latest edition. Contractors and other users external to Gas Transporters should direct their requests for copies of a GIS to the department or group responsible for the initial issue of their contract documentation.

Comments and queries regarding the technical content of this document should be directed in the first instance to the contract department of the Gas Transporter responsible for the initial issue of their contract documentation.

This standard calls for the use of procedures that may be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

Compliance with this engineering document does not confer immunity from prosecution for breach of statutory or other legal obligations.

Mandatory and non-mandatory requirements

For the purposes of a GIS the following auxiliary verbs have the meanings indicated:

- can** indicates a physical possibility;
- may** indicates an option that is not mandatory;
- shall** indicates a GIS requirement;
- should** indicates best practice and is the preferred option. If an alternative method is used then a suitable and sufficient risk assessment needs to be completed to show that the alternative method delivers the same, or better, level of protection.

Disclaimer

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Brief history

First published as BGC/PS/F7 Amendment No.1 published Amended issue published as GBE/F7 Editorial update to reflect demerger November 2000 Editorial update to reflect merger October 2002 Editorial update to comply with GRM Edited by BSI in accordance with BS 0-3:1997	November 1984 May 1986 April 1993 June 2001 November 2002 August 2004 August 2006
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1 Scope

This Gas Industry Standard (GIS) specifies the requirements for the manufacture and testing of carbon steel welding pipe fittings, of a nominal size 15 mm to 450 mm inclusive, designed for use with pipe conforming to GIS/L2 in gas distribution systems operating at pressures not greater than 7 bar. The types of pipe fittings included are:

- a) BS 3799 socket welding pipe fittings of nominal size 15 mm to 50 mm (inclusive);
- b) BS EN 10253-1 butt welding pipe fittings of nominal size 80 mm to 150 mm (inclusive);
- c) BS 1640-3.1 butt welding pipe fittings of nominal size 200 mm to 450 mm (inclusive);
- d) fillet welding flanges that conform to BS EN 1515-1, BS EN 1515-2 and BS EN 1092-1;
- e) fillet welding cathodic protection anode connections of nominal size 80 mm to 450 mm (inclusive);
- f) tie-in sleeves of nominal size 80 mm to 450 mm (inclusive);
- g) mitre bends.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Formal standards

BS 1503, *Specification for steel forgings for pressure purposes.*

BS 1640-3, *Specification for steel butt-welding pipe fittings for the petroleum industry — Part 3: Wrought carbon and ferritic alloy steel fittings — Metric units.*

BS 3799, *Specification for steel pipe fittings, screwed and socket-welding for the petroleum industry.*

BS 4190, *Specification for ISO metric black hexagon bolts, screws and nuts.*

BS 4320, *Specification for metal washers for general engineering purposes — Metric series.*

BS 4882, *Specification for bolting for flanges and pressure containing purposes*

BE EN 1092-1, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated — Steel flanges.*

BS EN 1515-1, *Flanges and their joints — Bolting — Part 1: Selection of bolting.*

BS EN 1515-2, *Flanges and their joints — Bolting — Part 2: Classification of bolt materials for steel flanges, PN designated.*

BS EN 10028-1, *Specification for flat products made of steels for pressure purposes — Part 1: General requirements.*

BS EN 10028-3, *Specification for flat products made of steels for pressure purposes — Part 3: Weldable fine grain steels, normalized.*

BS EN 10029, *Specification for tolerances on dimensions, shape and mass for hot rolled steel plates 3 mm thick or above.*

BS EN 10216-1, *Seamless steel tubes for pressure purposes — Technical delivery conditions.*

BS EN 10216-2, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 2: Non-alloy and alloy steel tubes with specified elevated temperature properties.*

BS EN 10217-1, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 1: Non-alloy steel tubes with specified room temperature properties.*

BS EN 10217-2, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 2: Electric welded non-alloy and alloy steel tubes with specified elevated temperature properties.*

BS EN 10220, *Seamless and welded steel tubes — Dimensions and masses per unit length.*

BS EN 10222-1, *Steel forgings for pressure purposes — Part 1: General requirements for open die forgings.*

BS EN 10222-5, *Steel forgings for pressure purposes — Part 5: Martensitic, austenitic and austenitic-ferritic stainless steels.*

BS EN 10253-1, *Butt-welding pipe fittings — Part 1: Wrought carbon steel for general use and without specific inspection requirements.*

BS EN 10272, *Stainless steel bars for pressure purposes.*

ASTM A106, *Seamless carbon steel pipe for high temperature service.*

Gas Industry Standards

GIS/L2, *Specification for steel pipe 21.3 mm to 1 219 mm outside diameter for operating pressures up to 7 bar (supplementary to BS EN 10208 1).*

National Grid standards

T/SP/P1, *Specification for the welding of steel pipe for distribution systems and installations (operating at pressures below 7 bar).*

T/SP/P13, *Specification for the partial penetration butt welding, socket and fillet welding of steel pipe and fittings for operating pressures up to 7 bar.*

3 Marking

Products conforming to GIS/F7 shall be permanently marked with the following information:

- a) the number and date of this specification, i.e. GIS/F7:2006 ¹⁾;
- b) the name or trademark of the manufacturer or their appointed agent;
- c) the manufacturer's contact details;
- d) where authorized, the product conformity mark of a third party certification body, e.g. BSI Kitemark.

NOTE Attention is drawn to the advantages of using third party certification of conformance to a standard."

4 Testing

4.1 Fillet welding flanges shall only be subject to the pneumatic test given in Annex C and not the hydrostatic test in Annex B, conforming to the test requirements in BS EN 1515-1, BS EN 1515-2 and BS EN 1092-1.

¹⁾ Marking GIS/F7:2006 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.

