

**ASME B16.14-2010**  
**(Revision of ASME B16.14-1991)**

# **Ferrous Pipe Plugs, Bushings, and Locknuts With Pipe Threads**

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**AN AMERICAN NATIONAL STANDARD**



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**AN AMERICAN NATIONAL STANDARD**



**Three Park Avenue • New York, NY • 10016 USA**

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# FOREWORD

In 1921, the American Engineering Standards Committee [later the American Standards Association (ASA)] organized Sectional Committee B16 to unify and develop standards for pipe flanges and fittings. Cosponsors of the B16 Committee were The American Society of Mechanical Engineers (ASME), the Heating and Piping Contractors National Association [now Mechanical Contractors Association of America (MCAA)], and the Manufacturers Standardization Society of the Valve and Fitting Industry (MSS). Cosponsors were later designated as Co-Secretariat organizations.

Threaded fittings were also included in the scope of the B16 Committee, and Subcommittee 2 (now Subcommittee B) was made responsible for threaded fittings other than steel.

The American Standard for Pipe Plugs was originally published as ASA B16e2-1936. It had been developed by Subcommittee 2 from material assembled and published by MSS as a standard practice in April 1929.

From the beginning, pipe plugs have been made with the American Standard Taper Pipe Thread but the design of the square heads necessary to screw them into fittings or any tapped hole has been a matter of manufacturers' and users' individual design. However, the use of pipe plugs soon broadened, and they came to be employed in many other service applications, e.g., automotive and industrial machinery. Accordingly, it was natural for the dimensions of the square heads and the sockets to conform to standard open wrench sizes and to maximum dimensions of standard hot-rolled steel bars.

Pipe bushing and locknut dimensions were originally included in ASA B16c-1939, American Standard for 150 lb Malleable Iron Screwed Fittings. ASA B16c-1939 was adapted from information assembled and published by MSS in 1929.

In response to a demand for inclusion under one cover, B16.14-1943, American Standard for Ferrous Plugs, Bushings, Locknuts, and Caps, was developed from ASA B16c-1939 and ASA B16d-1941, American Standard for Cast Iron Screwed Fittings, 125 lb and 250 lb, and approved by ASA in October 1943. The section of B16.14 covering pipe caps was later removed because of differences in pressure ratings between caps made of cast iron and malleable iron.

This Standard was revised in 1948 and was approved by letter ballot vote of the Sectional Committee and, following the approval of the sponsor bodies, it was presented to ASA, now the American National Standards Institute (ANSI), with recommendations for approval as an American Standard. This approval and designation was given on April 6, 1949.

Subcommittee 2 began a review of the document in 1963 and completed its work in 1964. The Sectional Committee approved a number of minor changes in format and wording. Following approval by the sponsor organizations, ANSI approval was granted on November 12, 1965.

In 1970, a review was initiated by Subcommittee 2 that resulted in the proposal to revise the document in several minor areas and update referenced standards. Following approvals by the Standards Committee and Co-Secretariat, ANSI granted approval on November 1, 1971.

In 1975, review was again initiated by Subcommittee B (formerly Subcommittee 2), and it was determined that the only significant changes needed were the updating of referenced standards and the addition of metric equivalents. Approvals were granted by the Standards Committee, Co-Secretariat, and ANSI, the latter on February 4, 1977.

In 1982, the American National Standards Committee was reorganized as an ASME Committee operating under procedures accredited by ANSI. That same year, Subcommittee B once again began review of the Standard. The only changes made were the dates of the referenced standards. After approval by the Standards Committee and ASME, final approval was granted by ANSI in July 1983.

In the 1991 edition of B16.14, U.S. customary units were established as the standard and updates were made to the referenced standards and minimum specifications for steel fittings. Following approval by the Standards Committee and ASME, approval as an American National Standard was given by ANSI on January 4, 1991, with the new designation ASME B16.14-1991.

In this edition of B16.14, metric dimensions have become the primary units, and inch dimensions are incorporated into this Standard as secondary units and shown in parentheses.

Following approval by the Standards Committee and the ASME Board, this revision to the 1991 edition of this Standard was approved as an American National Standard by ANSI on April 1, 2010, and designated as ASME B16.14-2010.

# 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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# CORRESPONDENCE WITH THE B16 COMMITTEE

**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  
New York, NY 10016-5990

As an alternative, inquiries may be submitted via e-mail to [SecretaryB16@asme.org](mailto: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 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 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 will be rewritten in this 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 that are open to the public. Persons wishing to attend any meeting should contact the Secretary of the B16 Standards Committee.

# ASME B16.14-2010

## SUMMARY OF CHANGES

Following approval by the B16 Committee and ASME, and after public review, ASME B16.14-2010 was approved by the American National Standards Institute on April 1, 2010.

In ASME B16.14-2010, sections 2 through 8 have been redesignated as sections 3 through 9, respectively. This edition also includes editorial changes, revisions, and corrections, which are identified by a margin designator, **(10)**, placed next to the affected area.

<i>Page</i>	<i>Location</i>	<i>Change</i>
1	1	Footnote (1) deleted
	2	Added
	4	Revised in its entirety
2	6	(1) Subparagraph (a) revised (2) In subpara. (b), references revised
	7	Subparagraph (a) revised
	8.1	Subparagraph (b) revised
3	Table 1	U.S. Customary units converted to metric units
4	Table 2	U.S. Customary units converted to metric units
	Table 3	U.S. Customary units converted to metric units
5, 6	Table 4	U.S. Customary units converted to metric units
7	Table 5	U.S. Customary units converted to metric units
9–14	Mandatory Appendix I	Added
15	Mandatory Appendix II	Formerly Mandatory Appendix I, redesignated as Mandatory Appendix II
16	Nonmandatory Appendix A	Added

# FERROUS PIPE PLUGS, BUSHINGS, AND LOCKNUTS WITH PIPE THREADS

## (10) 1 SCOPE

This Standard covers the following:

- (a) pressure–temperature ratings
- (b) size
- (c) marking
- (d) materials
- (e) dimensions and tolerances
- (f) threading
- (g) pattern taper

## (10) 2 GENERAL

### 2.1 References

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

### 2.2 Quality Systems

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

### 2.3 Relevant Units

This Standard states values both in metric units and U.S. Customary units. These systems of units are to be regarded separately. The U.S. Customary units are shown in parentheses or in separate tables. The values in these separate tables 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 constitutes nonconformance with the Standard.

### 2.4 Service Conditions

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

### 2.5 Convention

For determining conformance with this Standard, the convention for fixing significant digits where limits and 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 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.

## 2.6 Denotation

**2.6.1 Pressure Rating Designation.** Class followed by a dimensionless number is the designation for pressure–temperature ratings.

