ASME B18.5.2.1M-2006

[Revision of ASME B18.5.2.1M-1996 (R2003)]

Metric Round Head Short Square Neck Bolts

AN AMERICAN NATIONAL STANDARD



The American Society of Mechanical Engineers

Copyright ASME International
Provided by IHS under license with ASME
No reproduction or networking permitted without license from IHS

Not for Resale

ASME B18.5.2.1M-2006
[Revision of ASME B18.5.2.1M-1996 (R2003)]

Metric Round Head Short Square Neck Bolts

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers
Three Park Avenue • New York, NY 10016

Copyright ASME International
Provided by IHS under license with ASME
No reproduction or networking permitted without license from IHS
Not for Resale

Date of Issuance: October 2, 2006

This Standard will be revised when the Society approves the issuance of a new edition. There will be no addenda issued to this edition.

ASME issues written replies to inquiries concerning interpretations of technical aspects of this Standard. Interpretations are published on the ASME website under the Committee Pages at http://www.asme.org/codes/ as they are issued.

ASME is the registered trademark of The American Society of Mechanical Engineers.

This code or standard was developed under procedures accredited as meeting the criteria for American National Standards. The Standards Committee that approved the code or standard was balanced to assure that individuals from competent and concerned interests have had an opportunity to participate. The proposed code or standard was made available for public review and comment that provides an opportunity for additional public input from industry, academia, regulatory agencies, and the public-at-large.

ASME does not "approve," "rate," or "endorse" any item, construction, proprietary device, or activity.

ASME does not take any position with respect to the validity of any patent rights asserted in connection with any items mentioned in this document, and does not undertake to insure anyone utilizing a standard against liability for infringement of any applicable letters patent, nor assume any such liability. Users of a code or standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, is entirely their own responsibility.

Participation by federal agency representative(s) or person(s) affiliated with industry is not to be interpreted as government or industry endorsement of this code or standard.

ASME accepts responsibility for only those interpretations of this document issued in accordance with the established ASME procedures and policies, which precludes the issuance of interpretations by individuals.

No part of this document may be reproduced in any form,
in an electronic retrieval system or otherwise,
without the prior written permission of the publisher.

The American Society of Mechanical Engineers
Three Park Avenue, New York, NY 10016-5990

Copyright © 2006 by
THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
All rights reserved
Printed in U.S.A.

Copyright ASME International
Provided by IHS under license with ASME
No reproduction or networking permitted without license from IHS

Not for Resale

CONTENTS

Foreword iv
Committee Roster v
Correspondence With the B18 Committee vi

1 Introductory Notes 1

2 General Data 2

Tables
1 Dimensions of Round Head Short Square Neck Bolts 3
2 Length Tolerances 4
3 Maximum Grip Lengths, L_g, and Minimum Body Lengths, L_s 5
4 Thread Lengths 5

Nonmandatory Appendices
A Gage and Gaging for Checking Bolt Straightness 7
B Recommended Clearance Holes for Metric Round Head Short Square Neck Bolts 8

Copyright ASME International
Provided by IHS under license with ASME
No reproduction or networking permitted without license from IHS
Not for Resale

FOREWORD

ASME Standards Committee B18 for the Standardization of Bolts, Nuts, Rivets, Screws, Washers, and Similar Fasteners (formerly American National Standards Committee B18), was originated in March 1922 as Sectional Committee B18 under the aegis of the American Engineering Standards Committee (later the American Standards Association, the United States of America Standards Institute, and, as of October 6, 1969, the American National Standards Institute, Inc.) with the Society of Automotive Engineers and the American Society of Mechanical Engineers as joint sponsors. Subcommittees 2, 5, and 6 (later redesignated Subcommittee 9) were subsequently established and charged with the responsibilities for the technical content of standards for: external drive bolts and nuts, round unslotted head bolts, and plow bolts and nuts, round unslotted head bolts, and plow bolts, respectively. Subcommittee 9 was merged into Subcommittee 5 in 1977.

In October 1978, drafting of this Standard was started. The draft was circulated for letter ballot of Subcommittee 5 and Committee B18 on March 27, 1980. Following approval by Subcommittee 5 and Committee B18, this Standard was approved by the secretariat and submitted to the American National Standards Institute for designation as an American National Standard. This was granted on August 14, 1981.

In December 1986, ASME Committee B18 agreed to combine Subcommittee 5 into Subcommittee 2, since the products addressed by the two Subcommittees were quite similar. Committee B18 further agreed the designations of the Subcommittee 2 and 5 documents not be changed, since such changes would adversely affect current references to these Standards.

Following approval by Subcommittee 2 and Committee B18, the 1996 edition was approved by the secretariat and submitted to the American National Standards Institute for approval as an American National Standard. This was granted on March 8, 1996.

This revision, ASME B18.5.2.1M-2006, was approved by the American National Standards Institute on August 4, 2006.

Copyright ASME International
Provided by IHS under license with ASME
No reproduction or networking permitted without license from IHS
Not for Resale

ASME B18 COMMITTEE
Standardization of Bolts, Nuts, Rivets, Screws, Washers, and Similar Fasteners