4.2 Fillet welding cathodic protection anode connections shall not be tested as they are not pressure-containing.

4.3 Individual manufacturing and test procedures for tie-in sleeves shall be submitted to the gas transporter for consideration.

4.4 Socket weld fittings shall be tested in conformance with BS 3799.

4.5 Butt weld fittings of nominal size from 80 mm to 150 mm shall be hydrostatically tested (see Annex B) to the test pressures given in Table B.1.

4.6 Butt weld fittings of nominal size from 200 mm to 450 mm shall be hydrostatically tested to the test pressures given in Table B.2. Reference shall be made to BS 1640-3 to confirm whether they also require radiographic examination and impact tests for fusion welding fabrications or WPLO/WPL3 material grades respectively.

5 Socket welding pipe fittings based on BS 3799

5.1 Socket welding pipe fittings of nominal size 15 mm to 50 mm inclusive shall conform to BS 3799. The fittings covered are 90° elbows, 45° elbows, crosses, equal tees, reducing tees, couplings, half couplings, caps, unions and swage nipples.

5.2 Fittings shall be suitable for assembly with plain end pipe, dimensioned in conformance to BS EN 10220, and for socket welding in accordance with T/SP/P13.

5.3 Fittings shall be designated as 3000 lb, in conformance to BS 3799.

5.4 Dimensions of swage nipples shall be in conformance to BS 3799:1974, Table 12.

5.5 Fittings shall be manufactured from materials that conform to the BS 3799 designation WPA or WPB, except for the maximum carbon content.

5.6 The maximum carbon content of fittings materials shall be 0.25%, except where the material used is of a standard whose maximum allowable carbon content is less than 0.25%, where the maximum content shall not exceed the value specified in that specification.

5.7 Fittings shall be clearly and indelibly marked with the fitting/material standard, i.e. "GIS/F7 / BS 3799 WPA" or "GIS/F7 / BS 3799 WPB".

5.8 Where the size of fitting permits, the additional information shall be included (in order of precedence):

- a) name or trademark of contractor;
- b) nominal size in mm.

5.9 Socket weld fittings shall be tested in conformance with BS 3799.

6 Butt welding pipe fittings based on BS EN 10253-1

6.1 Butt welding pipe fittings of nominal size 80 mm to 150 mm inclusive shall conform to BS EN 10253-1.

NOTE The fittings covered are 2° elbows or mitre bends, 5° elbows or mitre bends, 11¼° elbows or mitre bends, 22½° elbows, 45° elbows, 90° elbows, 180° return bends, concentric reducers, eccentric reducers, equal tees, reducing tees and caps.

6.2 Fittings shall be suitable for assembly with pipe of dimensions that conform to GIS/L2, and for butt welding that conforms to T/SP/P1.

6.3 Fittings other than mitre bends shall be manufactured from one of the following materials:

- a) Pipe: BS 3602-1: HFS 430.
- b) Plate: BS 1501 - 151 grade 400A
BS 1501 - 151 grade 430A
BS 1501 - 161 grade 400A
BS 1501 - 161 grade 430A
- c) Forgings: BS 1503 - 221-410
BS 1503 - 221-430

6.4 The maximum carbon content of fittings materials shall be 0.23%, except where the material used is of a standard whose maximum allowable carbon content is less than 0.23%, where the maximum content shall not exceed the value specified in that specification. The carbon equivalent shall not exceed 0.40 on cast analysis as calculated using the formula $CE = C + Mn/6$. Random analysis checks for carbon and manganese may be carried out.

6.5 Materials for mitre bends shall be as specified in **A.2**.

6.6 The outside diameter and wall thickness at the welding ends of fittings shall be in accordance with Table 1. The tolerance on the outside diameter at the welding ends of fittings shall be ± 1.6 mm.

6.7 For 2°, 5° and 11¼° bends, either elbows or mitre bends may be used. For 2°, 5° and 11¼° elbows the contractor shall select a centre-to-end dimension that ensures the distance between the two weld end preparations at the intrados is not less than 6 mm. The tolerance on the angle of elbows shall be $\pm 1^\circ$. The dimensions and tolerances for mitre bends are specified in **A.3** and **A.4**.

6.8 The dimensions and tolerances of 22½° elbows shall meet the requirements of Table 2.

6.9 The weld ends of fittings shall comply with the weld end preparation dimensions shown in Figure 1.

6.10 Fittings shall be capable of withstanding the hydrostatic test given in Annex B.

6.11 The requirements for the hydrostatic testing of mitre bends are specified in **A.6**.

6.12 Fittings shall be stencilled or otherwise suitably marked with the following information:

- a) nominal size in mm;
- b) designation of this standard, i.e. "GIS/F7";
- c) the gas transporter purchase order reference number or code.

6.13 Additional markings (e.g. contractor's name or trademark) may be applied if space permits.

Table 1 — Outside diameter and wall thickness at welding ends of fittings based on BS EN 10253-1

Nominal size	Outside diameter (Minor axis for mitre bends)	Wall thickness
mm	mm	mm
80	88.9	4.9
100	114.3	5.4
150	168.3	5.4

Table 2 — Dimensions and tolerances of 22½° ½ elbows based on BS EN 10253-1

Nominal size	Centre to end dimension (B in BS 1965-1, Figure 4)	Tolerance on B	Tolerance on
mm	mm	mm	°
80	24	±6.5	±1
100	30	±6.5	±1
150	46	±6.5	±1

NOTE Tolerance is on the elbow angle, i.e. 22½°.