**2.6.2 Size.** Nominal pipe size (NPS) followed by a dimensionless number is the designation for nominal flange or flange fitting size. NPS is related to the reference nominal diameter,  $DN$ , used in international standards. The relationship is, typically, as follows:

NPS	DN
1	25
1 $\frac{1}{4}$	32
1 $\frac{1}{2}$	40
2	50
2 $\frac{1}{2}$	65
3	80
3 $\frac{1}{2}$	90
4	100

For  $NPS \geq 4$ , the related  $DN = 25 \times (NPS)$

## 3 PRESSURE–TEMPERATURE RATINGS

(a) Pressure–temperature ratings for plugs and bushings shall be in accordance with ASME B16.4 if made of cast iron, or ASME B16.3 if made of malleable iron, ductile iron, or steel. Use of cored plugs or hexagon head bushings should be limited to Class 125 cast iron and Class 150 malleable iron threaded fittings. Solid plugs and face bushings are recommended for use with Class 250 cast iron fittings and Class 300 malleable iron fittings.

(b) Locknuts are not pressure–temperature rated.

## 4 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 identifying the end connection of fittings. The number is not necessarily the same as the fitting inside diameter.

(10)

## 5 MARKING

Each fitting shall be marked for identification with the manufacturer's name or trademark, except where a marking is impractical.

## (10) 6 MATERIALS

(a) These fittings are furnished in gray iron, malleable iron, ductile iron, or steel as indicated in the individual tables.

(b) The chemical and mechanical properties of cast material shall equal or exceed those properties listed in ASTM A 126, as applicable. Steel castings, forgings, or machined bar properties shall correspond to the comparable ASTM casting material specifications. The fittings manufacturer shall be prepared to certify conformance based on test data.

## (10) 7 DIMENSIONS AND TOLERANCES

(a) Dimensions in metric units are given in Tables 1 through 5 for various types of fittings. Corresponding U.S. Customary values are given in Tables I-1 through I-5 in Mandatory Appendix I.

(b) At no point in the component wall shall the metal thickness be less than 90% of the values listed in the tables.

## 8 THREADS

### (10) 8.1 Thread Form

Threads shall be in accordance with ANSI/ASME B1.20.1. All internal taper pipe threads shall be countersunk a distance not less than one-half the pitch of the thread at an angle of approximately 45 deg with the axis of the thread. External taper pipe threads shall be chamfered at an angle between 30 deg and 45 deg with the axis. Countersinking and chamfering shall be concentric with the threads.

(a) The length of threads specified in the tables shall include the countersink or chamfer.

(b) The maximum allowable variation in the alignment of threads of all openings shall be 5.0 mm/m (0.06 in./ft).

### 8.2 Plugs

Plugs shall be threaded with ANSI/ASME B1.20.1 taper pipe threads. The variation in threading shall be limited to one turn large or one turn small from the gaging notch on the plug or the gaging face of the ring when using working gages.

### 8.3 Bushings

Bushings shall be threaded with American National Standard taper pipe threads. Gaging of all threads shall comply with ANSI/ASME B1.20.1, except those sizes of outside hexagon bushings where the external thread lengths are shorter than those required by ANSI/ASME B1.20.1. These bushings should be threaded so that when making up the joint, the shoulder of the head will not interfere. To ensure this, the threads, when made to the minimum length, shall be gaged as listed below with a tolerance of one turn large or one turn small.

NPS $\frac{1}{4}$ to NPS $1\frac{1}{2}$ , incl.	1 turn large
NPS 2	$1\frac{1}{2}$ turns large
NPS $2\frac{1}{2}$ to NPS 8, incl.	2 turns large

(a) An outside head bushing is one having any part of the polygon protruding beyond the outside diameter of the large end of the external thread.

(b) An inside head bushing is one having all parts of the polygon head contained within the root diameter of the large end of the external thread.

(c) A face bushing is one having two lugs on the face of the large end of the external thread by which a bar can be used for makeup with internal pipe threads. Lugs are optional on face bushings in small pipe sizes when made of bar stock.

### 8.4 Locknuts

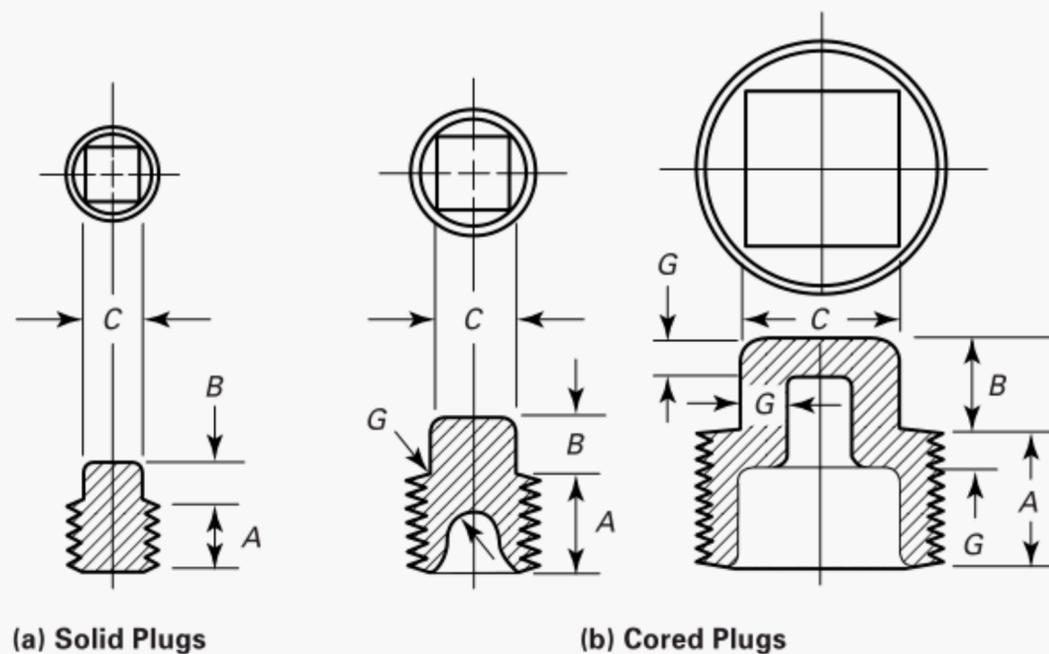
Locknuts shall be tapped with straight pipe threads in accordance with ANSI/ASME B1.20.1.

## 9 PATTERN TAPER

Plug squares or hexagons, raised or countersunk, may have opposite sides tapered a maximum of 4 deg total.

