

THE ENGINEERING EQUIPMENT AND MATERIALS USERS ASSOCIATION

90/10 COPPER NICKEL ALLOY PIPING FOR OFFSHORE APPLICATIONS

SPECIFICATION: FLANGES Composite and Solid

PUBLICATION No. 145 : 1987

EEMUA



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SPECIFICATION: FLANGES Composite and Solid

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THE ENGINEERING EQUIPMENT AND MATERIALS USERS ASSOCIATION

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FOREWORD

The Publications in this series of specifications for 90/10 copper nickel tubes, flanges and fittings are as follows:

Publication No. 144 Tubes: seamless and welded

Publication No. 145 Flanges: composite and solid

Publication No. 146 Fittings

This specification is for a series of composite (lap type) and solid flanges in metric dimensions based on ANSI B16.5, MSS SP-44 and BS 1560.

The basic metric dimensions for drilling and flange outside diameters are those given in ANSI B16.5, BS 1560 and MSS SP-44 for Class 150 rating with inch size bolting.

The flanges covered in this specification are suitable for maximum design pressures of 16 bar at 75°C and 20 bar at 38°C.

For sizes of a particular type of flange not covered within this specification the purchaser should satisfy himself that the flange is suitable for the service intended.

The diameters of hubs have been chosen to permit the use of ring spanners.

A list of other standards and codes referred to in this publication is given in appendix A.

SECTION ONE — COMPOSITE WELD NECK FLANGES

1.1 Scope and design basis

Section 1 is divided into two sub-sections. Sub-section 1A gives details of the 90/10 copper nickel weld neck stub ends, whereas sub-section 1B gives details of the forged carbon steel plate-type backing flanges.

The range of sizes covered for these composite weld-neck flanges are ½ in/16 mm — 36 in/914 mm.*

Two types of weld neck stub ends are included in sub-section 1A. The short components (type S) are based on DIN 86037 but modified to suit the appropriate tube wall dimensions. The long components (type L) are based on MSS SP-43 to suit the appropriate tube wall dimensions. The long stub ends have been included to facilitate the attachment of this type of flange to butt welding elbows, tees, and the small end of reducers.

Only one type of backing flange is included in sub-section 1B. The same backing flange is required for all weld neck stub ends whether they be long or short, 16 bar or 20 bar. This type of backing flange is not suitable for use with composite slip-on stub ends (section 2B).

The thicknesses of the plate type backing flanges have been determined to meet the requirements of the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, 1983 edition, Appendix 2, except that design stresses have been established in accordance with ANSI B31.3 criteria.

The following design criteria have been used:

- (a) Drilling and outside diameter dimensions of flange sizes ½ inch/16 mm – 24 in/610 mm are in accordance with ANSI B16.5 and BS 1560, whereas the larger sizes, 28 in/711 mm – 36 in/914 mm are in accordance with MSS SP-44.
- (b) All calculations for backing flanges have been carried out using a design pressure of 20 bar at 38°C.
- (c) Backing flanges: ASTM A105 forged carbon steel.
- (d) Gaskets: 1.5 mm thick CAF (compressed asbestos fibre) inside bolt circle.
- (e) Bolting: ASTM A193-B7.

Design stresses used in the calculations were as follows:

- (i) Steel backing flanges: 160.7 N/mm².
- (ii) B7 bolting: 172.4 N/mm².

Based on the results of the above calculations an attempt has been made to rationalise ½ in/16 mm up to and including 1½ in/44.5 mm backing flanges which utilise the same bolting. The opportunity was taken therefore to use the same flange thickness (dimension 'b') determined for the largest of this size range and apply it to the smaller sizes, resulting in identical bolt lengths for all flanges in that range. This was considered to be a practical and economical advantage within the industry.

The dimensions of backing flanges are governed by the strength required to resist the bolting forces which may occur on bolting up. Therefore all backing flanges are suitable for a maximum working pressure of 20 bar at 38°C.

This specification does not specify hydraulic test pressures for flanges or components, details of which should be obtained from the appropriate application standards.

* For purposes of this specification inch dimensions are nominal and metric dimensions refer to specified outside diameters.

Composite weld neck flanges**1.2 Pressure/temperature ratings**

Pressure/temperature ratings are the maximum allowable working pressures (MAWP) at the temperatures shown in appendix C.

If a stub end rated at 16 bar is required to be connected to a stub end rated at 20 bar then that flanged joint shall be rated at 16 bar (see tables 1.2 and 1.3).

