

ASME B16.39-2009

[Revision of ASME B16.39-1998 (R2006)]

Malleable Iron Threaded Pipe Unions

Classes 150, 250, and 300

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AN AMERICAN NATIONAL STANDARD



The American Society of
Mechanical Engineers



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FOREWORD

In 1921, the American Engineering Standards Committee, later the American Standards Association (ASA), now the American National Standards Institute (ANSI), authorized the organization of a Sectional Committee on the Standardization of Pipe Flanges and Flanged Fittings, with the following organizations as joint sponsors: Heating, Piping, and Air Conditioning Contractors National Association, later the Mechanical Contractors Association of America (MCAA); Manufacturers Standardization Society of the Valve and Fittings Industry (MSS); and the American Society of Mechanical Engineers (ASME).

Threaded fittings were added to the scope of the B16 Committee, and Subcommittee No. 2 (now Subcommittee B) was made responsible for threaded fittings other than steel. Standards for cast and malleable iron fittings were approved by ASA as early as 1927.

For many years, the need for standardization of threaded malleable iron unions was met by Federal Specifications (published by the General Services Administration) and other documents published by the Association of American Railroads (AAR) and the Underwriters Laboratories (UL). As these standards continued to diverge, however, manufacturers concluded that a common practice would be desirable. Accordingly, beginning in 1967, MSS developed a standard practice embodying features of the existing standards and published it as MSS SP-76-1970.

During the next few years, ANSI recognition of the AAR and UL standards was withdrawn in favor of SP-76, and in 1975 MSS submitted its standards to Subcommittee B of American National Standards Committee B16 for consideration as an American National Standard. After several modifications and the addition of metric equivalents, the Standard was approved by the Committee, co-secretariat organizations, and ANSI. It was then published with the designation ANSI B16.39-1977.

In 1982 American National Standards Committee B16 was reorganized as an ASME Committee operating under procedures accredited by ANSI. The 1986 edition of B16.39 updated the referenced standards and specifications, established U.S. Customary units as the standard, and provided for electrodeposition as an alternative to hot dipping for any application of zinc coating. Following approval by the Standards Committee and ASME, approval as an American National Standard was given by ANSI on December 31, 1986, with the new designation ASME/ANSI B16.39-1986.

In the 1998 edition of ASME B16.39, reference standards were updated, a quality system program annex was added, and several editorial revisions were made. Following approval by ASME B16 Subcommittee B and the B16 Standards Committee, ANSI approved this American National Standard on November 20, 1998.

In this edition, metric units are now shown as the primary units in the body text and tables with U.S. Customary units shown in parentheses or in separate tables or in an Appendix. The *D* min. values in Table 3 have been replaced with the L2 values (external thread length) from ASME B1.20.2M-2006, *Pipe Threads, 60 deg, General Purpose* and the *D* min. values in Table I-3 have been replaced with the L2 values from ASME B1.20.1-1983, *Pipe Threads General Purpose (Inch)*.

Following approval by the B16 Standards Committee, ASME B16.39-2009 was approved as an American National Standard by ANSI on April 13, 2009.

ASME B16 COMMITTEE

Standardization of Valves, Flanges, Fittings, and Gaskets

(The following is the roster of the Committee at the time of approval of this Standard.)

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General. ASME Standards are developed and maintained with the intent to represent the consensus of concerned interests. As such, users of this Standard may interact with the Committee by requesting interpretations, proposing revisions, and attending Committee meetings. Correspondence should be addressed to:

Secretary, B16 Standards Committee
The American Society of Mechanical Engineers
Three Park Avenue
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As an alternative, inquiries may be submitted via e-mail to: SecretaryB16@asme.org.

Proposing Revisions. Revisions are made periodically to the Standard to incorporate changes that appear necessary or desirable, as demonstrated by the experience gained from the application of the Standard. Approved revisions will be published periodically.

The Committee welcomes proposals for revisions to this Standard. Such proposals should be as specific as possible, citing the paragraph number(s), the proposed wording, and a detailed description of the reasons for the proposal, including any pertinent documentation.

Interpretations. Upon request, the B16 Standards Committee will render an interpretation of any requirement of the Standard. Interpretations can only be rendered in response to a written request sent to the Secretary of the B16 Standards Committee.