Table 1 Dimensions of Square Head Plugs

(10)



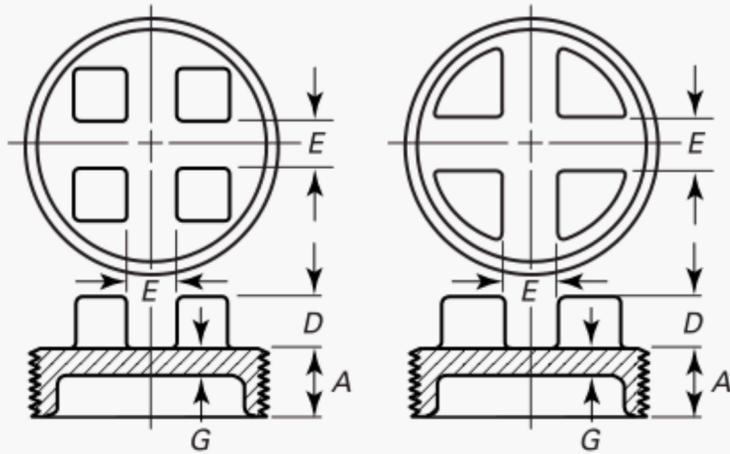
NPS [Notes (1), (2)]	Minimum Thread Length, A	Minimum Height of Square, B	Nominal Width Across Flats, C [Note (3)]	Nominal Metal Thickness, G [Note (4)]
1/8	9.4	6.1	9/32	...
1/4	11.2	7.1	3/8	...
3/8	12.2	7.9	7/16	...
1/2	14.2	9.7	9/16	4.1
3/4	16.0	11.2	5/8	4.6
1	19.1	12.7	13/16	5.1
1 1/4	20.3	14.2	15/16	5.6
1 1/2	21.1	15.8	1 1/8	6.1
2	22.4	17.3	1 5/16	6.6
2 1/2	27.2	18.8	1 1/2	7.4
3	28.7	20.3	1 11/16	7.9
3 1/2	30.0	21.8	1 7/8	8.6

GENERAL NOTE: All dimensions are given in millimeters except nominal width across flats, which are given in inches.

## NOTES:

- (1) Solid plugs are provided in NPS 1/8 to NPS 3 1/2, incl.; cored plugs are provided in NPS 1/2 to NPS 3 1/2, incl.
- (2) For NPS 4 and larger, slotted or bar pattern plugs are provided (see Table 2).
- (3) These dimensions are the nominal width across flats as given in Appendix V of ASME B18.2.1. Square head plugs are designed to fit these wrenches.
- (4) Cored plugs have metal thickness at all points equal to dimension G, except at the end of the thread. For tolerance, see para. 7(b).

(10) Table 2 Dimensions of Bar or Slotted Head Plugs



Optional Designs

NPS	Minimum Thread Length, A	Minimum Height of Lug, D	Minimum Distance Between Lugs, E	Metal Thickness, G [Note (1)]
4	31.0	25.4	22.4	9.4
5	33.3	25.4	22.4	11.7
6	35.6	31.8	31.8	13.2
8	39.9	35.1	38.1	16.8

GENERAL NOTES:

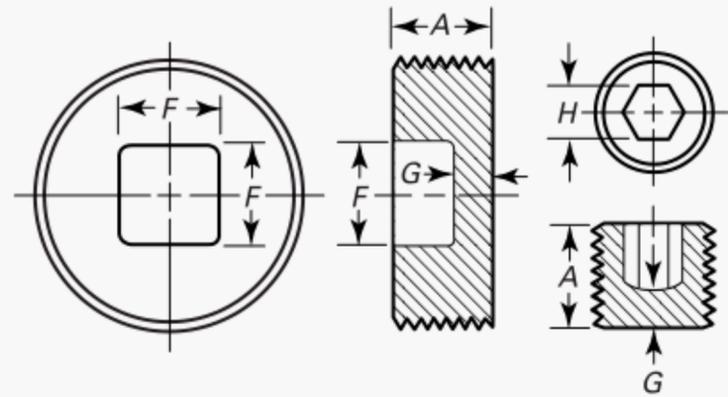
- (a) All dimensions are given in millimeters.
- (b) For NPS 3 1/2 and smaller, square head plugs are provided (see Table 1).

NOTE:

- (1) Cored plugs have metal thickness at all points equal to dimension G, except at the end of the thread. For tolerance, see para. 7(b).

Table 3 Dimensions of Countersunk Plugs

(10)



NPS	Minimum Thread Length, A	Nominal Size of Square Socket, F [Note (1)]	Size of Hexagon, H [Note (2)]	Metal Thickness, G [Note (3)]
1/8	9.4	...	3/16	1.5
1/4	11.2	...	1/4	2.3
3/8	12.2	...	5/16	3.3
1/2	14.2	3/8	3/8	4.1
3/4	16.0	1/2	9/16	4.6
1	19.1	1/2	5/8	5.1
1 1/4	20.3	3/4	...	5.6
1 1/2	21.1	3/4	...	6.1
2	22.4	7/8	...	6.6
2 1/2	27.2	1 1/8	...	7.4
3	28.7	1 3/8	...	7.9
3 1/2	30.0	1 1/2	...	8.6
4	31.0	2	...	9.4

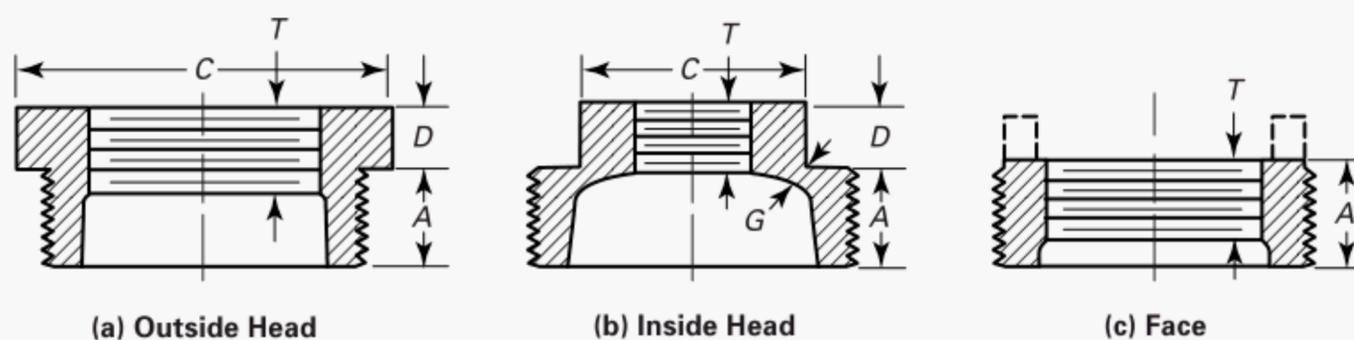
GENERAL NOTE: All dimensions are given in millimeters except nominal sizes of square sockets and sizes of hexagons, which are given in inches.

NOTES:

- (1) Square socket within countersunk pattern shall have dimensions to fit commercial square bars of sizes indicated.
- (2) Hexagon socket within countersunk pattern shall have dimensions to fit regular wrenches used with hexagon socket set screws.
- (3) For metal thickness tolerance, see para. 7(b).