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

STANDARDS COMMITTEE OFFICERS

D. A. Clever, *Chair*
R. D. Strong, *Vice Chair*
S. W. Vass, *Vice Chair*
R. L. Crane, *Secretary*

STANDARDS COMMITTEE PERSONNEL

J. B. Belford, *Corresponding Member,* Lawson Products, Inc.
V. Cartina, Aztech Locknut
D. A. Clever, Deere and Co.
A. P. Cockman, Ford Motor Co.
R. L. Crane, The American Society of Mechanical Engineers
A. C. DiCola, Wrought Washer Co.
B. A. Dusina, Federal Screw Works
J. S. Foote, *Corresponding Member,* Trade Association Management, Inc.
D. S. George, Ford Motor Co.
J. Greenslade, *Corresponding Member,* Greenslade and Co.
J. J. Grey, *Corresponding Member,* Fastener Consulting Services, Inc.
B. Hasiuk, *Corresponding Member,* Defense Industrial Supply Center Philadelphia
A. Herskovitz, Consultant
J. Hubbard, *Corresponding Member,* Rockford Fastener, Inc.
J. Jennings, *Corresponding Member,* Naval Surface Warfare Center
M. Keller, *Corresponding Member,* Paracad Technology Co.
J. F. Koehl, *Corresponding Member,* Spirol International Corp.
W. H. Kopke, ITW Shakeproof Assembly Components
J. G. Langenstein, *Member Emeritus,* Consultant
W. J. Lutkus, Emhart Industrial Heli-Coil
D. McCrindle, Canadian Fasteners Institute
M. D. Prasad, *Corresponding Member,* General Motors Corp.
J. A. Roley, *Corresponding Member,* Caterpillar, Inc.
W. L. Sakowski, Account Managers, LLC
S. Savoji, ITW Medalist
W. R. Schevey, *Corresponding Member,* BGM Fastener Co., Inc.
W. R. Stevens, Ramco
R. D. Strong, General Motors Corp.
S. W. Vass, Consultant
C. B. Wackrow, MNP Corp.
W. K. Wilcox, Consultant
C. B. Williamson, *Corresponding Member,* Fastenal Co.
C. J. Wilson, Industrial Fasteners Institute
R. B. Wright, *Corresponding Member,* Wright Tool Co.
J. G. Zeratsky, National Rivet & Manufacturing Co.

SUBCOMMITTEE 2 — EXTERNAL DRIVE FASTENERS

S. W. Vass, *Chair,* Consultant
R. L. Crane, *Secretary,* The American Society of Mechanical Engineers
H. S. Brenner, Almay Consultants
D. A. Clever, Deere and Co.
A. P. Cockman, Ford Motor Co.
B. A. Dusina, Federal Screw Works
J. S. Foote, Trade Association Management, Inc.
D. S. George, Ford Motor Co.
J. Greenslade, Greenslade and Co.
A. Herskovitz, Consultant
M. W. Holubecki, Electric Boat Corp.
J. Hubbard, Rockford Fastener, Inc.
J. Jennings, *Corresponding Member,* Naval Surface Warfare Center
M. Keller, Paracad Technology Co.
W. H. King, Porteous Fastener Co.
D. McCrindle, Canadian Fasteners Institute
R. B. Meade, R. Bruce Meade and Associates, LLC
J. A. Roley, Caterpillar, Inc.
S. Savoji, ITW Medalist
G. M. Simpson, Semblex Corp.
W. R. Stevens, Ramco
R. D. Strong, General Motors Corp.
C. B. Wackrow, MNP Corp.
W. K. Wilcox, Consultant
C. B. Williamson, Fastenal Co.
C. J. Wilson, Industrial Fasteners Institute

Copyright ASME International
Provided by IHS under license with ASME
No reproduction or networking permitted without license from IHS
Not for Resale

CORRESPONDENCE WITH THE B18 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, B18 Standards Committee
The American Society of Mechanical Engineers
Three Park Avenue
New York, NY 10016-5990

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 B18 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 B18 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, which 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 B18 Standards Committee regularly holds meetings, which are open to the public. Persons wishing to attend any meeting should contact the Secretary of the B18 Standards Committee.

Copyright ASME International
Provided by IHS under license with ASME
No reproduction or networking permitted without license from IHS
Not for Resale

METRIC ROUND HEAD SHORT SQUARE NECK BOLTS

1 INTRODUCTORY NOTES

1.1 Scope

1.1.1 This Standard covers the general and dimensional data for metric series round head short square neck bolts recognized as an American National Standard and intended primarily for applications in thin metals.

1.1.2 The inclusion of dimensional data in this Standard is not intended to imply that all sizes described are production stock items. Consumers should consult with suppliers concerning lists of stock production items.

1.2 Comparison With ISO 8678:1988

1.2.1 Steel bolts produced to this Standard are functionally interchangeable with bolts which conform to ISO 8678:1988. Differences between this Standard and ISO 8678 are: size M14, materials other than steel, and minor variations in tolerances, such as, permissible swell, fin, or die seam on the body of bolts with nominal lengths longer than 150 mm. **Dimensional requirements in addition to, or different from ISO 8678, are shown in bold type in this Standard.**

1.2.2 Letter symbols designating dimensional characteristics are in accordance with ISO 225 and ISO 8678, except where capitals have been used instead of the lowercase letters used in the ISO standards.

1.3 Terminology

For definitions of terms relating to fasteners or component features used in this Standard, refer to ASME B18.12.

1.4 Dimensions

1.4.1 All dimensions in this Standard are in millimeters (mm), and apply to unplated or uncoated product, unless stated otherwise.

1.4.2 Symbols specifying geometric characteristics are in accordance with ASME Y14.5M.

1.5 Clearance Holes

The recommended sizes of clearance holes in materials to be assembled, using round head short square neck bolts, are given in Nonmandatory Appendix B.

1.6 Designation

1.6.1 Round head short square neck bolts are designated by the following data, preferably in the sequence shown: product name and designation of the standard, nominal diameter and thread pitch, nominal length, steel property class or material identification, and protective coating, if required.

EXAMPLES:

Round head short square neck bolt B18.5.2.1M,
M10 × 1.5 × 50 – 9.8 - zinc plated per ASTM F 1941M Fe/Zn 5C.

Round head short square neck bolt B18.5.2.1.M,
M6 × 1 × 35, stainless steel class C1-50 ASTM F 738M.