The request for an interpretation should be clear and unambiguous. It is further recommended that the inquirer submit his/her request in the following format:

Subject:	Cite the applicable paragraph number(s) and the topic of the inquiry.
Edition:	Cite the applicable edition of the Standard for which the interpretation is being requested.
Question:	Phrase the question as a request for an interpretation of a specific requirement suitable for general understanding and use, not as a request for an approval of a proprietary design or situation. The inquirer may also include any plans or drawings that are necessary to explain the question; however, they should not contain proprietary names or information.

Requests that are not in this format may be rewritten in the appropriate format by the Committee prior to being answered, which may inadvertently change the intent of the original request.

ASME procedures provide for reconsideration of any interpretation when or if additional information that might affect an interpretation is available. Further, persons aggrieved by an interpretation may appeal to the cognizant ASME Committee or Subcommittee. ASME does not "approve," "certify," "rate," or "endorse" any item, construction, proprietary device, or activity.

Attending Committee Meetings. The B16 Standards Committee regularly holds meetings, which are open to the public. Persons wishing to attend any meeting should contact the Secretary of the B16 Standards Committee.

MALLEABLE IRON THREADED PIPE UNIONS

Classes 150, 250, and 300

1 SCOPE

1.1 General

This Standard covers threaded malleable iron unions, Classes 150, 250, and 300. It also contains provisions for using steel for NPS $\frac{1}{8}$ unions. This Standard includes

- (a) design
- (b) pressure–temperature ratings
- (c) size
- (d) marking
- (e) materials
- (f) joints and seats
- (g) threads
- (h) hydrostatic strength
- (i) tensile strength
- (j) air pressure test
- (k) sampling
- (l) coatings
- (m) dimensions

Mandatory Appendix I provides tables in U.S. Customary units.

1.2 References

Standards and specifications adopted by reference in this Standard are shown in Mandatory Appendix II, which is part of this Standard. It is not considered practical to identify the specific edition of each referenced standard and specification in the text, when referenced. Instead, the specific editions of the referenced standards and specifications are listed in Mandatory Appendix II.

1.3 Quality Systems

Nonmandatory requirements relating to the fitting manufacturer's quality system programs are described in Nonmandatory Appendix A.

1.4 Relevant Units

This Standard states values in both SI (metric) and U.S. Customary units. These systems of units are to be regarded separately. Within the text, the U.S. Customary units are shown in parentheses or in separate tables. The values stated in each table are not exact equivalents; therefore, it is required that each system of units be used independently of the other. Combining values from the two systems may constitute nonconformance with the Standard.

1.5 Service Conditions

Criteria for selection of materials suitable for particular fluid service are not within the scope of this Standard.

1.6 Convention

For the purpose of determining conformance with this Standard, the convention for fixing significant digits where limits, maximum and minimum values are specified, shall be rounded as defined in ASTM E 29. This requires that an observed or calculated value shall be rounded off to the nearest unit in the last right-hand digit used for expressing the limit. Decimal values and tolerance do not imply a particular method of measurement.

1.7 Denotation

1.7.1 Pressure Rating Designation. Class, followed by a dimensionless number, is the designation for pressure–temperature ratings as follows:

Class	150	250	300
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1.7.2 Size. NPS, followed by a dimensionless number, is the designation for nominal fitting size. NPS is related to the reference nominal diameter, DN, used in international standards. The relationship is, typically, as follows:

NPS	DN
$\frac{1}{4}$	8
$\frac{1}{2}$	15
1	25
$1\frac{1}{4}$	32
$1\frac{1}{2}$	40
2	50
$2\frac{1}{2}$	65
3	80
4	100

2 DESIGN

The complete union shall consist of a tail or male part, a head or female part, and a union nut. The type of joint may be ball-to-cone, ball-to-ball, or ball-and-socket with metal-to-metal seating surfaces of iron, copper, or copper alloy. The threaded ends shall be male or female pipe threads. The head or female part may be furnished as a coupling, an elbow, or a tee.