Table 4 Dimensions of Outside Head, Inside Head, and Face Bushings

(10)



NPS [Note (1)]	Minimum Length of External Thread, A [Note (2)]	Minimum Length of Internal Thread, T	Minimum Height of Head, D	Minimum Width of Head, C [Note (3)]		Nominal Metal Thickness, G [Note (4)]
				Outside	Inside	
$1/4 \times 1/8$	11.2	6.6 [Note (5)]	3.6	16.3 [Note (6)]	...	...
$3/8 \times 1/4$	12.2	10.2 [Note (5)]	4.1	17.3 [Note (6)]	...	...
$3/8 \times 1/8$	12.2	6.4	4.1	17.3 [Note (6)]	...	...
$1/2 \times 3/8$	14.2	10.4 [Note (5)]	4.8	22.1 [Note (6)]	...	...
$1/2 \times 1/4$	14.2	8.1	4.8	22.1 [Note (6)]	...	...
$1/2 \times 1/8$	14.2	6.4	4.8	22.1 [Note (6)]	...	...
$3/4 \times 1/2$	16.0	13.5 [Note (5)]	5.6	29.2 [Note (6)]	...	...
$3/4 \times 3/8$	16.0	9.1	5.6	29.2 [Note (6)]	...	...
$3/4 \times 1/4$	16.0	8.1	5.6	29.2 [Note (6)]	...	...
$3/4 \times 1/8$	16.0	6.4	5.6	29.2 [Note (6)]	...	...
$1 \times 3/4$	19.1	12.7	6.4	36.1 [Note (6)]	...	...
$1 \times 1/2$	19.1	10.9	6.4	36.1 [Note (6)]	...	...
$1 \times 3/8$	19.1	9.1	7.6	...	28.5	...
$1 \times 1/4$	19.1	8.1	7.6	...	28.5	...
$1 \times 1/8$	19.1	6.4	7.6	...	28.5	...
$1 1/4 \times 1$	20.3	14.7	7.1	44.7	...	...
$1 1/4 \times 3/4$	20.3	12.7	7.1	44.7	...	...
$1 1/4 \times 1/2$	20.3	10.9	8.6	...	34.0	4.8
$1 1/4 \times 3/8$	20.3	9.1	8.6	...	28.5	4.8
$1 1/4 \times 1/4$	20.3	8.1	8.6	...	28.5	4.8
$1 1/2 \times 1 1/4$	21.1	18.0 [Note (5)]	7.9	50.8	...	...
$1 1/2 \times 1$	21.1	14.7	7.9	50.8	...	...
$1 1/2 \times 3/4$	21.1	12.7	9.4	...	41.4	5.1
$1 1/2 \times 1/2$	21.1	10.9	9.4	...	34.0	5.1
$1 1/2 \times 3/8$	21.1	9.1	9.4	...	28.5	5.1
$1 1/2 \times 1/4$	21.1	8.1	9.4	...	28.5	5.1
$2 \times 1 1/2$	22.4	17.8	8.6	63.0	...	...
$2 \times 1 1/4$	22.4	17.0	8.6	63.0	...	...
$2 \times 1$	22.4	14.7	10.4	...	49.5	5.6
$2 \times 3/4$	22.4	12.7	10.4	...	41.4	5.6
$2 \times 1/2$	22.4	10.9	10.4	...	34.0	5.6
$2 \times 3/8$	22.4	9.1	10.4	...	28.5	5.6
$2 \times 1/4$	22.4	8.1	10.4	...	28.5	5.6
$2 1/2 \times 2$	27.2	19.1	9.4	75.7	...	...
$2 1/2 \times 1 1/2$	27.2	17.8	11.2	68.1	...	...
$2 1/2 \times 1 1/4$	27.2	17.0	11.2	...	60.7	6.1
$2 1/2 \times 1$	27.2	14.7	11.2	...	49.5	6.1
$1 1/2 \times 3/4$	27.2	12.7	11.2	...	41.4	6.1
$2 1/2 \times 1/2$	27.2	10.9	11.2	...	34.0	6.1

(10) **Table 4 Dimensions of Outside Head, Inside Head, and Face Bushings (Cont'd)**

NPS [Note (1)]	Minimum Length of External Thread, A [Note (2)]	Minimum Length of Internal Thread, T	Minimum Height of Head, D	Minimum Width of Head, C [Note (3)]		Nominal Metal Thickness, G [Note (4)]
				Outside	Inside	
3 × 2½	28.7	23.4	10.2	98.0	...	...
3 × 2	28.7	19.1	12.2	83.3	...	...
3 × 1½	28.7	17.8	12.2	...	68.1	6.6
3 × 1¼	28.7	17.0	12.2	...	60.7	6.6
3 × 1	28.7	14.7	12.2	...	49.5	6.6
3 × ¾	28.7	12.7	12.2	...	41.4	6.6
3 × ½	28.7	10.9	12.2	...	34.0	6.6
3½ × 3	30.0	24.9	10.9	117.3	...	...
3½ × 2½	30.0	23.4	13.2	98.0	...	...
3½ × 2	30.0	19.1	13.2	...	83.3	7.1
3½ × 1½	30.0	17.8	13.2	...	68.1	7.1
3½ × 1¼	30.0	17.0	13.2	...	60.7	7.1
3½ × 1	30.0	14.7	13.2	...	49.5	7.1
4 × 3½	31.0	26.2	12.7	132.1	...	...
4 × 3	31.0	24.9	12.7	117.3	...	...
4 × 2½	31.0	23.4	15.2	...	98.0	7.9
4 × 2	31.0	19.1	15.2	...	83.3	7.9
4 × 1½	31.0	17.8	15.2	...	68.1	7.9
4 × 1¼	31.0	17.0	15.2	...	60.7	7.9
4 × 1	31.0	14.7	15.2	...	49.5	7.9
5 × 4	33.3	27.4	12.7	147.1	...	...
5 × 3½	33.3	26.2	15.2	132.1	...	...
5 × 3	33.3	24.9	15.2	...	117.3	9.7
5 × 2½	33.3	23.4	15.2	...	98.0	9.7
5 × 2	33.3	19.1	15.2	...	83.3	9.7
6 × 5	35.6	30.0	16.0	179.1	...	...
6 × 4	35.6	27.4	19.1	...	147.1	10.9
6 × 3½	35.6	26.2	19.1	...	132.1	10.9
6 × 3	35.6	24.9	19.1	...	117.3	10.9
6 × 2½	35.6	23.4	19.1	...	98.0	10.9
6 × 2	35.6	19.1	19.1	...	83.3	10.9
8 × 6	39.9	32.5	21.1	210.3	...	...
8 × 5	39.9	30.0	21.1	...	179.1	14.0
8 × 4	39.9	27.4	21.1	...	147.1	14.0
8 × 3½	39.9	26.2	21.1	...	132.1	14.0
8 × 3	39.9	24.9	21.1	...	117.3	14.0