The temperature shown for a corresponding pressure rating is considered to be the same as that of the contained fluid.

1.3 Materials**1.3.1 Flanges**

Stub ends detailed in sub-section 1A shall be manufactured in 90/10 CuNi alloy UNS 7060X* the composition and mechanical properties of which are specified in table 1.6.1.

Backing flanges detailed in sub-section 1B shall be manufactured from the material specified in table 1.6.2. Alternative steels may be used for the backing flanges provided that they have mechanical properties equal to or better than those specified in ASTM A105 (normalised) and are acceptable to the purchaser.

1.3.2 Gaskets

The gaskets normally used with flanges to this specification are those made from compressed asbestos fibre (CAF) or equivalent. The gaskets shall not be graphited. Alternatively neoprene type gaskets with a minimum Shore hardness of not less than 75 may be used located within the bolt circle.

Note: Gaskets should not be used when mating with elastomer/rubber faced flanges.

1.3.3 Bolting (stud bolts)

Bolting for flanges to this specification shall be selected from ASTM A193-B7 and ASTM A194-2H and should be suitably protected from corrosion.

SUB-SECTION 1A — WELD NECK STUB ENDS**1A.1 Manufacture**

Stub ends shall be manufactured by one or more of the following processes:

- (a) Hot forging.
- (b) Cold forging followed by annealing.
- (c) Friction welded from wrought material in accordance with the requirements of BS 6223.
- (d) Other methods of manufacture shall be as agreed between the purchaser and the manufacturer.

* Alloy UNS 7060X is a modified form of the following national designated alloys — UNS 70600, BS CN 102 and DIN 2.0872.

Composite weld neck flanges

1A.2 Information to be supplied by the purchaser

The following shall be specified by the purchaser on the order (for stub ends).

- (a) The title and number of this specification (EEMUA Publication No. 145: 1987: section 1A).
- (b) Size: inches and millimetres.
- (c) The pressure rating: 16 bar or 20 bar.
- (d) Whether type "S" or type "L" stub ends are required, see tables 1.2 and 1.3.
- (e) Whether certificates of compliance or manufacturer's certificates are required (see clause 1A.8).
- (f) Whether it is his intention to inspect the material at the supplier's works.
- (g) Whether the individual cast analyses are required to be supplied (see addendum). See clause 1B.2 for information to be supplied by the purchaser for backing flanges.
- (h) Whether any additional identification marking other than that specified herein is required.

1A.3 Freedom from defects

The stub ends shall be visibly clean, smooth and free from defects greater than 0.5 mm in depth, irregularities, scale or deposits.

1A.4 Joint facings and surface finish

All stub end jointing surfaces shall be machine finished and when compared by visual or tactile means with reference specimens, they shall comply with the values shown in table 1.1.

It is not intended that instrument measurements be taken on the faces themselves and the R_a and R_z values relate to the reference specimens.

Table 1.1

Surface finish (weld neck stub ends).

Method of machining	R_a^* μm		R_z^* μm	
	min	max	min	max
turning	3.2	12.5	12.5	50

Note: The term "turning" includes any method of machining producing concentric or spiral grooves.

1A.5 Selection of test samples

For stub ends produced by hot forging or cold forging followed by annealing, samples for determination of mechanical properties shall be selected in accordance with Clause 9.2 of BS 2872: 1969. The mechanical properties so determined shall comply with the requirements of table 1.6.1 of this section.

Samples shall be selected from each cast for chemical analysis and shall comply with the requirements of table 1.6.1 of this section.

* R_a and R_z are defined in BS 1134

Composite weld neck flanges

For stub ends produced by friction welding using seamless tube and hot rolled or cold rolled and annealed sheet or plate, samples shall be selected as follows: -

- (a) Seamless tube in accordance with clause 1.6 of EEMUA Publication No. 144: 1987: section 1. The mechanical properties of the finished components shall comply with the requirements of table 1.6.1 of this section.
- (b) Sheet/plate in accordance with clause 11 of BS 2870: 1980 or clause 1.8 of BS 2875: 1969. The analysis and mechanical properties of each sheet or plate used to produce the stub ends shall comply with the requirements of table 1.6.1 of this section.

1A.6 Marking

1A.6.1 All stub ends 2 in/57 mm and larger shall be clearly and permanently marked by means of a vibratory etching tool or electrochemical etching as follows:

- (a) Purchase order number (PO).
- (b) The number of this section (EEMUA Publication No. 145: 1987: section 1A).
- (c) Size: inches and millimetres.
- (d) The nominal pressure rating: 16 bar or 20 bar.
- (e) Material designation UNS 7060X.
- (f) Batch traceability number (BTN).
- (g) Manufacturer's name or trademark (MTM).