NOTE: It is common practice in ISO standards to omit thread pitch from product size designations when screw threads are metric coarse thread series (e.g., M10 is M10 × 1.5).

1.6.2 For the recommended part number (PIN) system for metric round head short square neck bolts, see ASME B18.24.

1.7 Referenced Standards

Unless otherwise specified, the standards referenced shall be the most recent issue at the time of order placement. The following is a list of publications referenced in this Standard.

ASME B1.3M, Screw Thread Gaging Systems for Dimensional Acceptability — Inch and Metric Screw Threads (UN, UNR, UNJ, M, and MJ)

ASME B1.13M, Metric Screw Threads — M Profile

ASME B18.2.8, Clearance Holes for Bolts, Screws, and Studs

ASME B18.12, Glossary of Terms for Mechanical Fasteners

ASME B18.18.1M, Inspection and Quality Assurance for General Purpose Fasteners

ASME B18.18.2M, Inspection and Quality Assurance for High-Volume Machine Assembly Fasteners

ASME B18.18.3M, Inspection and Quality Assurance for Special Purpose Fasteners

ASME B18.18.4M, Inspection and Quality Assurance for Fasteners for Highly Specialized Engineered Applications — Metric

ASME B18.24, Part Identifying Number (PIN) Code System Standard for B18 Fastener Products

Copyright ASME International
Provided by IHS under license with ASME
No reproduction or networking permitted without license from IHS
Not for Resale

ASME Y14.5M, Dimensioning and Tolerancing

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

ASTM F 468M, Standard Specification for Nonferrous Bolts, Hex Cap Screws, and Studs for General Use (Metric)

ASTM F 568M, Standard Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners

ASTM F 738M, Standard Specification for Stainless Steel Metric Bolts, Screws, and Studs

ASTM F 788/F 788M, Standard Specification for Surface Discontinuities of Bolts, Screws, and Studs, Inch and Metric Series

ASTM F 1941M, Electrodeposited Coatings on Threaded Fasteners (Metric)

Publisher: ASTM International (ASTM), 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959

ISO 225, Fasteners — Bolts, Screws, and Studs — Symbols and Designations of Dimensions

ISO 8678:1988, Cup Head Square Neck Bolts With Small Head and Short Neck — Product Grade B

Publisher: International Organization for Standardization (ISO), 1 Rue de Varembé, Case Postale 56, CH-1211, Genève 20 Switzerland/Suisse

SAE J1199, Mechanical and Material Requirements for Metric Externally Threaded Steel Fasteners

Publisher: Society of Automotive Engineers (SAE), 400 Commonwealth Drive, Warrendale, PA 15096-0001

2 GENERAL DATA

2.1 Heads

2.1.1 Top of Head. The spherical top surface of the head may be underfilled within a circle equal to the nominal bolt diameter, *D*, concentric to the bolt axis, providing the head height, *K*, is maintained.

2.1.2 Head Height. The head height is the distance, as measured parallel to the axis of the bolt, from the top of the head to the underhead bearing surface. See para. 2.11.

2.1.3 Edge of Head. The edge of the head may be flat or rounded, and the periphery may be somewhat irregular, providing the limits for head diameter, D_k, bearing surface diameter, D_w , and head edge thickness, C (measured at the minimum bearing surface diameter, D_w min.), are maintained.

2.1.4 Bearing Surface. The bearing surface shall be reasonably flat and perpendicular within one degree to the axis of the bolt. **A 0.5 mm maximum height die seam fin across the bearing surface shall be permissible.**

2.2 Square Neck

2.2.1 Depth of Neck. The depth of the square neck is the distance, measured parallel to the axis, from the bearing surface to the plane where the corner chamfer would intersect the nominal bolt diameter.

2.2.2 Corner Depth. The corner depth is the distance, measured at a corner of the square, from the plane of the bearing surface to the last plane at which the width across corners, E, is within its specified limits.

2.2.3 Width Across Corners. The corners of the square neck may be rounded or underfilled to the extent allowed by the minimum width across corners, E, and the minimum corner depth, F_1. **There may be a fin or die seam on the corners of the square not to exceed the maximum width across corners.**

2.3 Fillets

The radius of fillets at the junction of head and square neck and at the junction of square neck and shank shall be within the specified limits, **except for bolts produced from nonferrous and corrosion resistance materials, on which maximum fillets shall be subject to agreement between manufacturer and purchaser.**

2.4 Body Diameter

The body diameter for lengths up to 150 mm shall be within the limits of Table 1. **For bolts longer than 150 mm, there may be reasonable swell, fin, or die seam not to exceed the nominal bolt diameter by the following:**

***(a)* 0.65 mm for M6**
***(b)* 0.75 mm for M8 through M14**
***(c)* 1.25 mm for M16**
***(d)* 1.50 mm for M20**

2.5 Length

The length of the bolt, L, shall be measured parallel to the axis of the bolt from the bearing surface to the extreme end of the shank. Tolerances for bolt lengths are given in Table 2.