Table 1 Pressure–Temperature Ratings

Temperature, °C	Pressure, bar		
	Class 150 Unions	Class 250 Unions	Class 300 Unions
–29 to 66	20.7	34.5	41.4
100	17.5	30.6	37.5
125	15.2	27.7	34.6
150	12.9	24.8	31.7
175	10.6	22.0	28.9
200	8.2	19.1	26.0
225	5.9	16.2	23.1
232	5.2
250	...	13.4	20.3
275	...	10.5	17.4
288	...	9.0	15.9

GENERAL NOTES:

(a) 1 bar = 14.5 psi = 100 kPa

(b) $^{\circ}\text{C} = \frac{^{\circ}\text{F} - 32}{1.8}$ **3 PRESSURE–TEMPERATURE RATINGS**

(a) Pressure–temperature ratings are shown in Table 1 and Table I-1.

(b) Unions with copper or copper alloy seats are not intended for use where temperature exceeds 232°C (450°F).

(c) All ratings are independent of the contained fluid and are the maximum pressures at the tabulated temperatures. Intermediate ratings may be obtained by linear interpolation between the temperatures shown.

(d) The temperatures shown for the corresponding pressure rating shall be the material temperature of the pressure-retaining structure. It may be assumed that the material temperature is the same as the fluid temperature. Use of a pressure rating at a material temperature other than that of the contained fluid is the responsibility of the user and subject to the requirements of any applicable code.

4 SIZE**4.1 Nominal Pipe Size**

As applied in this Standard, the use of the phrase “nominal pipe size” or the designation NPS followed by a dimensionless number is for the purpose of identifying the end connection of unions. The number is not necessarily the same as the fitting inside diameter. The connecting pipe dimension can be found in ASME B36.10M.

5 MARKING

Unions shall be marked on the nut with the manufacturer’s name or trademark and nominal pressure class

Table 2 Tensile Strength of Unions

NPS	Ultimate Load, kN		
	Class 150	Class 250	Class 300
$\frac{1}{8}$	11	11	18
$\frac{1}{4}$	17	17	27
$\frac{3}{8}$	24	24	36
$\frac{1}{2}$	34	34	45
$\frac{3}{4}$	47	47	62
1	69	69	80
$1\frac{1}{4}$	95	95	100
$1\frac{1}{2}$	115	115	125
2	135	135	180
$2\frac{1}{2}$	155	155	245
3	180	180	335
4	220	220	490

except on bar stock unions, where marking is impractical. Additional markings permitted by MSS SP-25 may be used.

6 MATERIALS

(a) The mechanical properties of the malleable iron castings shall be at least equal to those specified in ASTM A 197.

(b) Steel bar stock having a yield strength of not less than 207 MPa (30 ksi) may be substituted for malleable iron in NPS $\frac{1}{8}$ unions.

(c) Insert rings may be of suitable copper or copper alloy. Where copper alloy seats are furnished, either the head or tail part of unions produced from bar stock may be solid copper alloy. Such parts must meet the tensile strength requirements listed in Table 2 and Table I-2.

7 JOINTS AND SEATS

Inserts shall be secured into the ends to become a permanent part of them with no signs of cracking. Inserted seat rings shall be of sufficient width to allow ample bearing for the seating of the male end.

8 THREADING OF PIPE ENDS**8.1 Types of Threads**

Pipe ends of head and tail parts shall be threaded with taper pipe threads (ASME B1.20.1) except that NPS $\frac{1}{8}$ unions made from bar stock may have NPSC internal straight pipe threads.

8.2 Tolerances

The variation in taper threading shall be limited to one turn large and one turn small from the gaging face of the ring and gaging notch on the plug when using working gages.

The reference point for the internal product thread is the starting end of the fitting, providing the chamfer does not exceed the major diameter of the internal thread. When a chamfer on the product thread exceeds this limit, the reference point becomes the last thread scratch on the chamfer cone. Allowance must be made for depth of counterbore on counterbored fittings.

9 HYDROSTATIC STRENGTH

Assembled unions shall be capable of withstanding, without rupture or leakage through the shell or at the union joint, an internal hydrostatic pressure of five times the cold 66°C (150°F) pressure rating for 1 min.

10 TENSILE STRENGTH

(a) Assembled unions shall be capable of withstanding, without rupture, the tensile loads shown in Table 2 and Table I-2.