Examples of marking:

PO 145/1 2/57 20 7060X BTN MTM

- Notes: (i) Stamping with metallic stamps is not permitted.
(ii) Marking shall not be on the gasket contact surfaces.

1A.6.2 Stub ends in sizes 1½ in/44.5 mm and smaller where it is not practical to apply the full requirements of 1A.6.1 shall be marked as follows:

- (a) Material designation UNS 7060X.
- (b) Batch traceability number (BTN)
- (c) Manufacturer's name or trademark (MTM).
- (d) Size: inches and millimetres.
- (e) Nominal pressure rating: 16 bar or 20 bar.

The remainder of the marking requirements shall be applied to indestructible-type labels securely attached to the component. The labels shall be clearly and permanently marked.

1A.7 Inspection and testing

This section does not make provision for routine pressure testing of stub ends. They shall, however, be dimensionally correct and be marked in accordance with this section. All stub ends shall be capable of withstanding without leakage or signs of distress a hydraulic pressure as follows:

- 16 bar rated flanges, test pressure = 24 bar.
- 20 bar rated flanges, test pressure = 30 bar.

1A.8 Certification

Certificate(s) shall be supplied, either:

1A.8.1 A certificate of compliance which shall state that the stub ends have been manufactured in accordance with all the requirements of this section (EEMUA Publication No. 145: 1987: section 1A) or:

Composite weld neck flanges

1A.8.2 A manufacturer's certificate(s) which shall state that the stub ends have been manufactured in accordance with all the requirements of this section (EEMUA Publication No. 145: 1987: section 1A) and:

- (a) State the actual compositional limits determined for each of the elements designated in table 1.6.1 of the casts used in the manufacture of each batch as defined in clause 9.2 of BS 2872: 1969.

In the case of stub ends produced by friction welding state the actual compositional limits determined for each of the elements separately designated in table 1.6.1 of the casts used for producing the seamless tube and for the sheet/plate used in each batch of stub ends.

Note: Individual cast analyses shall be retained by the manufacturer — see Addendum: discretionary contractual clauses.

- (b) State the results of mechanical tests performed on each batch (see clause 1A.5 — selection of test samples).

SUB-SECTION 1B — WELD NECK BACKING FLANGES**1B.1 Manufacture**

Backing flanges shall be of forged carbon steel to ASTM A105 (normalised) except that the carbon content and the carbon equivalent shall not exceed the values given in table 1.6.2.

1B.2 Information to be supplied by the purchaser

The following shall be specified by the purchaser on the order (for backing flanges):

- (a) The title and number of this specification (EEMUA Publication No. 145: 1987 section 1B).
- (b) Size: inches and millimetres.
- (c) Pressure rating: Class 150.
- (d) Whether it is his intention to inspect the material at the supplier's works (see Addendum).
- (e) Whether manufacturer's certificates are required (see clause 1B.8).
- (f) Whether any additional identification marking other than that specified herein is required.
- (g) Whether any temporary or permanent corrosion protection is required other than that specified in clause 1B.9.

See clause 1A.2 for information to be supplied by the purchaser for stub ends.

1B.3 Drilling

All bolt holes shall be drilled and shall be equally spaced on the pitch circle diameter 'K' (see table 1.4).

1B.4 Facings and surface finish

The outside diameters and bores of backing flanges shall be machine finished and edges shall have a radius of 3 mm in accordance with table 1.4. The face of the backing flange to be in contact with the stub ends shall be machined flat.

1B.5 Selection of test samples

Samples representing each lot of backing flanges shall be selected, and subjected to testing, in accordance with the requirements of ASTM A105.

Composite weld neck flanges**1B.6 Marking**

Backing flanges shall be clearly marked with round-nose steel stamps around the rim.

Backing flanges shall be clearly marked as follows:

- (a) Purchase Order Number (PO).
- (b) The number of this section (EEMUA Publication No. 145: 1987: section 1B).
- (c) Size: inches and millimetres.
- (d) The nominal pressure rating: Class 150.
- (e) Material designation: A105 (ASTM A105) see table 1.6.2.
- (f) Batch traceability number (BTN).
- (g) Manufacturer's name or trademark (MTM).

Examples of marking:

PO 145/1B 10/267 150 A105 BTN MTM.

1B.7 Inspection and testing

Backing flanges shall be dimensionally correct and be marked in accordance with this section.