## GENERAL NOTES:

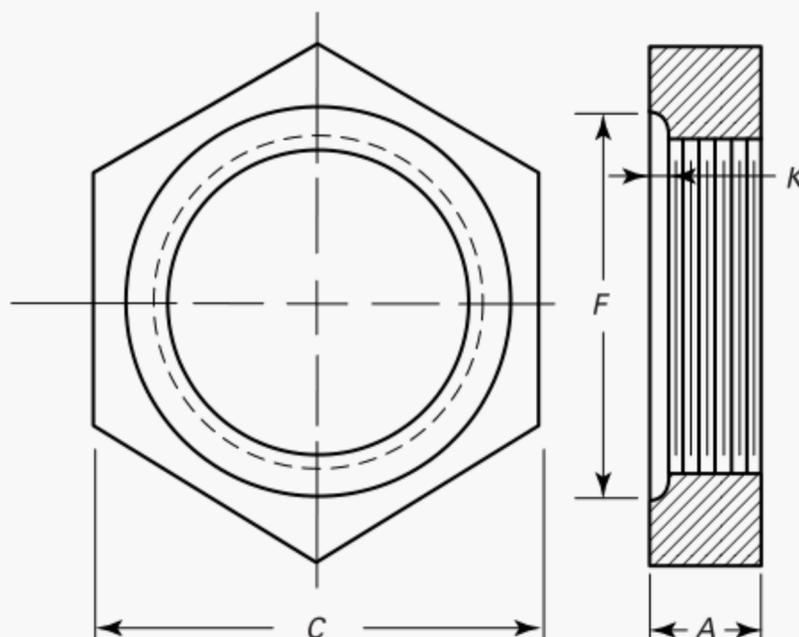
- (a) All dimensions are given in millimeters.  
 (b) Cored bushings have minimum metal thickness at all points equal to dimension G, except at the end of the thread.

## NOTES:

- (1) Hexagon head or octagon head bushings NPS 2½ and smaller reducing one NPS shall not be made of gray cast iron. Other NPS may be made of either cast iron or malleable iron, ductile iron, or steel. Face bushings NPS 2½ and smaller shall not be made of gray cast iron. Face bushings NPS 3 and larger reducing one NPS shall not be made of gray cast iron. Face bushings NPS 3 and larger reducing two NPS or more may be made of either cast or malleable iron, ductile iron, or steel.  
 (2) In the case of outside head bushings, length A includes provisions for imperfect threads (see also section 8).  
 (3) Heads of bushings shall be hexagonal or octagonal, except that on the larger sizes of outside head bushings, the heads may be made round with lugs instead of hexagonal or octagonal.  
 (4) G is the same as metal thickness for Class 125 Cast Iron Threaded Fittings (ASME B16.4). For tolerance, see para. 7(b).  
 (5) To provide proper metal thickness, these NPS shall not be cored out to diameters greater than the root diameter of the internal thread. The length of the internal thread may be equal to the minimum dimension, T, or greater up to the full length of bushing.  
 (6) When made of bar stock, the dimensions may be 5/8 in., 11/16 in., 7/8 in., 1 1/8 in., and 1 7/16 in., respectively, in order to use regular bar stock sizes.

Table 5 Dimensions of Locknuts

(10)



NPS	Minimum Nominal Thickness, A	Minimum Width Across Flats, C [Note (1)]		Minimum Diameter of Packing Recess, F [Note (2)]	Depth of Packing Recess, K [Note (2)]
		Malleable Iron, Ductile Iron, Steel	Cast Iron		
1/8	4.8	17.5 [Note (3)]	...	12.7	1.0
1/4	6.4	21.3 [Note (3)]	...	16.8	1.5
3/8	7.1	25.4 [Note (3)]	...	19.6	1.5
1/2	7.9	30.0 [Note (3)]	...	24.6	1.5
3/4	8.6	36.3 [Note (3)]	...	31.2	1.5
1	9.7	44.5	...	38.1	1.5
1 1/4	10.7	53.3	...	47.2	1.5
1 1/2	11.9	59.7	...	53.9	1.5
2	13.5	73.2	...	66.8	2.3
2 1/2	15.0	88.9	98.0	80.8	2.3
3	17.0	108.5	117.3	97.5	2.3
3 1/2	18.5	122.9	132.1	111.3	3.3
4	20.3	136.7	147.1	127.0	3.3

GENERAL NOTE: All dimensions are given in millimeters.

## NOTES:

- (1) NPS 3 1/2 and smaller are hexagonal; NPS 4 may be either hexagonal or octagonal.
- (2) The packing recess surface may be as-cast. When made from bar stock, the recess may be tool finished.
- (3) Locknuts in these NPS may be made from bar stock, in which case dimension C may be 1 1/16 in., 7/8 in., 1 in., 1 3/16 in., and 1 7/16 in., respectively, in order to conform with regular hexagon bar stock sizes.

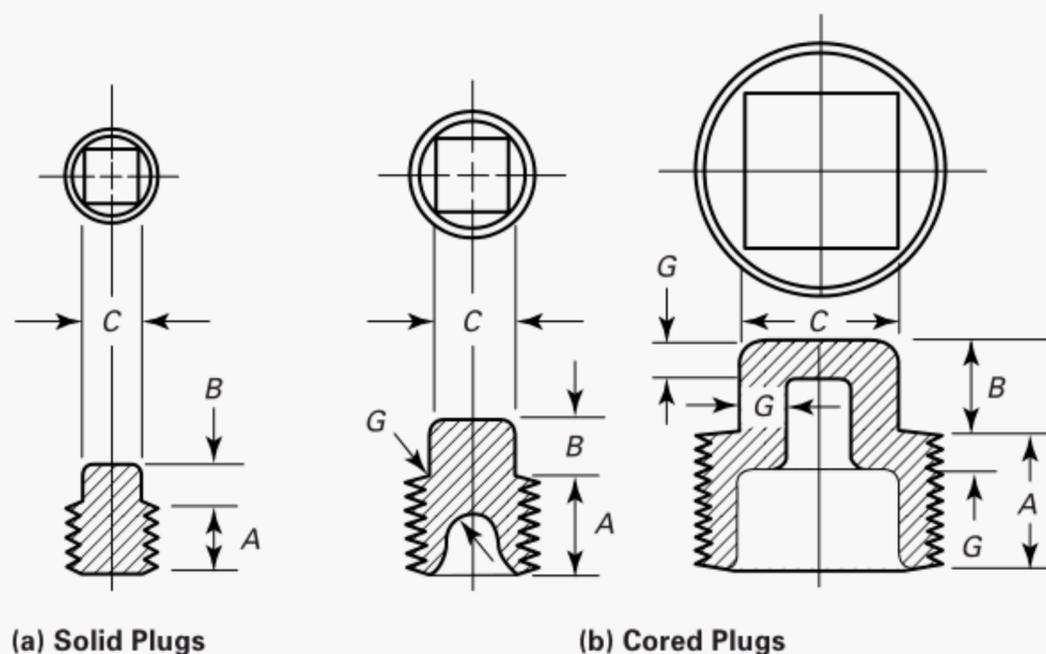
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# **MANDATORY APPENDIX I**

## **DIMENSIONS OF FITTINGS IN U.S. CUSTOMARY UNITS**

(10)

Tables I-1 through I-5 are presented on the following pages.