2.6 Straightness

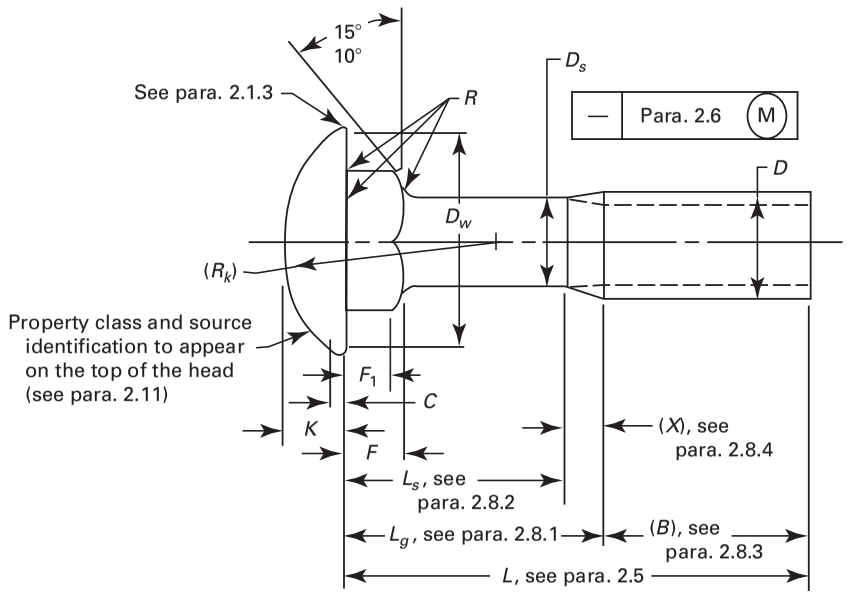
Shanks of bolts shall be straight with a maximum camber at the maximum material condition of 0.05 mm plus 0.002 times bolt length ($0.05 + 0.002L$) for nominal sizes M8 and smaller, and within 0.05 mm plus 0.0025 times bolt length ($0.05 + 0.0025L$) for nominal sizes M10 and larger. A gage and gaging procedure for checking bolt straightness is given in Nonmandatory Appendix A.

2.7 Screw Threads

2.7.1 Thread Series and Tolerance Class. Screw threads shall be coarse series, general purpose, external, metric screw threads with tolerance class 6g conforming

Copyright ASME International
Provided by IHS under license with ASME
No reproduction or networking permitted without license from IHS
Not for Resale

Copyright ASME International
Provided by IHS under license with ASME
No reproduction or networking permitted without license from IHS



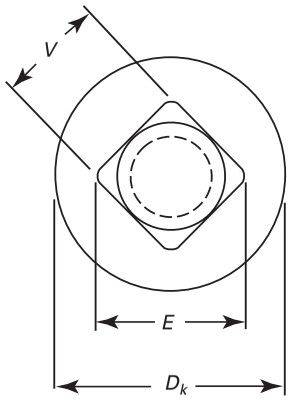


Table 1 Dimensions of Round Head Short Square Neck Bolts

Nominal Bolt Size and Thread Pitch, $D \times P$	Body Diameter, D_s [Note (1)]		Head Diameter, D_k [Note (2)]	Bearing Surface Diameter, D_w [Note (3)]	Head Height, K [Note (4)]		Head Edge Thickness, C [Note (2)]		Square Width Across Corners, E [Note (5)]		Square Width Across Flats, V		Square Depth, F [Note (6)]		Square Corner Depth, F_1 [Note (5)]	Head Radius, (R_k) [Note (7)]	Fillet Radius, R [Note (8)]	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Min.	Ref.	Max.	Min.
M6 × 1	6.00	5.21	14.2	12.2	3.6	3.0	1.9	1.1	**9.16**	7.64	6.48	5.88	3.0	2.4	1.9	**10.7**	0.5	**0.25**
M8 × 1.25	8.00	7.04	18.0	15.8	4.8	4.0	2.2	1.2	**12.13**	10.20	8.58	7.85	3.0	2.4	1.9	**12.5**	0.8	**0.40**
M10 × 1.5	10.00	8.86	22.3	19.6	5.8	5.0	2.5	1.5	**14.96**	12.80	10.58	9.85	4.0	3.2	2.6	**15.5**	0.8	**0.40**
M12 × 1.75	12.00	10.68	26.6	23.8	6.8	6.0	2.8	1.8	**17.96**	15.37	12.70	11.82	4.0	3.2	2.6	**19.0**	1.2	**0.60**
M14 × 2	**14.00**	**12.50**	**30.5**	**27.6**	**7.9**	**7.0**	**3.3**	**2.1**	**20.79**	**17.97**	**14.70**	**13.82**	**4.0**	**3.2**	**2.6**	**21.9**	1.2	**0.60**
M16 × 2	16.00	14.50	35.0	31.9	8.9	8.0	3.6	2.4	**23.62**	20.57	16.70	15.82	5.0	4.2	3.4	**25.5**	1.2	**0.60**
M20 × 2.5	20.00	18.16	43.0	39.9	10.9	10.0	4.2	3.0	**29.47**	25.73	20.84	19.79	5.0	4.2	3.4	**31.9**	1.6	**0.80**

NOTES:
(1) See para. 2.4.
(2) See para. 2.1.3.
(3) See paras. 2.1.3 and 2.1.4.
(4) See paras. 2.1.2 and 2.11.
(5) See paras. 2.2.2 and 2.2.3.
(6) See para. 2.2.1.
(7) See para. 2.1.1.
(8) See para. 2.3.

Not for Resale

Table 2 Length Tolerances

Nominal Length	Length Tolerance
Over 10 mm through 18 mm	±0.90
Over 18 mm through 30 mm	±1.05
Over 30 mm through 50 mm	±1.25
Over 50 mm through 80 mm	±1.50
Over 80 mm through 120 mm	±1.75
Over 120 mm through 180 mm	±2.00
Over 180 mm through 250 mm	±2.30
Over 250 mm through 300 mm	±2.60

to ASME B1.13M, unless otherwise specified by the purchaser. For bolts with additive finish, size limits for tolerance class 6g apply before plating or coating. Also, the thread profile after coating is subject to acceptance using a basic (tolerance position *h*) size GO thread gage and tolerance class 6g thread gage for either minimum material, GO or NOT GO.

2.7.2 Thread Gaging. Unless otherwise specified, dimensional acceptability of screw threads shall be determined based on System 21, ASME B1.3M.

2.8 Thread Length

The length of thread on bolts shall be controlled by the maximum grip length, L_g, and the minimum body length, L_s, as set forth in paras. 2.8.1 through 2.8.4.