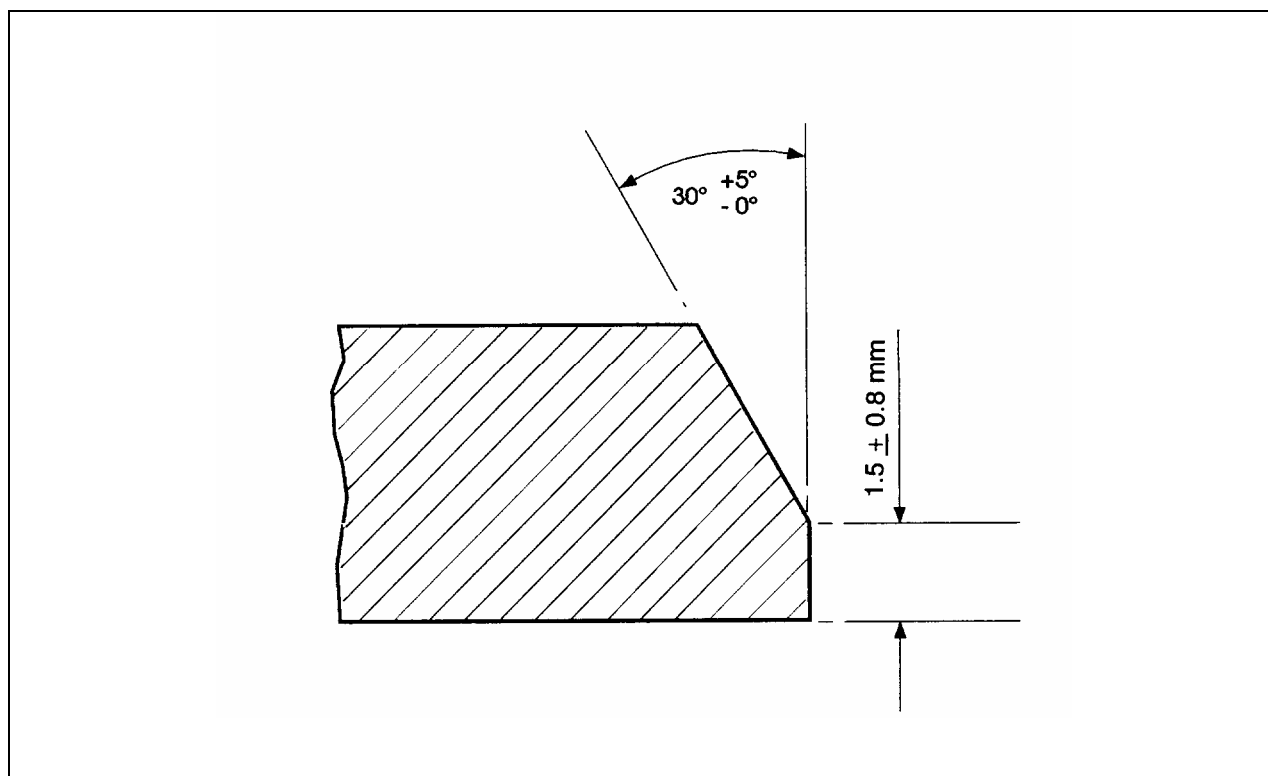


Figure 1 — Weld end preparation for fittings based on BS EN 10253-1

7 Butt welding pipe fittings based on BS 1640-3

7.1 Butt welding pipe fittings of nominal size 200 mm to 450 mm inclusive shall be in accordance with BS 1640-3. The fittings covered are 2° elbows or mitre bends, 5° elbows or mitre bends, 11¼° long radius elbows, 45° long radius elbows, 90° long radius elbows, 180° long radius return bends, concentric reducers, eccentric reducers equal tees, reducing tees and caps.

7.2 Fittings shall be suitable for assembly with pipe dimensioned in accordance with GIS/L2, and for butt welding in accordance with T/SP/P1.

7.3 Fittings other than mitre bends shall be manufactured from one of the following materials:

- a) Pipe: ASTM A 106, Grade B, hot finished.
- b) Plate: BS 1501-151 grade 400A
BS 1501-151 grade 430A
BS 1501-161 grade 400A
BS 1501-161 grade 430A.
- c) Forgings: BS 1503-221 - 410
BS 1503-221 - 430.

7.4 The maximum carbon content of fittings materials shall be 0.23%, except where the material used is of a specification whose maximum allowable carbon content is less than 0.23%, where the maximum content shall not exceed the value specified in that specification. The carbon equivalent shall be not greater than 0.40 on cast analysis as calculated using the formula $CE = C + Mn/6$. Random analysis checks for carbon and manganese may be carried out.

7.5 Materials for mitre bends shall be as specified in **A.2**.

7.6 The body thickness of fittings shall be such that it is at least equal in strength to that of a straight pipe of the same material and the same nominal size and thickness.

7.7 The outside diameter and wall thickness at the welding ends of fittings shall be in accordance with Table 3. The tolerances on the outside diameter and inside diameter at the welding ends of fittings other than mitre bends shall be in accordance with Table 4.

7.8 For 2° and 5° bends, either elbows or mitre bends are acceptable. For 2° and 5° elbows the contractor shall select a centre to end dimension or centre line radius, which will ensure that the distance between the two weld end preparations at the intrados is not less than 6 mm. The tolerance on the angle of elbows shall be $\pm 1^\circ$. The dimensions and tolerances for mitre bends are specified in **A.3** and **A.4**.

7.9 The dimensions and tolerances of 11¼° and 22½° long radius elbows shall conform to the requirements of Table 5 and Figure 2.

7.10 The weld ends of fittings shall conform to the weld end preparation dimensions shown in Figure 3.

7.11 Fittings shall be capable of passing the hydrostatic test described in Annex B.

7.12 Fittings shall be stencilled or otherwise suitably marked with the following information:

- a) nominal size in mm;
- b) designation of this specification, i.e. "GIS/F7";
- c) the gas transporter's purchase order reference number or code.