**Table I-1 Dimensions of Square Head Plugs****(a) Solid Plugs****(b) Cored Plugs**

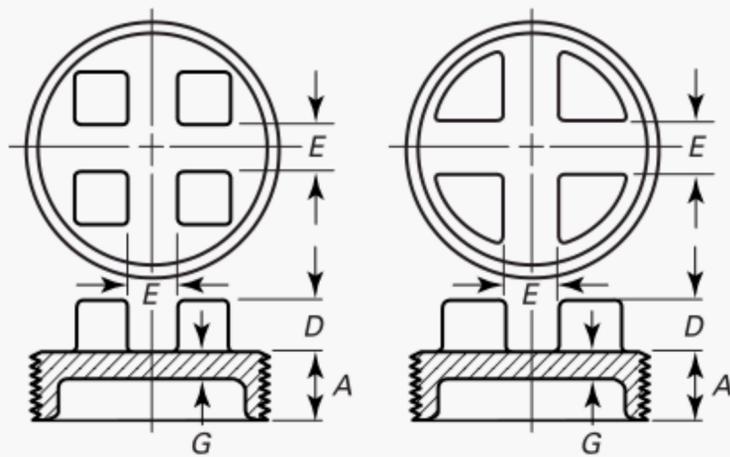
NPS [Notes (1), (2)]	Minimum Thread Length, A	Minimum Height of Square, B	Nominal Width Across Flats, C [Note (3)]	Nominal Metal Thickness, G [Note (4)]
1/8	0.37	0.24	9/32	...
1/4	0.44	0.28	3/8	...
3/8	0.48	0.31	7/16	...
1/2	0.56	0.38	9/16	0.16
3/4	0.63	0.44	5/8	0.18
1	0.75	0.50	13/16	0.20
1 1/4	0.80	0.56	15/16	0.22
1 1/2	0.83	0.62	1 1/8	0.24
2	0.88	0.68	1 5/16	0.26
2 1/2	1.07	0.74	1 1/2	0.29
3	1.13	0.80	1 11/16	0.31
3 1/2	1.18	0.86	1 7/8	0.34

GENERAL NOTE: Dimensions are in inches.

NOTES:

- (1) Solid plugs are provided in NPS 1/8 to NPS 3 1/2, incl.; cored plugs, NPS 1/2 to NPS 3 1/2, incl.
- (2) For NPS 4 and larger, slotted or bar pattern plugs are provided (see Table I-2).
- (3) These dimensions are the nominal size of wrench as given in Appendix V of ASME B18.2.1. Square head plugs are designed to fit these wrenches.
- (4) Cored plugs have metal thickness at all points equal to dimension G, except at the end of the thread. For tolerance, see para. 7(b).

**Table I-2 Dimensions of Bar or Slotted Head Plugs**



**Optional Designs**

NPS	Minimum Thread Length, A	Minimum Height of Lug, D	Minimum Distance Between Lugs, E	Metal Thickness, G [Note (1)]
4	1.22	1.00	0.88	0.37
5	1.31	1.00	0.88	0.46
6	1.40	1.25	1.25	0.52
8	1.57	1.38	1.50	0.66

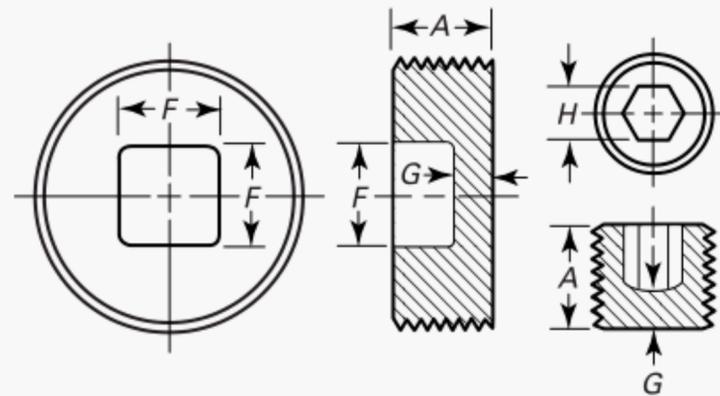
**GENERAL NOTES:**

- (a) Dimensions are given in inches.
- (b) For NPS 3 1/2 and smaller, square head plugs are provided (see Table I-1).

**NOTE:**

- (1) Cored plugs have metal thickness at all points equal to dimension G, except at the end of the thread. For tolerance, see para. 7(b).

**Table I-3 Dimensions of Countersunk Plugs**



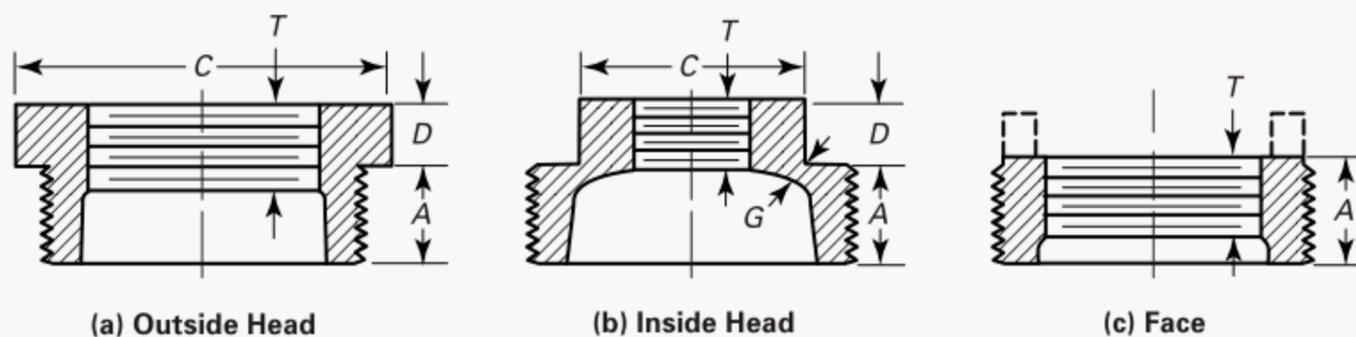
NPS	Minimum Thread Length, A	Nominal Size of Square Socket, F [Note (1)]	Size of Hexagon, H [Note (2)]	Metal Thickness, G [Note (3)]
1/8	0.37	...	3/16	0.06
1/4	0.44	...	1/4	0.09
3/8	0.48	...	5/16	0.13
1/2	0.56	3/8	3/8	0.16
3/4	0.63	1/2	9/16	0.18
1	0.75	1/2	5/8	0.20
1 1/4	0.80	3/4	...	0.22
1 1/2	0.83	3/4	...	0.24
2	0.88	7/8	...	0.26
2 1/2	1.07	1 1/8	...	0.29
3	1.13	1 3/8	...	0.31
3 1/2	1.18	1 1/2	...	0.34
4	1.22	2	...	0.37

**GENERAL NOTE:** Dimensions are in inches.

**NOTES:**

- (1) Square socket within countersunk pattern shall have dimensions to fit commercial square bars of sizes indicated.
- (2) Hexagon socket within countersunk pattern shall have dimensions to fit regular wrenches used with hexagon socket set screws.
- (3) For metal thickness tolerance, see para. 7(b).