2.8.1 Grip Length. The grip length, L_g, is the distance measured parallel to the axis of the bolt from the bearing surface to the face of a standard noncounterbored, noncountersunk, GO-thread ring gage, assembled by hand, as far as the thread will permit.

For standard diameter-length combinations, the values for L_g max. are specified in Table 3. For diameter-length combinations not listed in Table 3, the maximum grip length shall be determined from Table 4 as follows:

(a) All bolts of nominal lengths equal to or shorter than L_1, specified in Table 4, shall be threaded full length. For bolts which are threaded full length, L_g max. shall be as specified in Table 4.

(b) For bolts of nominal lengths longer than L_1, specified in Table 4, the maximum grip length shall be equal to the nominal bolt length L minus the basic thread length B, specified in Table 4 (L_g max. $= L - B$).

2.8.2 Body Length. The body length, L_s, is the distance, measured parallel to the axis of the bolt, from the bearing surface to the last scratch of thread or top of the extrusion angle, whichever is closer to the head. For standard diameter-length combinations of bolts, the values of L_s min. are specified in Table 3. For diameter-length combinations not listed in Table 3, the minimum body length shall be equal to the maximum grip length minus the transition thread length as specified in Table 4 [L_s min. $= L_g$ max. $- (X)$].

2.8.3 Basic Thread Length. The basic thread length, B, specified in Table 4, is a reference dimension intended for calculation purposes only. It is the distance, measured parallel to the axis of the bolt, from the extreme end of the bolt to the last complete (full form) thread.

2.8.4 Transition Thread Length. The transition thread length, (X), specified in Table 4, is a reference dimension intended for calculation purposes only. It includes the length of incomplete threads and tolerances on grip length and body length. The transition from full form thread to incomplete thread shall be smooth and uniform. **The major diameter of the incomplete threads shall not exceed the actual major diameter of the complete (full form) threads. For bolts of property class 10.9 and higher strength materials (tensile strength 1040 MPa and higher), the transition threads shall have a rounded root contour, no radius of which shall be less than the specified minimum root radius of the full form thread.**

2.9 Point

Bolts need not be pointed. The length from the end of the bolt to the first full formed thread at major diameter shall be no greater than two thread pitches, **as determined by the distance the end of the bolt enters into a cylindrical NOT GO major diameter ring gage.**

2.10 Materials and Mechanical Properties

2.10.1 Steel. Unless otherwise specified, steel bolts shall conform to the requirements of ASTM F 568M or SAE J1199.

2.10.2 Corrosion-Resistant Steel. Unless otherwise specified, corrosion-resistant steel bolts shall conform to the requirements of ASTM F 738M.

2.10.3 Nonferrous Metal. Unless otherwise specified, nonferrous bolts shall conform to the requirements of ASTM F 468M.

2.11 Identification Symbols

Markings shall be raised or recessed on the top of the head, unless otherwise specified by the purchaser. Markings shall be legible to the unaided eye with the exception of corrective lenses. **When raised, markings shall project not less than 0.1 mm for M14 and smaller bolts, and 0.3 mm for M16 and M20 bolts. The total head height (head plus markings) shall not exceed the specified maximum head height, K_{max}, plus**

***(a)* 0.1 mm for M5 and M6 bolts**
***(b)* 0.2 mm for M8 and M10 bolts**
***(c)* 0.3 mm for M12 and M14 bolts**
***(d)* 0.4 mm for M16 and M20 bolts**

2.11.1 Property Class Symbols. Each bolt shall be marked in accordance with the requirements of the applicable specification for its chemistry and mechanical properties.

Copyright ASME International
Provided by IHS under license with ASME
No reproduction or networking permitted without license from IHS
Not for Resale

Table 3 Maximum Grip Lengths, L_g, and Minimum Body Lengths, L_s

Nominal Diameter and Thread Pitch	M6 × 1		M8 × 1.25		M10 × 1.5		M12 × 1.75		M14 × 2		M16 × 2		M20 × 2.5	
Nominal Length, L	L_g Max.	L_s Min.	L_g Max.	L_s Min.	L_g Max.	L_s Min.	L_g Max.	L_s Min.	L_g Max.	L_s Min.	L_g Max.	L_s Min.	L_g Max.	L_s Min.
12	5.0	...	...	...	...	...	...	...	...	...	...	...	...	...
16	5.0	...	5.5	...	...	...	...	...	...	...	...	...	...	...
20	5.0	...	5.5	...	7.0	...	7.5	...	...	...	...	...	...	...
25	5.0	...	5.5	...	7.0	...	7.5	...	**8.0**	...	...	...	...	...
30	5.0	...	5.5	...	7.0	...	7.5	...	**8.0**	...	9.0	...	...	...
35	5.0	...	5.5	...	7.0	...	7.5	...	**8.0**	...	9.0	...	10.0	...
40	5.0	...	5.5	...	7.0	...	7.5	...	**8.0**	...	9.0	...	10.0	...
45	5.0	...	5.5	...	7.0	...	7.5	...	**8.0**	...	9.0	...	10.0	...
50	5.0	...	5.5	...	7.0	...	7.5	...	**8.0**	...	9.0	...	10.0	...
55	37.0	32.0	33.0	26.75	29.0	21.5	25.0	16.25	**8.0**	...	9.0	...	10.0	...
60	42.0	37.0	38.0	31.75	34.0	26.5	30.0	21.25	**26.0**	**16.0**	9.0	...	10.0	...
65	...	...	43.0	36.75	39.0	31.5	35.0	26.25	**31.0**	**21.0**	27.0	17.0	10.0	...
70	...	...	48.0	41.75	44.0	36.5	40.0	31.25	**36.0**	**26.0**	32.0	22.0	10.0	...
80	...	...	58.0	51.75	54.0	46.5	50.0	41.25	**46.0**	**36.0**	42.0	32.0	34.0	21.5
90	...	...	...	...	64.0	56.5	60.0	51.25	**56.0**	**46.0**	52.0	42.0	44.0	31.5
100	...	...	...	...	74.0	66.5	70.0	61.25	**66.0**	**56.0**	62.0	52.0	54.0	41.5
110	...	...	...	...	...	...	80.0	71.25	**76.0**	**66.0**	72.0	62.0	64.0	51.5
120	...	...	...	...	...	...	90.0	81.25	**86.0**	**76.0**	82.0	72.0	74.0	61.5
130	...	...	...	...	...	...	...	...	**90.0**	**80.0**	86.0	76.0	78.0	65.5
140	...	...	...	...	...	...	...	...	**100.0**	**90.0**	96.0	86.0	88.0	75.5
150	...	...	...	...	...	...	...	...	...	...	106.0	96.0	98.0	85.5
160	...	...	...	...	...	...	...	...	...	...	116.0	106.0	108.0	95.5
180	...	...	...	...	...	...	...	...	...	...	...	...	128.0	115.5
200	...	...	...	...	...	...	...	...	...	...	...	...	148.0	135.5