7.13 Additional markings (e.g. the contractor's name or trademark) may be applied if space permits.

Table 3 — Outside diameter and wall thickness at welding ends of fittings based on BS 1640-3

Nominal size mm	Outside diameter (minor axis for mitre bends) mm	Wall thickness mm
200	219.1	6.35
250	273.0	6.35
300	323.9	6.35
400	406.4	7.92
450	457.2	7.92

Table 4 — Tolerances at welding ends of fittings other than mitre bends based on BS 1640-3

Nominal size mm	Tolerance on outside diameter mm	Tolerance on inside diameter mm
200	±2.0,-1.6	±1.6
250	±2.0	±2.0
300	±2.0	±2.0
400	±2.5	±2.5
450	±2.5	±2.5

Table 5 — Dimensions and tolerances of 11 ¼° and 22 ½° long radius elbows based on BS 1640-3

Nominal size mm	Centre line radius P mm	Tolerance on P mm	Tolerance on θ °
200	305.0	±1.5	±1
250	381.0	±2.0	±1
300	457.0	±2.0	±1
400	609.5	±2.0	±1
450	686.0	±2.0	±1

NOTE These dimensions and tolerances apply to elbows with elbow angle θ equal to 11¼° or 22½°. Dimensions P and θ are shown in Figure 2.

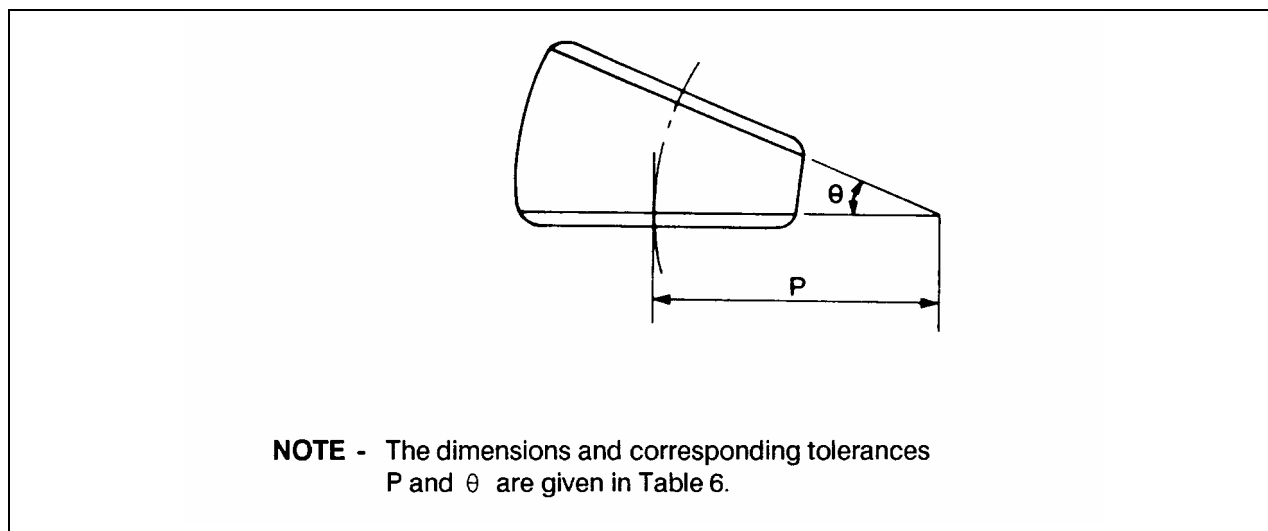


Figure 2 — Dimensions of $11\frac{1}{4}^\circ$ and $22\frac{1}{2}^\circ$ long radius elbows based on BS 1640-3