Table I-4 Dimensions of Outside Head, Inside Head, and Face Bushings



NPS [Note (1)]	Minimum Length of External Thread, A [Note (2)]	Minimum Length of Internal Thread, T	Minimum Height of Head, D	Minimum Width of Head, C [Note (3)]		Nominal Metal Thickness, G [Note (4)]
				Outside	Inside	
$1/4 \times 1/8$	0.44	0.26 [Note (5)]	0.14	0.64 [Note (6)]	...	...
$3/8 \times 1/4$	0.48	0.40 [Note (5)]	0.16	0.68 [Note (6)]	...	...
$3/8 \times 3/8$	0.48	0.25	0.16	0.68 [Note (6)]	...	...
$1/2 \times 3/8$	0.56	0.41 [Note (5)]	0.19	0.87 [Note (6)]	...	...
$1/2 \times 1/4$	0.56	0.32	0.19	0.87 [Note (6)]	...	...
$1/2 \times 1/8$	0.56	0.25	0.19	0.87 [Note (6)]	...	...
$3/4 \times 1/2$	0.63	0.53 [Note (5)]	0.22	1.15 [Note (6)]	...	...
$3/4 \times 3/8$	0.63	0.36	0.22	1.15 [Note (6)]	...	...
$3/4 \times 1/4$	0.63	0.32	0.22	1.15 [Note (6)]	...	...
$3/4 \times 1/8$	0.63	0.25	0.22	1.15 [Note (6)]	...	...
$1 \times 3/4$	0.75	0.50	0.25	1.42 [Note (6)]	...	...
$1 \times 1/2$	0.75	0.43	0.25	1.42 [Note (6)]	...	...
$1 \times 3/8$	0.75	0.36	0.30	...	1.12	...
$1 \times 1/4$	0.75	0.32	0.30	...	1.12	...
$1 \times 1/8$	0.75	0.25	0.30	...	1.12	...
$1 1/4 \times 1$	0.80	0.58	0.28	1.76	...	...
$1 1/4 \times 3/4$	0.80	0.50	0.28	1.76	...	...
$1 1/4 \times 1/2$	0.80	0.43	0.34	...	1.34	0.18
$1 1/4 \times 3/8$	0.80	0.36	0.34	...	1.12	0.18
$1 1/4 \times 1/4$	0.80	0.32	0.34	...	1.12	0.18
$1 1/2 \times 1 1/4$	0.83	0.77 [Note (5)]	0.31	2.00	...	...
$1 1/2 \times 1$	0.83	0.58	0.31	2.00	...	...
$1 1/2 \times 3/4$	0.83	0.50	0.37	...	1.63	0.20
$1 1/2 \times 1/2$	0.83	0.43	0.37	...	1.34	0.20
$1 1/2 \times 3/8$	0.83	0.36	0.37	...	1.12	0.20
$1 1/2 \times 1/4$	0.83	0.32	0.37	...	1.12	0.20
$2 \times 1 1/2$	0.88	0.70	0.34	2.48	...	...
$2 \times 1 1/4$	0.88	0.67	0.34	2.48	...	...
$2 \times 1$	0.88	0.58	0.41	...	1.95	0.22
$2 \times 3/4$	0.88	0.50	0.41	...	1.63	0.22
$2 \times 1/2$	0.88	0.43	0.41	...	1.34	0.22
$2 \times 3/8$	0.88	0.36	0.41	...	1.12	0.22
$2 \times 1/4$	0.88	0.32	0.41	...	1.12	0.22
$2 1/2 \times 2$	1.07	0.75	0.37	2.98	...	...
$2 1/2 \times 1 1/2$	1.07	0.70	0.44	2.68	...	...
$2 1/2 \times 1 1/4$	1.07	0.67	0.44	...	2.39	0.24
$2 1/2 \times 1$	1.07	0.58	0.44	...	1.95	0.24
$1 1/2 \times 3/4$	1.07	0.50	0.44	...	1.63	0.24
$2 1/2 \times 1/2$	1.07	0.43	0.44	...	1.34	0.24

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**Table I-4 Dimensions of Outside Head, Inside Head, and Face Bushings (Cont'd)**

NPS [Note (1)]	Minimum Length of External Thread, A [Note (2)]	Minimum Length of Internal Thread, T	Minimum Height of Head, D	Minimum Width of Head, C [Note (3)]		Nominal Metal Thickness, G [Note (4)]
				Outside	Inside	
3 × 2½	1.13	0.92	0.40	3.86	...	...
3 × 2	1.13	0.75	0.48	3.28	...	...
3 × 1½	1.13	0.70	0.48	...	2.68	0.26
3 × 1¼	1.13	0.67	0.48	...	2.39	0.26
3 × 1	1.13	0.58	0.48	...	1.95	0.26
3 × ¾	1.13	0.50	0.48	...	1.63	0.26
3 × ½	1.13	0.43	0.48	...	1.34	0.26
3½ × 3	1.18	0.98	0.43	4.62	...	...
3½ × 2½	1.18	0.92	0.52	3.86	...	...
3½ × 2	1.18	0.75	0.52	...	3.28	0.28
3½ × 1½	1.18	0.70	0.52	...	2.68	0.28
3½ × 1¼	1.18	0.67	0.52	...	2.39	0.28
3½ × 1	1.18	0.58	0.52	...	1.95	0.28
4 × 3½	1.22	1.03	0.50	5.20	...	...
4 × 3	1.22	0.98	0.50	4.62	...	...
4 × 2½	1.22	0.92	0.60	...	3.86	0.31
4 × 2	1.22	0.75	0.60	...	3.28	0.31
4 × 1½	1.22	0.70	0.60	...	2.68	0.31
4 × 1¼	1.22	0.67	0.60	...	2.39	0.31
4 × 1	1.22	0.58	0.60	...	1.95	0.31
5 × 4	1.31	1.08	0.50	5.79	...	...
5 × 3½	1.31	1.03	0.60	5.20	...	...
5 × 3	1.31	0.98	0.60	...	4.62	0.38
5 × 2½	1.31	0.92	0.60	...	3.86	0.38
5 × 2	1.31	0.75	0.60	...	3.28	0.38
6 × 5	1.40	1.18	0.63	7.05	...	...
6 × 4	1.40	1.08	0.75	...	5.79	0.43
6 × 3½	1.40	1.03	0.75	...	5.20	0.43
6 × 3	1.40	0.98	0.75	...	4.62	0.43
6 × 2½	1.40	0.92	0.75	...	3.86	0.43
6 × 2	1.40	0.75	0.75	...	3.28	0.43
8 × 6	1.57	1.28	0.83	8.28	...	...
8 × 5	1.57	1.18	0.83	...	7.05	0.55
8 × 4	1.57	1.08	0.83	...	5.79	0.55
8 × 3½	1.57	1.03	0.83	...	5.20	0.55
8 × 3	1.57	0.98	0.83	...	4.62	0.55