(b) Tests shall be conducted by attaching threaded steel bars or pipe to each end of the union using the pipe threads. Bars or pipe are to be secured in a tensile testing machine. Load shall be increased at a uniform rate until the tensile load is attained.

11 AIR PRESSURE TEST

Assembled unions selected in accordance with section 12 shall be tested with air at a minimum pressure of 2.8 bar (40 psi).

12 SAMPLING FOR AIR PRESSURE TEST

A random sample of unions representative of the production lot shall be submitted for testing in accordance with section 11. The average outgoing quality level (AOQL), as defined in ANSI/ASQ Z1.4, of the established acceptable sampling plans used shall not exceed 2%. A lot, for purposes of this Standard, is defined as the number of unions of the same size, design, and pressure rating submitted for testing at any one time.

13 COATINGS

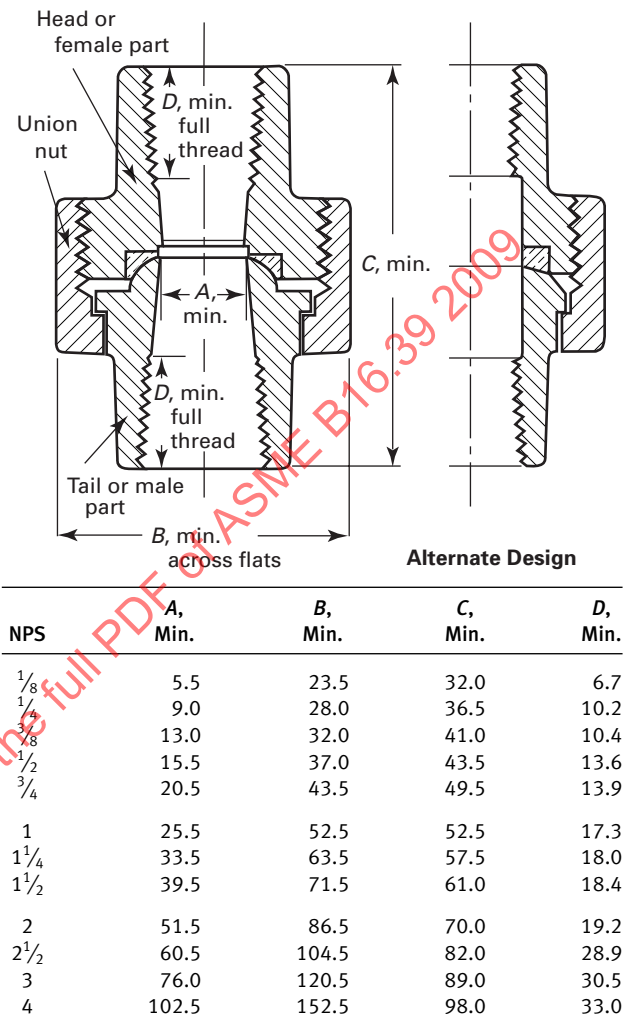
13.1 Malleable Iron Unions

When malleable iron unions are zinc coated, they shall be hot dipped in accordance with ASTM A 153 or have an electrodeposited zinc coating conforming to ASTM B 633, Type 1, Service Condition 4. Hot dipped coatings shall be a minimum thickness of 86 μm (0.0034 in.) and applied prior to threading. Electrodeposited zinc shall be a minimum thickness of 25 μm (0.001 in.) and may be applied either before or after threading.

13.2 Steel Unions

NPS $\frac{1}{8}$ unions made from steel bar, per para. 6(b) of this Standard, may be either uncoated or have an

Table 3 SI Dimensions of Class 150 Malleable Iron Threaded Unions



GENERAL NOTE: Dimensions are in millimeters.

electrodeposited zinc coating conforming to ASTM B 633, Type 1, Service Condition 4. The electrodeposited zinc coatings may be applied either before or after threading.