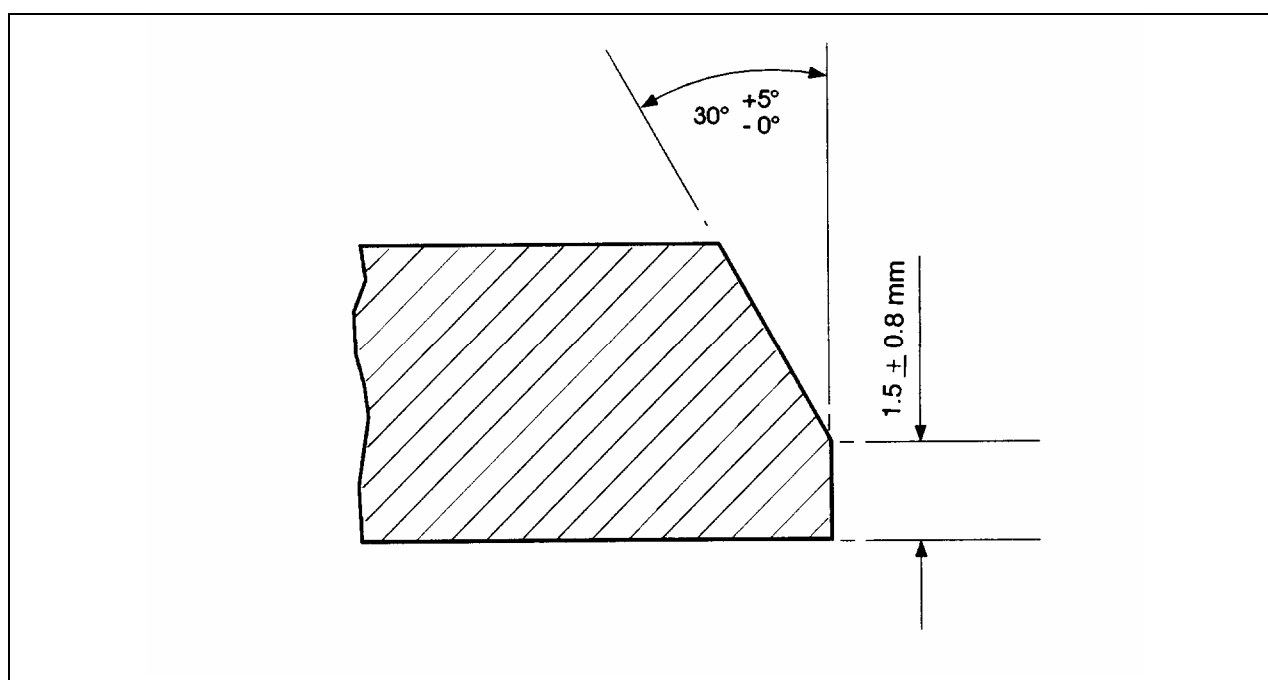


Figure 3 — Weld end preparation for fittings based on BS 1640-3

8 Fillet welding flanges based on BS 4504-3.1

8.1 Fillet welding flanges of nominal size 15 mm to 450 mm inclusive shall conform to BS 4504-3.1. The flanges covered are those designated in BS 4504-3.1 as pressure rating PN 16 and code 101 (plate flanges), code 112 (slip-on nubbed flanges) and code 105 (blank flanges).

8.2 Flanges shall be suitable for assembly with plain end pipe dimensioned in accordance with GIS/L2, and for fillet welding in accordance with T/SP/P13.

8.3 Flanges shall be manufactured from one of the following materials:

- a) Plate: BS 1501-151 grade 400A;
- b) Forgings: BS 1503-221-410;
BS1 503-221-430.

8.4 The maximum carbon content of fittings materials shall be 0.23 %, except where the material used is of a specification whose maximum allowable carbon content is less than 0.23 %, where the maximum content shall not exceed the value specified in that specification. The carbon equivalent shall not exceed 0.40 on cast analysis as calculated using the formula $CE = C + Mn/6$.

8.5 Random analysis checks for carbon and manganese may be carried out.

8.6 The dimensions and tolerances of flanges shall conform to the requirements of Table 6.

Table 6 — Dimensions and tolerances of flanges

Nominal size DN	Pipe outside diameter, <i>d</i>	Flange bore	Tolerance on flange bore
mm	mm	mm	mm
15	21.3	21.8	+0.3, -0
20	26.9	27.4	+0.3, -0
25	33.7	34	+0.3, -0
32	42.4	42.9	+0.3, -0
40	48.3	49.0	+0.3, -0
50	60.3	61.0	+0.3, -0
80	88.9	89.7	+0.7, -0
100	114.3	115.3	+0.7, -0
150	168.3	169.3	+0.7, -0
200	219.1	220.1	+0.7, -0
250	273.0	274.0	+0.7, -0
300	323.9	324.9	+1.0, -0
400	406.4	407.4	+1.0, -0
450	457.0	458.0	+1.0, -0

8.7 Flanges shall have raised joint faces (Type B) unless otherwise specified by the gas transporter at the order stage.

8.8 Flanges shall be stencilled or otherwise suitably marked with the following information:

- a) nominal pressure, i.e. PN 16;
- b) nominal size, e.g. DN 80;
- c) designation of this specification, i.e. "GIS/F7";
- d) the gas transporter purchase order reference number or code.

8.9 Additional markings (e.g. contractor's name or trademark) may be applied if space permits.

8.10 If the gas transporter specifies that bolts are to be supplied with flanges, they shall conform to the following standards:

- a) Hexagon bolts and nuts: BS 4190, grade 4.6 bolts and grade 4 nuts. Other combinations of grades of nuts and bolts given in BS 4190 may also be used.
- b) Studbolts and nuts: BS 4882 metric series mild or carbon steel. Acceptable alternatives are BS 4882, grade B7/M or L7/M bolts with grade 4/M or 7/M nuts.

In all cases, standard black normal series washers conforming to BS 4320 shall be used.

8.11 Flanges shall only be subjected to the pneumatic test, given in Annex C, conforming to the test requirements given in BS EN 1515-1, BS EN 1515-2 and BS EN 1092-1.

9 Fillet welding cathodic protection anode connections

9.1 Fillet welding cathodic protection anode connections of nominal size 80 mm to 450 mm inclusive shall be suitable for fillet welding in accordance with T/SP/P13.

9.2 The fittings shall not be used for any mechanical, load bearing, anchorage or similar purposes.

NOTE The fittings are intended solely as electrical connections for cathodic protection test cables or for associated earthing or continuity bonding.

9.3 All fittings shall comply with the dimensions, tolerances, finishes, materials, heat treatments, markings, etc., shown in Figure 4.

9.4 All fittings shall be supplied with a metric series mild or carbon steel hexagon nut to BS 4882 and two standard black normal series washers to BS 4320. If specified by the gas transporter, an anti-vibration washer shall replace one of the standard black washers.

9.5 Fittings shall be identified with the following information marked on an attached label, or shall be otherwise indelibly marked:

- a) designation of this specification, i.e. "GIS/F7";
- b) **"WARNING: CONTINUITY CONNECTION ONLY - NO LOAD BEARING APPLICATIONS"**;
- c) the gas transporter purchase order reference number or code.