**GENERAL NOTES:**

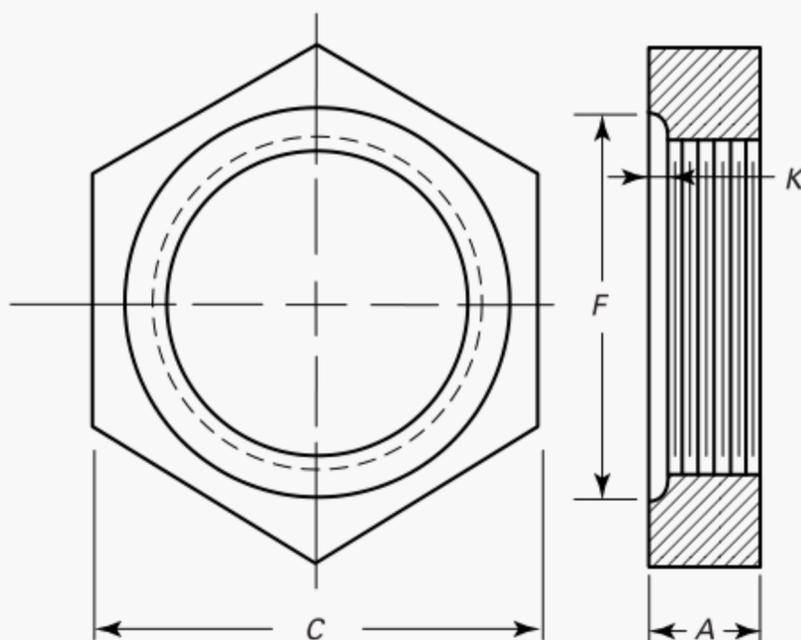
(a) Dimensions are in inches.

(b) Cored bushings have minimum metal thickness at all points equal to dimension G, except at the end of the thread.

**NOTES:**

- (1) Hexagon head or octagon head bushings NPS 2½ and smaller reducing one NPS shall not be made of gray cast iron. Other NPS may be made of either cast iron or malleable iron, ductile iron, or steel. Face bushings NPS 2½ and smaller shall not be made of gray cast iron. Face bushings NPS 3 and larger reducing one NPS shall not be made of gray cast iron. Face bushings NPS 3 and larger reducing two NPS or more may be made of either cast iron or malleable iron, ductile iron, or steel.
- (2) In the case of outside head bushings, length A includes provisions for imperfect threads (see also section 8).
- (3) Heads of bushings shall be hexagonal or octagonal, except that on the larger sizes of outside head bushings, the heads may be made round with lugs instead of hexagonal or octagonal.
- (4) G is the same as metal thickness for Class 125 Cast Iron Threaded Fittings (ASME B16.4). For tolerance, see para. 7(b).
- (5) To provide proper metal thickness, these NPS shall not be cored out to diameters greater than the root diameter of the internal thread. The length of the internal thread may be equal to the minimum dimension, T, or greater up to the full length of bushing.
- (6) When made of bar stock, the dimensions may be 5/8 in., 11/16 in., 7/8 in., 1 1/8 in., and 1 7/16 in., respectively, in order to use regular bar stock sizes.

Table I-5 Dimensions of Locknuts



NPS	Minimum Nominal Thickness, A	Minimum Width Across Flats, C [Note (1)]		Minimum Diameter of Packing Recess, F [Note (2)]	Depth of Packing Recess, K [Note (2)]
		Malleable Iron, Ductile Iron, Steel	Cast Iron		
1/8	0.19	0.69 [Note (3)]	...	0.50	0.04
1/4	0.25	0.84 [Note (3)]	...	0.66	0.06
3/8	0.28	1.00 [Note (3)]	...	0.77	0.06
1/2	0.31	1.18 [Note (3)]	...	0.97	0.06
3/4	0.34	1.43 [Note (3)]	...	1.23	0.06
1	0.38	1.75	...	1.50	0.06
1 1/4	0.42	2.10	...	1.86	0.06
1 1/2	0.47	2.35	...	2.12	0.06
2	0.53	2.88	...	2.63	0.09
2 1/2	0.59	3.50	3.86	3.18	0.09
3	0.67	4.27	4.62	3.84	0.09
3 1/2	0.73	4.84	5.20	4.38	0.13
4	0.80	5.38	5.79	5.00	0.13

GENERAL NOTE: Dimensions are in inches.

NOTES:

- (1) NPS 3 1/2 and smaller are hexagonal; NPS 4 may be either hexagonal or octagonal.
- (2) The packing recess surface may be as-cast. When made from bar stock, the recess may be tool finished.
- (3) Locknuts in these NPS may be made from bar stock, in which case dimension C may be 11/16 in., 7/8 in., 1 in., 1 3/16 in., and 1 7/16 in., respectively, in order to conform with regular hexagon bar stock sizes.

## MANDATORY APPENDIX II REFERENCES

(10)

The following is a list of standards and specifications referenced in this Standard:

ANSI/ASME B1.20.1-1983 (R2001), Pipe Threads, General Purpose (Inch)

ASME B16.3-2006, Malleable Iron Threaded Fittings: Classes 150 and 300

ASME B16.4-2006, Gray Iron Threaded Fittings: Classes 125 and 250

ASME B18.2.1-1996, Square and Hex Bolts and Screws (Inch Series)

Publisher: The American Society of Mechanical Engineers (ASME), Three Park Avenue, New York, NY 10016-5990; Order Department: 22 Law Drive, P.O. Box 2900, Fairfield, NJ 07007-2900 ([www.asme.org](http://www.asme.org))

ASTM A 126-84, Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings

Publisher: American Society for Testing and Materials (ASTM International), 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959 ([www.astm.org](http://www.astm.org))

(10)

## NONMANDATORY APPENDIX A QUALITY SYSTEM PROGRAM

The products manufactured in accordance with this Standard shall be produced under a quality system program following the principles of the ISO 9000 series.<sup>1</sup> A determination of the need for registration and/or

---

<sup>1</sup> The series is also available from the American National Standards Institute (ANSI) and the American Society for Quality (ASQ) as American National Standards that are identified by a prefix "Q" in place of the prefix "ISO." Each standard of the series is listed under Mandatory Appendix II.

certification of the product manufacturer's quality system program by an independent organization shall be the responsibility of the manufacturer. The detailed documentation demonstrating program compliance shall be available to the purchaser at the manufacturer's facility. A written summary description of the program utilized by the product manufacturer shall be available to the purchaser upon request. The product manufacturer is defined as the entity whose name or trademark appears on the product in accordance with the marking or identification requirements in this Standard.

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