13.3 Union Seating Surfaces

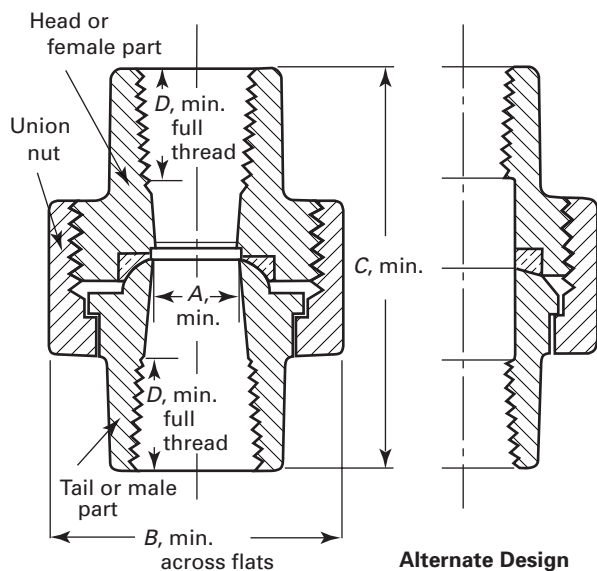
Union seating surfaces shall not be coated.

13.4 Other Coatings

Other coatings, specified by the purchaser, shall be furnished meeting the agreed requirements. Copper or copper alloy seats shall not have a zinc coating.

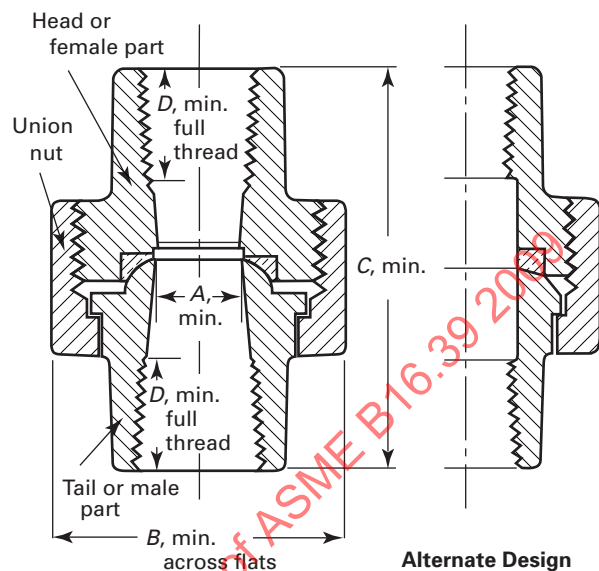
14 DIMENSIONS

Dimensions in millimeters are given in Tables 3 through 5. Dimensions in inches are given in Tables I-3 through I-5.

Table 4 SI Dimensions of Class 250 Malleable Iron Threaded Unions

NPS	A, Min.	B, Min.	C, Min.	D, Min.
1/8	5.5	23.5	32.0	7.5
1/4	7.5	28.5	39.5	11.0
3/8	10.5	32.0	43.5	12.0
1/2	13.5	37.0	46.0	14.5
3/4	19.0	43.5	52.5	16.5
1	24.0	52.5	58.5	19.0
1 1/4	32.5	65.5	66.5	21.5
1 1/2	38.0	73.5	70.5	22.0
2	49.0	88.5	79.5	25.5
2 1/2	59.0	105.5	89.5	29.5
3	73.5	126.0	97.5	31.0
4	97.0	164.5	111.5	34.0

GENERAL NOTE: Dimensions are in millimeters.

Table 5 SI Dimensions of Class 300 Malleable Iron Threaded Unions

NPS	A, Min.	B, Min.	C, Min.	D, Min.
1/8	5.5	23.5	32.0	7.5
1/4	7.5	34.0	39.5	11.0
3/8	10.5	38.0	43.5	12.0
1/2	13.5	44.5	46.0	14.5
3/4	19.0	54.5	54.0	16.5
1	24.0	63.0	58.5	19.0
1 1/4	32.5	76.5	67.5	21.5
1 1/2	38.0	83.5	72.5	22.0
2	49.0	100.5	82.0	25.5
2 1/2	59.0	120.0	84.5	29.5
3	73.5	136.5	104.0	31.0
4	97.0	178.0	113.5	34.0

GENERAL NOTE: Dimensions are in millimeters.

MANDATORY APPENDIX I

DIMENSIONS AND PRESSURE RATINGS OF UNIONS IN U.S. CUSTOMARY UNITS

This Appendix provides tables of the standard inch dimensions and pressure ratings for unions.