GENERAL NOTES:
(a) L_g is grip length and L_s is body length. See paras. 2.8.1 and 2.8.2.
(b) Grip lengths, L_g, are shown for the recommended diameter–length combinations. Standard lengths over 200 mm are in increments of 20 mm.
(c) Bolts with diameter–length combinations shown above the solid stepped line are threaded full length (i.e., L_1).
(d) For bolts with lengths not shown, see para. 2.8.1.

Table 4 Thread Lengths

Nominal Bolt Diameter and Thread Pitch	Bolt Lengths, L			Transition Thread Length, X Ref.	Bolts Threaded Full Length	
	$>L_1$ ≤125	>125 ≤200	>200		Bolt Lengths to and Including, L_1	Maximum Grip Length, L_g
	Basic Thread Length, (B), (Ref.)					
M6 × 1	18	24	37	5.00	50	5.0
M8 × 1.25	22	28	41	6.25	50	5.5
M10 × 1.5	26	32	45	7.50	50	7.0
M12 × 1.75	30	36	49	8.75	50	7.5
M14 × 2	34	40	53	10.00	55	8.0
M16 × 2	38	44	57	10.00	60	9.0
M20 × 2.5	46	52	65	12.50	70	10.0

Copyright ASME International
Provided by IHS under license with ASME
No reproduction or networking permitted without license from IHS
Not for Resale

2.11.2 Source Symbols. Each bolt shall be marked to identify its source (manufacturer or private label distributor).

2.12 Surface Condition

Bolts need not be finished on any surface except the threads.

2.13 Finish

Unless otherwise specified, the finish (surface) of the bolts shall be plain.

(a) natural (as processed), in a clean condition, and lightly oiled for steel bolts

(b) cleaned or descaled, or both, and bright for bolts made of stainless steel or nonferrous metal

2.14 Workmanship

Bolts shall be free from surface imperfections such as burrs, seams, laps, loose scale, and other surface irregularities which could affect their serviceability.

When control of surface discontinuities is required, the purchaser shall specify conformance to ASTM F 788/F 788M.

2.15 Inspection and Quality Assurance

Unless otherwise specified, acceptability of round head short square neck bolts shall be determined according to ASME B18.18.1M.

2.16 Dimensional Conformance

2.16.1 Unless otherwise specified, the following designated dimensional characteristics shall be inspected to the inspection levels shown according to ASME B18.18.2M.

Characteristic	Inspection Level
Thread Acceptability	C
Body Diameter, D_s	B
Square Depth, F	C
Square Width Across Corners, E	C
Grip Length, L_g max.	B
Bolt Length, L	C
Visual Inspection [NOTE (1)]	C

NOTE:

(1) Visual inspection shall include property class marking, source marking, fillet, and workmanship.

If verifiable in-process inspection is used according to ASME B18.18.3M or ASME B18.18.4M, the final inspection level sample sizes of those respective standards shall apply.

2.16.2 For nondesignated dimensional characteristics, ASME B18.18.1M shall apply. Should a nondesignated dimensional characteristic be determined to be outside its specified limits, it shall be considered conforming to this Standard if the user who is the installer accepts the dimension based on: form, fit, and function considerations.

Copyright ASME International
Provided by IHS under license with ASME
No reproduction or networking permitted without license from IHS Not for Resale

NONMANDATORY APPENDIX A
GAGE AND GAGING FOR CHECKING BOLT STRAIGHTNESS

The conformance of bolts to shank straightness or camber limitations set forth in the bolt specifications should be checked by use of the typical gage illustrated in Fig. A-1, in accordance with the following procedure.

The allowable camber shall be calculated by applying the applicable formula to the length to be inspected, and shall be expressed as a two-place decimal. The camber thus derived shall be added to the specified maximum body diameter. The moveable rail of the gage shall be adjusted to provide a parallel space between the rails equal to this distance by obtaining common readings on both micrometer heads. The moveable rail shall then be locked in place by tightening the securing screws.

The bolt shall then be inserted between rails, excluding from the gage any permissible length of swell or fin under the head or neck. The bolt shall next be rotated by hand through a full 360 deg. Any interference occurring between the bolt and the gage, which is sufficient to prevent rotation, shall indicate excessive camber.