9.6 Additional markings (e.g. contractor's name or trademark) may be applied if space permits.

9.7 The fittings shall not be tested as they are not pressure-containing.

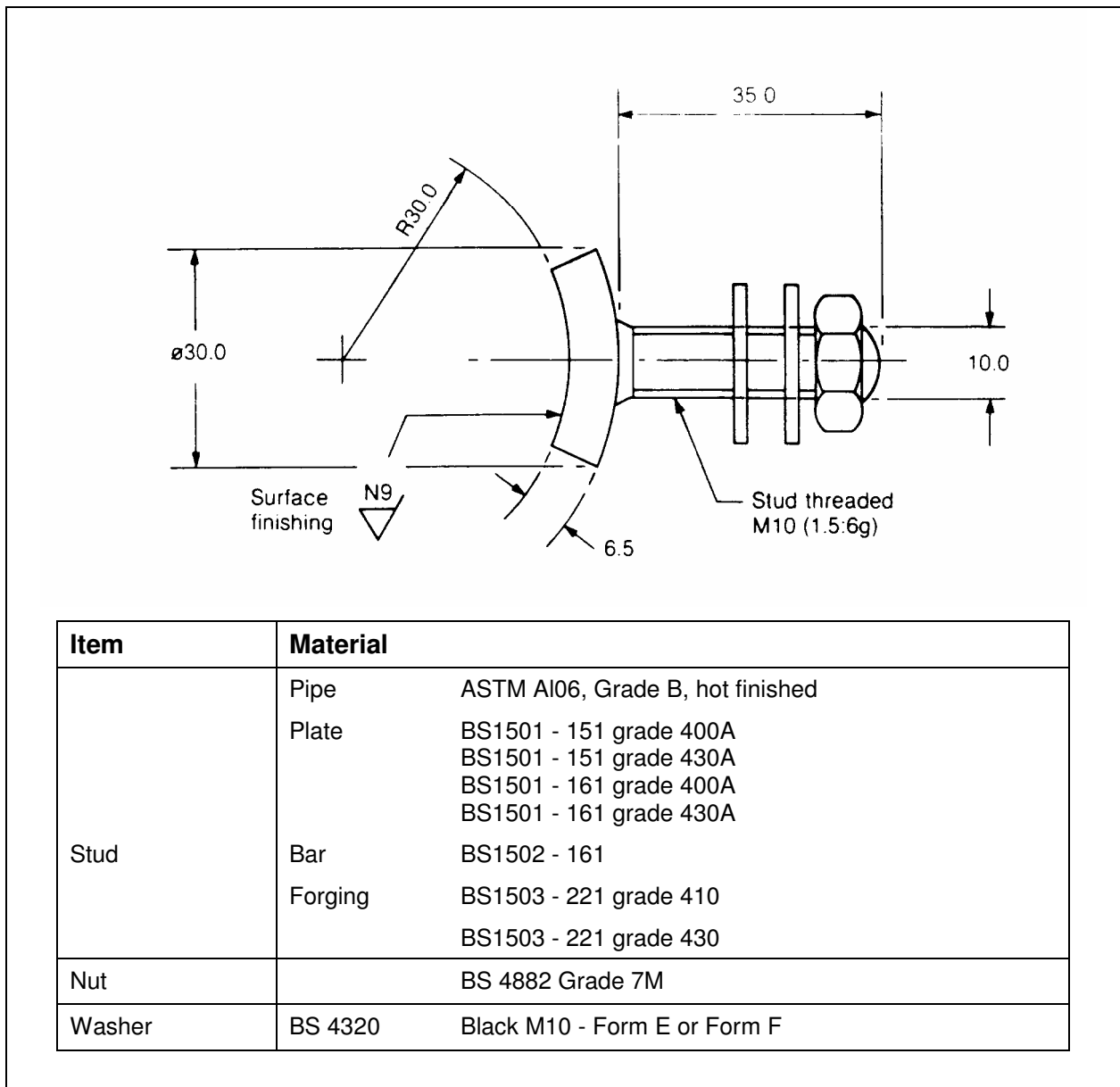


Figure 4 — Cathodic protection anode connection stud

10 Tie-in sleeves

10.1 Tie-in sleeves of nominal size 80 mm to 450 mm inclusive shall be used for fillet welding in accordance with T/SP/P13.

NOTE The fittings are for use as tie-in length connections during construction of a pipeline and where pipe cut-out and subsequent replacement is necessary as a means of repair during service.

10.2 Pipe material shall conform to BS 3601, grade S430.

10.3 All fittings shall comply with the dimensions, tolerances and finishes shown in Figure 5.

10.4 Details of the manufacturing and testing procedures shall be submitted to the gas transporter prior to the commencement of manufacture.

10.5 Fittings shall be stencilled or otherwise suitably marked with the following information:

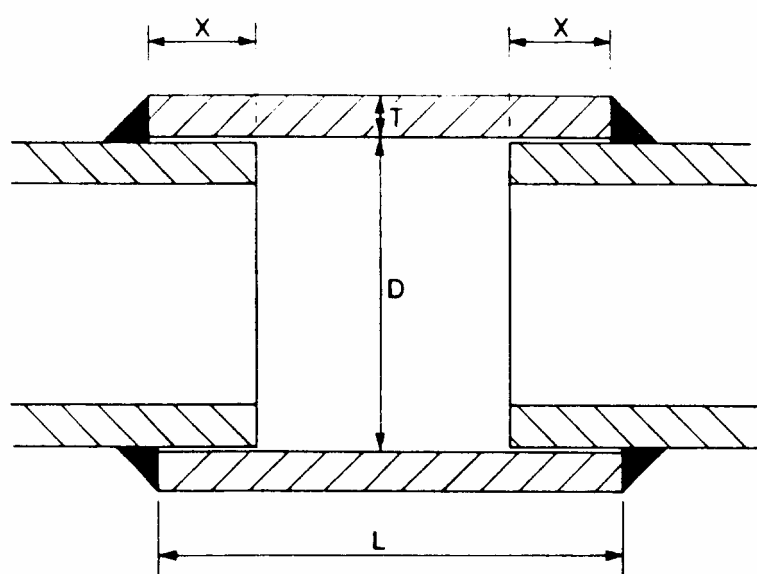
- a) pipe nominal size;
- b) designation of this specification, i.e. "GIS/F7";
- c) the gas transporter purchase order reference number or code.