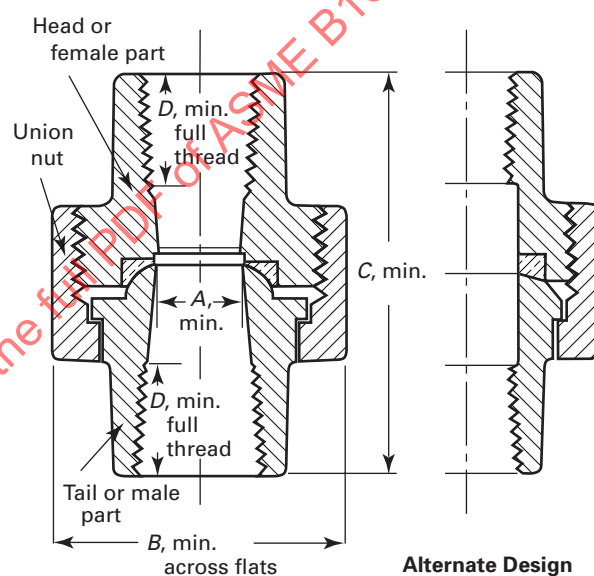
Table I-1 Pressure-Temperature Ratings

Temperature, °F	Pressure, psi		
	Class 150	Class 250	Class 300
-20 to 150	300	500	600
200	265	455	550
250	225	405	505
300	185	360	460
350	150	315	415
400	110	270	370
450	75	225	325
500	...	180	280
550	...	130	230

Table I-2 Tensile Strength of Unions

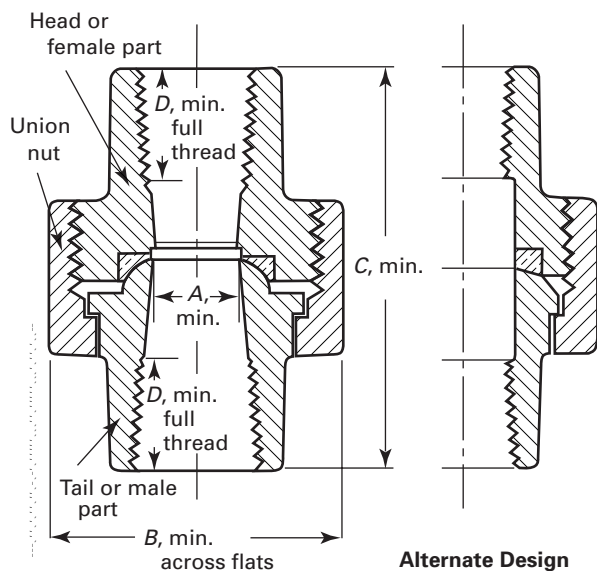
NPS	Ultimate Load, lbf		
	Class 150	Class 250	Class 300
1/8	2,500	2,500	4,000
1/4	3,800	3,800	6,000
3/8	5,300	5,300	8,000
1/2	7,700	7,700	10,000
3/4	10,600	10,600	14,000
1	15,500	15,500	18,000
1 1/4	21,300	21,300	23,000
1 1/2	25,800	25,800	28,000
2	30,000	30,000	40,000
2 1/2	35,000	35,000	55,000
3	40,000	40,000	75,000
4	50,000	50,000	110,000