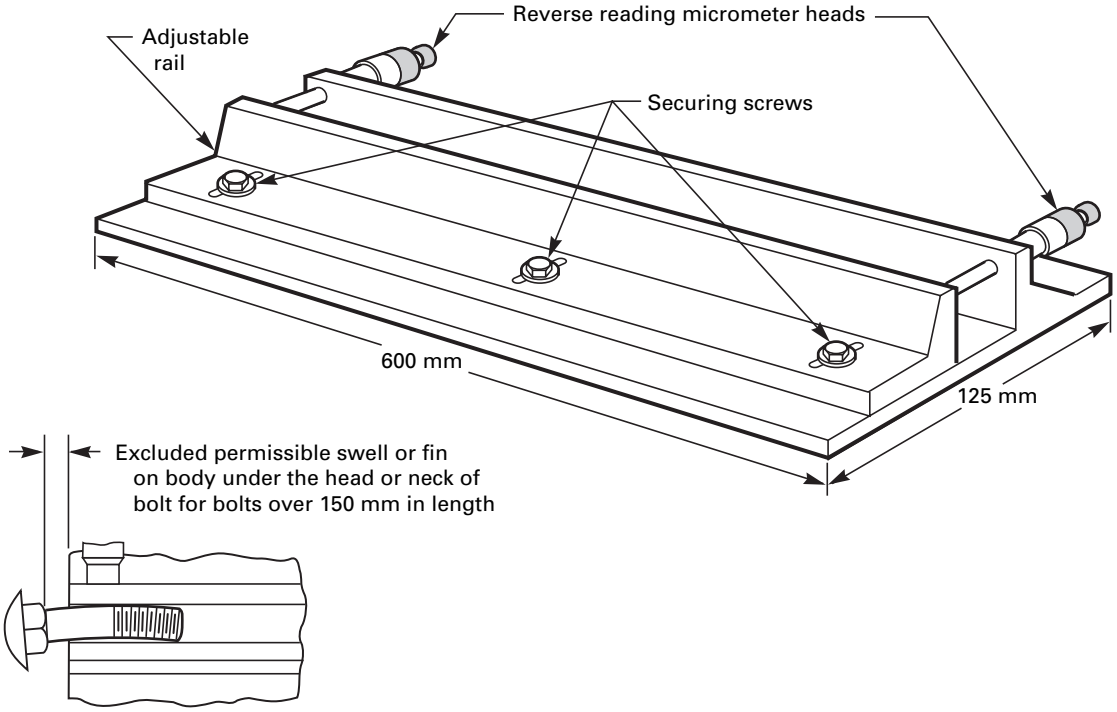


Fig. A-1 Typical Straightness Gage

Copyright ASME International
Provided by IHS under license with ASME
No reproduction or networking permitted without license from IHS
Not for Resale

NONMANDATORY APPENDIX B
RECOMMENDED CLEARANCE HOLES FOR METRIC ROUND HEAD SHORT SQUARE NECK BOLTS

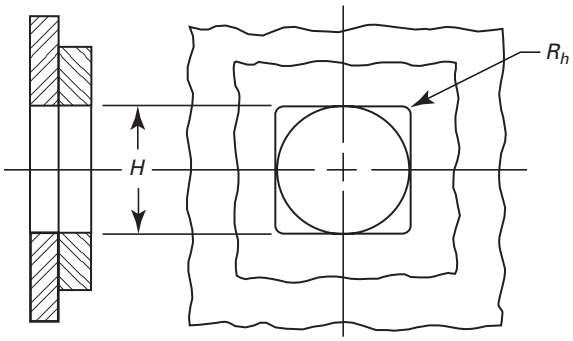


Table B-1 Clearance Hole Sizes

Nominal Bolt Diameter and Thread Pitch	Clearance Hole Diameter or Width (Square), *H*, Min.			Maximum Corner Radius, R_h
	Close Clearance [Note (1)]	Normal Clearance (Preferred) [Note (2)]	Loose Clearance [Note (3)]	
M6 × 1	...	6.6	7.0	0.3
M8 × 1.25	...	9.0	10.0	0.4
M10 × 1.5	...	11.0	12.0	0.4
M12 × 1.75	13.0	13.5	14.5	0.6
M14 × 2	15.0	15.5	16.5	0.6
M16 × 2	17.0	17.5	18.5	0.6
M20 × 2.5	21.0	22.0	24.0	0.8

GENERAL NOTE: A complete listing of clearance hole sizes is found in ASME B18.2.8.

NOTES:

(1) Close clearance hole sizes should be specified only for square holes in either very thin, or soft material, or both, for slots, or where conditions such as critical alignment of assembled parts, wall thickness, or other limitations necessitate use of a minimal hole.

(2) Normal clearance hole sizes are preferred for general purpose applications, and should be specified unless special design considerations dictate the need for either a close or loose clearance hole.

(3) Loose clearance hole sizes should be specified only for applications where maximum adjustment capability between components being assembled is necessary. Loose clearance square holes or slots may not prevent bolt turning during wrenching.

Copyright ASME International
Provided by IHS under license with ASME
No reproduction or networking permitted without license from IHS
Not for Resale