10.6 Additional markings (e.g. contractor's name or trademark) may be applied if space permits.

10.7 Fittings shall also be marked with the following information on an attached label or shall be otherwise indelibly marked:

"MINIMUM SLEEVE/PIPE OVERLAP X mm EACH END"

where X is the appropriate dimension shown in Figure 5.



All dimensions in millimetres

NOMINAL SIZE OF PIPE TO BE REPAIRED		80	100	150	200	250	300	400	450
SLEEVE DIMENSIONS									
Nominal size of stock pipe		90	100	150	200	250	300	400	450
Stock pipe outside diameter		101.6	114.3	168.3	219.1	273.0	323.9	406.4	457.0
Stock pipe wall		8.0	11.0	10.0	11.0	11.0	11.0	14.2	14.2
Finished swaged or machined inside diameter D	Maximum	90.7	116.3	170.3	221.1	275.0	325.9	409.4	460.0
	Minimum	90.1	115.7	169.7	220.5	274.4	325.3	408.4	459.0
Minimum finished wall (T)		5.0	5.4	5.4	6.3	6.3	6.3	8.0	8.0
Sleeve length ± 5 (L)		150	150	150	225	225	225	300	300
Sleeve overlap (minimum) (X)		35	35	35	50	50	50	60	60

NOTE Sleeves are manufactured from stock pipe and require no external machining when machined or swaged to the inside diameter tolerances specified. The finished wall dimension will depend on the outside diameter and wall thickness of the stock pipe, but shall be not less than the values specified.

Figure 5 — Tie-in sleeve

Annex A (normative)

Additional requirements for mitre bends

A.1 The preferred material for the manufacture of mitre bends is electric resistance welded pipe conforming to GIS/L2, which meets the dimensional requirements for mitre bends if it is selected in accordance with **A.3**.

A.2 Where electric resistance welded pipe to GIS/L2 is not available, pipe which meets all of the requirements of **6.3** or **7.3** (as appropriate) may be used if it meets the dimensional requirements specified in GIS/L2 and **A.4**.

A.3 In order to meet the requirements of **A.4** using pipe to GIS/L2, pipe of outside diameter less than the maximum value specified in GIS/L2 shall be used as given in Tables A.1 and A.2. If necessary, re-rounding of this pipe may be carried out using a technique approved by Quality Assurance.

A.4 The dimensions and tolerances of mitre bends shall meet the requirements of Tables A.3 and A.4 or Tables A.5 and A.6 as appropriate.

A.5 A weld end on a mitre bend constitutes an ellipse with minor axis equivalent to the pipe diameter. The two minor axes of each mitre bend shall be parallel in all planes to within the tolerances given in Table A.7.

A.6 Hydrostatic testing is not required for mitre bends manufactured from pipe that conforms to GIS/L2 because the pipe has already been pressure tested. Mitre bends manufactured from pipe that does not conform to GIS/L2 shall meet the requirements of **6.8** or **7.8**, as appropriate.

A.7 The contractor shall test mitre bends to ensure that the weld ends represent a true ellipse.

Table A.1 — Maximum outside diameter of pipe for mitre bends based on BS EN 10253-1

Nominal size mm	Mitre angle degrees	Maximum outside diameter of pipe mm
80	$2\frac{13}{16}$	89.67
	$5\frac{5}{8}$	89.59
	$11\frac{1}{4}$	89.27
100	$2\frac{13}{16}$	115.27
	$5\frac{5}{8}$	115.16
	$11\frac{1}{4}$	114.74
150	$2\frac{13}{16}$	169.25
	$5\frac{5}{8}$	169.10
	$11\frac{1}{4}$	168.48

Table A.2 — Maximum outside diameter of pipe for mitre bends based on BS 1640-3

Nominal size mm	Mitre angle degrees	Maximum outside diameter of pipe mm
200	2 ¹³ / ₁₆	220.03
	5 ⁵ / ₈	219.83
250	2 ¹³ / ₁₆	273.92
	5 ⁵ / ₈	273.67
300	2 ¹³ / ₁₆	324.80
	5 ⁵ / ₈	324.51
400	2 ¹³ / ₁₆	407.28
	5 ⁵ / ₈	406.91
450	2 ¹³ / ₁₆	457.86
	5 ⁵ / ₈	457.45

Table A.3 — Dimensions of mitre bends based on BS EN 10253-1

Nominal size mm	Inside length N mm	Weld end major axis M mm
80	40	88.9
100	40	114.3
150	40	168.3

NOTE These dimensions apply to bends with mitre angle θ equal to 2°, 5° or 11¼°. Dimensions M, N and θ are shown in Figure A.1.

Table A.4 — Tolerances on dimensions of mitre bends based on BS EN 10253-1

Dimensions (see Figure A.1)	Tolerance
Inside length "N"	±6.5 mm
Weld end major axis "M"	±1.2 mm
End angle "½"	±½°

Table A.5 — Dimensions of mitre bends based on BS 1640-3

Nominal size mm	Inside length N mm	Weld end major axis M mm
200	40	219.1
250	40	273.0
300	40	323.9
400	40	406.4
450	40	457.0