Backing flanges shall be visually examined for defects and irregularities in the protective coat.

1B.8 Certification

Certificate(s) shall be supplied, either:

1B.8.1 a certificate of compliance which shall state that the backing flanges have been manufactured in accordance with all the requirements of this section (EEMUA Publication No. 145: 1987: section 1B) or:

1B.8.2 a manufacturer's certificate which shall state that the backing flanges have been manufactured in accordance with all the requirements of this section (EEMUA Publication No. 145: 1987: section 1B) and:

- (a) State the analysis of each heat used in the manufacture of each order (see clause 1B.5: selection of test samples).
- (b) State the results of mechanical tests performed on each heat used in the manufacture of each order (see clause 1B.5: selection of test samples).

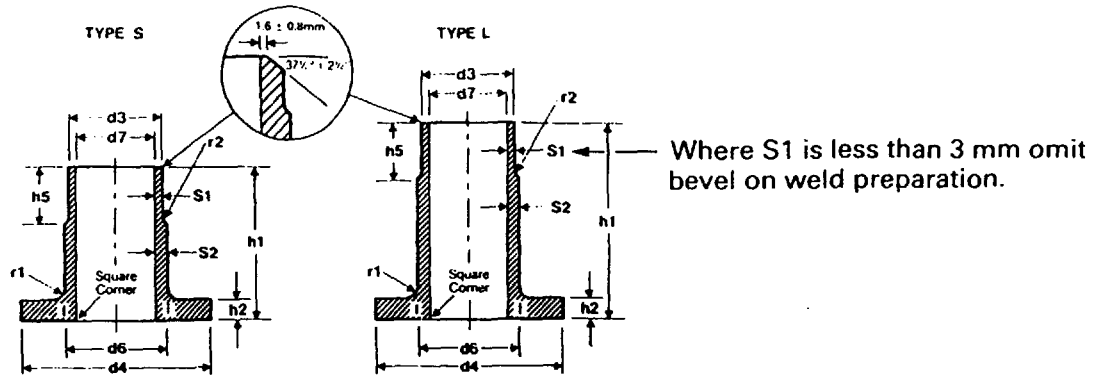
1B.9 Temporary corrosion protection

Unless otherwise specified by the purchaser, flanges shall be protected against corrosion during transit and storage according to the following procedure:

- (a) blast clean to standard Sa2½ as specified in Swedish Standard SIS 055 900.
- (b) apply blast primer of zinc rich epoxy coating to a dry film thickness of 25–50µm immediately after blast cleaning. After blast priming the identification marking shall be repeated, as necessary, by painting in such colours as to be clearly visible.

Composite weld neck flanges

Table 1.2

Weld neck 90/10 CuNi stub ends:16 bar rating^{*}

for tolerances see table 1.5.1

Size in/mm	d3	d4	d6	d7	Type S h1 ..	Type L h1	h2	r1	r2	h5	S1 min	S2
1/2/16	USE 20 bar SEE TABLE 1.3											
3/4/25												
1/30												
1 1/4/38												
1 1/2/44.5												
2/57												
2 1/2/76.1												
3/88.9												
4/108												
6/159	159	212	161.5	153.75	50	89	9	5	5	15	3.0	4.0
8/219.1	219.1	270	222	211.10	50	102	9	5	5	15	4.0	5.5
10/267	267	320	270	257.97	50	127	9	5	5	15	4.5	6.0
12/323.9	323.9	370	327	312.83	50	152	11	7	5	16	5.5	7.0
14/368	368	430	371	364.22	50	152	11	7	5	16	6.5	8.0
16/419	419	482	422	404.17	50	152	12	7	7	16	7.0	8.5
18/457.2	457.2	530	460	441.5	50	152	12	7	7	16	8.0	9.5
20/508	508	585	511	490.5	50	152	12	7	7	20	8.5	10.0
24/610	610	685	613	589.5	60	152	14	9	7	20	10.5	12.0
28/711	711	800	719	687.5	60	190	19	9	7	24	12.0	14.5
32/813	813	905	821	786.5	60	190	20.5	9	7	24	13.5	16.0
36/914	914	1000	922	883.5	60	190	22	9	7	32	15.5	17.5

All dimensions in millimetres except where indicated

^{*} For weld-neck stub-ends operating at a maximum design pressure of 20 bar at 38°C — see table 1.3^{**} Type "S" stub ends are not suitable for welding with the backing flange in position on stub end

ERRATUM

Column d7
size 14/368
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