Table I-3 Dimensions of Class 150 Malleable Iron Threaded Unions



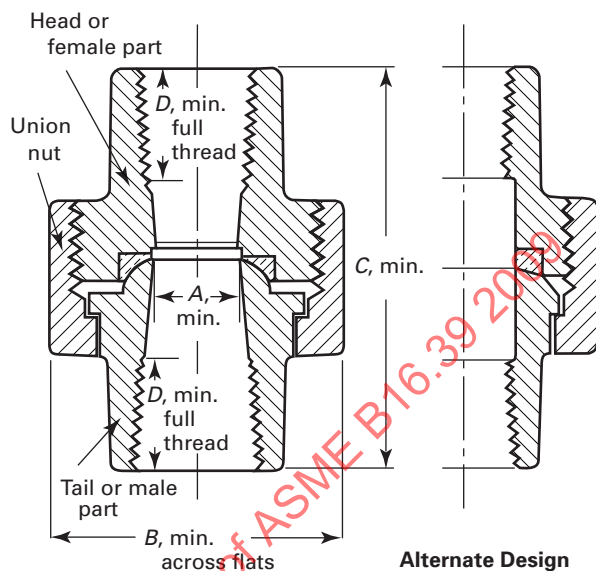
NPS	A, Min.	B, Min.	C, Min.	D, Min.
1/8	0.21	0.93	1.26	0.26
1/4	0.36	1.10	1.44	0.40
3/8	0.52	1.26	1.61	0.41
1/2	0.61	1.45	1.72	0.53
3/4	0.80	1.71	1.94	0.55
1	1.00	2.07	2.06	0.68
1 1/4	1.31	2.50	2.26	0.71
1 1/2	1.55	2.82	2.41	0.72
2	2.03	3.41	2.75	0.76
2 1/2	2.38	4.12	3.22	1.14
3	3.00	4.75	3.50	1.20
4	4.03	6.00	3.85	1.30

GENERAL NOTE: Dimensions are in inches.

Table I-4 Dimensions of Class 250 Malleable Iron Threaded Unions

NPS	A, Min.	B, Min.	C, Min.	D, Min.
1/8	0.21	0.93	1.26	0.30
1/4	0.30	1.11	1.55	0.43
3/8	0.42	1.26	1.71	0.47
1/2	0.54	1.45	1.81	0.57
3/4	0.74	1.71	2.07	0.64
1	0.95	2.07	2.31	0.75
1 1/4	1.27	2.57	2.62	0.84
1 1/2	1.50	2.89	2.78	0.87
2	1.93	3.48	3.13	1.00
2 1/2	2.32	4.15	3.52	1.17
3	2.90	4.96	3.84	1.23
4	3.82	6.47	4.39	1.33

GENERAL NOTE: Dimensions are in inches.

Table I-5 Dimensions of Class 300 Malleable Iron Threaded Unions

NPS	A, Min.	B, Min.	C, Min.	D, Min.
1/8	0.21	0.93	1.26	0.30
1/4	0.30	1.33	1.55	0.43
3/8	0.42	1.50	1.71	0.47
1/2	0.54	1.76	1.81	0.57
3/4	0.74	2.15	2.12	0.64
1	0.95	2.48	2.31	0.75
1 1/4	1.27	3.02	2.66	0.84
1 1/2	1.50	3.28	2.85	0.87
2	1.93	3.96	3.23	1.00
2 1/2	2.32	4.72	3.33	1.17
3	2.90	5.37	4.09	1.23
4	3.82	7.00	4.47	1.33

GENERAL NOTE: Dimensions are in inches.

MANDATORY APPENDIX II REFERENCES

The following is a list of publications referenced in this Standard.

ANSI/ASQC Z1.4-2003, Sampling Procedures and Tables for Inspection by Attributes

Publisher: American Society for Quality (ASQ), P.O. Box 3005, Milwaukee, WI 53201-3005 (www.asq.org)

ASME B1.20.1-1983 (R2006), Pipe Threads, General Purpose (Inch)¹

ASME B36.10M-2004, Welded and Seamless Wrought Steel Pipe¹

Publisher: The American Society of Mechanical Engineers (ASME), Three Park Avenue, New York, NY 10016-5990; Order Department: 22 Law Drive, Box 2300, Fairfield, NJ 07007-2300 (www.asme.org)

ASTM A 153/A 153M-95, Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM B 633-2007, Specification for Electrodeposited Coatings of Zinc on Iron and Steel

¹ May also be obtained from the American National Standards Institute (ANSI), 25 West 43rd Street, New York, NY 10036.

ASTM A 197/A 197M-2000 (R2006), Specification for Cupola Malleable Iron

Publisher: American Society for Testing and Materials (ASTM), 100 Barr Harbor Drive, West Conshohocken, PA 19428 (www.astm.org)

ISO 9000: 2005, Quality Management Systems – Fundamentals and Vocabulary

ISO 9001: 2000, Quality Management Systems – Requirements

ISO 9004: 2000, Quality Management Systems – Guidelines for Performance Improvements

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