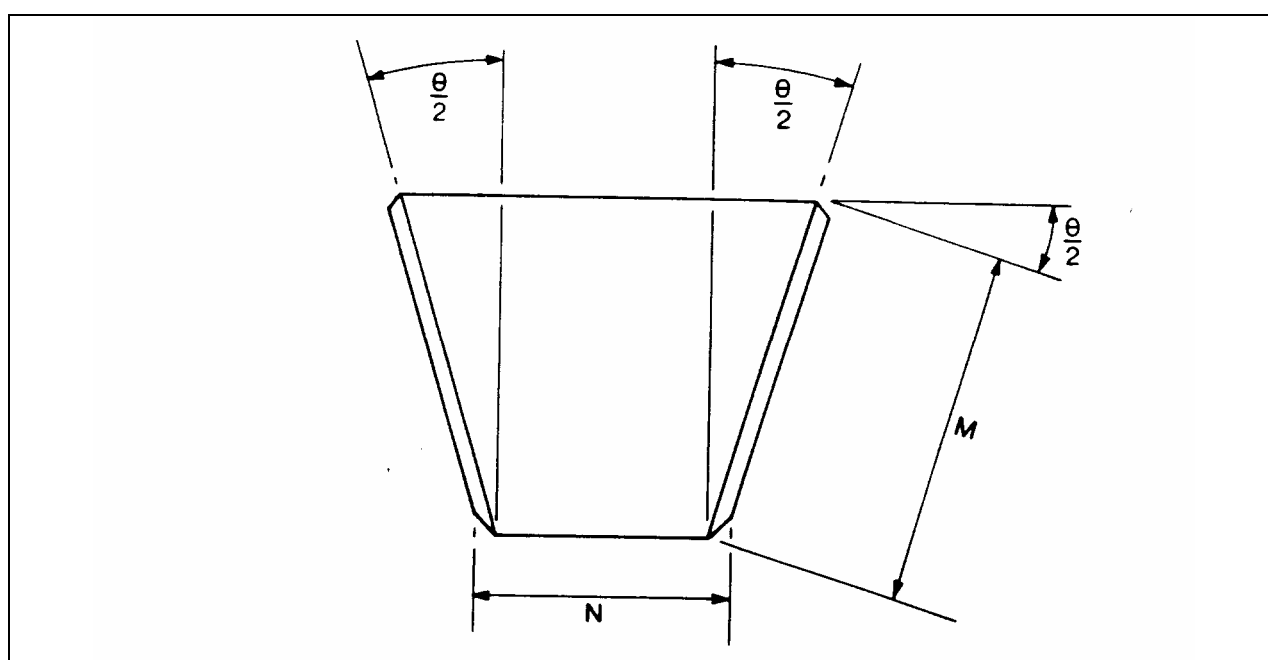
NOTE These dimensions apply to bends with mitre angle θ equal to 2° or 5° . Dimensions M, N and θ are shown in Figure A.1.

Table A.6 — Tolerances on dimensions of mitre bends based on BS 1640-3

Dimensions (see Figure A.1)	Tolerance
Inside length "N"	± 6 mm
Weld end major axis "M"	± 1 mm
End angle " $\frac{\theta}{2}$ "	$\pm \frac{1}{2}^\circ$

Table A.7 — Tolerances on minor axes of mitre bends

Nominal size mm	Tolerance mm
80 and 100	0.8
150	1.2
200 to 450 inclusive	1.6

**Figure A.1 — Dimensions of mitre bends**

Annex B (normative) Hydrostatic bursting test

B.1 Principle

All fittings shall be capable of withstanding a test pressure that conforms to the British Standard for the pipe in which the fitting will be used. This test is a prototype test agreed between purchaser and manufacturer conforming to BS EN 10253-1:1999, Annex A and at the test pressures indicated in Table 3.

Fillet welding flanges, butt welding fittings and mitred bends not made from pipe conforming to GIS/L2 shall be capable of withstanding the test pressures given in Tables 3 and 7.

NOTE This is a prototype test for type approval done on the design range of fittings and on the diameters agreed between purchaser and the manufacturer conforming to BS EN 10253-1:1999.

B.2 Apparatus

B.2.1 *Butt welding pipe fitting.*

B.2.2 *Two straight pipes, of the same material and nominal wall thickness as the fitting, of a length equal to at least twice the pipe outside diameter.*

B.2.3 *Hydrostatic pressure test equipment.*

B.3 Procedure

B.3.1 Weld a straight pipe to each end of the fitting.

B.3.2 Weld closures to the pipe ends beyond the minimum length.

B.3.3 Apply the hydrostatic test pressures given in Table 7 to the assembly then increase the pressure until either the fitting or one of the pipes bursts.

B.4 Results

Fittings shall be capable of passing the hydrostatic test pressures given in Tables B.1 and B.2 without any signs of observed leakage through either loss in pressure from test equipment or use of a leak detector solution.

Table B.1 — Hydrostatic test pressures for fittings based on BS EN 10253-1

Nominal size mm	Wall thickness mm	Test pressure bar
80	4.9	155
100	5.4	133
150	5.4	90

Table B.2 — Hydrostatic test pressures for fittings based on BS 1640-3

Nominal size mm	Wall thickness mm	Test pressure bar
200	6.35	81
250	6.35	65
300	6.35	55
400	7.92	55
450	7.92	49

Annex C (normative)
Pneumatic test**C.1 Principle**

All fittings except fillet welding cathodic protection anode connections shall be subject to a pneumatic test at 1.5 times the maximum operating pressure of the fitting use for duration of 1 h.

C.2 Apparatus

C.2.1 *Butt welding pipe fitting.*

C.2.2 *Two straight pipes, of the same material and nominal wall thickness as the fitting, of a length equal to at least twice the pipe outside diameter.*

C.2.3 *Pneumatic pressure test equipment.*

C.3 Procedure

C.3.1 Weld a straight pipe to each end of the fitting.

C.3.2 Weld closures to the pipe ends beyond the minimum length.

C.3.3 Apply a test pressure of 1.5 times the maximum operating pressure for 1 h.

C.4 Results

The fittings shall not show any signs of observed leakage through either loss in pressure from test equipment or use of a leak detector solution.