B18 AMERICAN NATIONAL STANDARDS FOR BOLTS, NUTS, RIVETS, SCREWS, WASHERS, AND SIMILAR FASTENERS

Small Solid Rivets B18.1.1-1972 (R2001)
Large Rivets B18.1.2-1972 (R2001)
Metric Small Solid Rivets B18.1.3M-1983 (R2001)
Square and Hex Bolts and Screws (Inch Series) B18.2.1-1996
Square and Hex Nuts (Inch Series) B18.2.2-1987 (R1999)
Metric Hex Cap Screws B18.2.3.1M-1999
Metric Formed Hex Screws B18.2.3.2M-2005
Metric Heavy Hex Screws B18.2.3.3M-1979 (R2001)
Metric Hex Flange Screws B18.2.3.4M-2001
Metric Hex Bolts B18.2.3.5M-1979 (R2001)
Metric Heavy Hex Bolts B18.2.3.6M-1979 (R2001)
Metric Heavy Hex Structural Bolts B18.2.3.7M-1979 (R2001)
Metric Hex Lag Screws B18.2.3.8M-1981 (R1999)
Metric Heavy Hex Flange Screws B18.2.3.9M-2001
Square Head Bolts (Metric Series) B18.2.3.10M-1996 (R2003)
Metric Hex Nuts, Style 1 . . . . . B18.2.4.1M-2002
Metric Hex Nuts, Style 2 . . . . . B18.2.4.2M-2005
Metric Slotted Hex Nuts B18.2.4.3M-1979 (R2001)
Metric Hex Flange Nuts B18.2.4.4M-1982 (R1999)
Metric Hex Jam Nuts B18.2.4.5M-1979 (R2003)
Metric Heavy Hex Nuts B18.2.4.6M-1979 (R2003)
Fasteners for Use in Structural Applications B18.2.6-2006
Metric 12-Spline Flange Screws B18.2.7.1M-2002
Clearance Holes for Bolt, Screws, and Studs B18.2.8-1999
Socket Cap, Shoulder, and Set Screws, Hex and Spline Keys (Inch Series) B18.3-2003
Socket Head Cap Screws (Metric Series) B18.3.1M-1986 (R2002)
Metric Series Hexagon Keys and Bits B18.3.2M-1979 (R2003)
Hexagon Socket Head Shoulder Screws (Metric Series) B18.3.3M-1986 (R2002)
Hexagon Socket Button Head Cap Screws (Metric Series) B18.3.4M-1986 (R2002)
Hexagon Socket Flat Countersunk Head Cap Screws (Metric Series) B18.3.5M-1986 (R2002)
Metric Series Socket Set Screws B18.3.6M-1986 (R2002)
Round Head Bolts (Inch Series) B18.5-1990 (R2003)
Metric Round Head Short Square Neck Bolts B18.5.2.1M-2006
Metric Round Head Square Neck Bolts B18.5.2.2M-1982 (R2000)
Round Head Square Neck Bolts With Large Head (Metric Series) B18.5.2.3M-1990 (R2003)
Wood Screws (Inch Series) B18.6.1-1981 (R2003)
Slotted Head Cap Screws, Square Head Set Screws, and Slotted Headless Set Screws (Inch Series) B18.6.2-1998
Machine Screws and Machine Screw Nuts B18.6.3-2003
Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws (Inch Series) B18.6.4-1998
Metric Thread-Forming and Thread-Cutting Tapping Screws B18.6.5M-2000
Metric Machine Screws B18.6.7M-1999
General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps B18.7-1972 (R2001)
Metric General Purpose Semi-Tubular Rivets B18.7.1M-1984 (R2000)
Clevis Pins and Cotter Pins (Inch Series) B18.8.1-1994 (R2000)
Taper Pins, Dowel Pins, Straight Pins, Grooved Pins, and Spring Pins (Inch Series) B18.8.2-2000
Spring Pins: Coiled Type, Spring Pins: Slotted, Machine Dowel Pins: Hardened Ground, and Grooved Pins (Metric Series) B18.8.100M-2000
Cotter Pins, Headless Clevis Pins, and Headed Clevis Pins (Metric Series) B18.8.200M-2000
Plow Bolts (Inch Series) B18.9-1996 (R2003)
Track Bolts and Nuts B18.10-1982 (R2000)
Miniature Screws B18.11-1961 (R2000)
Glossary of Terms for Mechanical Fasteners B18.12-2001
Screw and Washer Assemblies — Sems (Inch Series) B18.13-1996 (R2003)
Screw and Washer Assemblies: Sems (Metric Series) B18.13.1M-1998 (R2003)
Forged Eyebolts B18.15-1985 (R2003)
Metric Lifting Eyes B18.15M-1998 (R2004)

Copyright ASME International
Provided by IHS under license with ASME
No reproduction or networking permitted without license from IHS
Not for Resale

Prevailing-Torque Type Steel Metric Hex Nuts and Hex Flange Nuts B18.16M-2004
Inspection and Quality Assurance for General Purpose Fasteners B18.18.1M-1987 (R1999)
Inspection and Quality Assurance for High-Volume Machine Assembly Fasteners B18.18.2M-1987 (R1999)
Inspection and Quality Assurance for Special Purpose Fasteners B18.18.3M-1987 (R1999)
Inspection and Quality Assurance for Fasteners for Highly Specialized Engineered Applications B18.18.4M-1987 (R1999)
Inspection and Quality Assurance Plan Requiring In-Process Inspection and Controls. B18.18.5M-1998 (R2003)
Quality Assurance Plan for Fasteners Produced in a Third Party Accreditation System B18.18.6M-1998 (R2003)
Quality Assurance Plan for Fasteners Produced in a Customer Approved Control Plan B18.18.7M-1998 (R2003)
Lock Washers (Inch Series) B18.21.1-1999
Lock Washers (Metric Series) B18.21.2M-1999
Metric Plain Washers. B18.22M-1981 (R2000)
Plain Washers B18.22.1-1965 (R2003)
Part Identifying Number (PIN) Code System for B18 Fastener Products B18.24-2004
Square and Rectangular Keys and Keyways. B18.25.1M-1996 (R2003)
Woodruff Keys and Keyways B18.25.2M-1996 (R2003)
Square and Rectangular Keys and Keyways: Width Tolerances and
Deviations Greater Than Basic Size B18.25.3M-1998 (R2003)
Tapered and Reduced Cross Section Retaining Rings (Inch Series) B18.27-1998
Helical Coil Screw Thread Inserts — Free Running and Screw Locking (Inch Series). B18.29.1-1993 (R2002)
Helical Coil Screw Thread Inserts: Free Running and Screw Locking (Metric Series) B18.29.2M-2005
Open-End Blind Rivets With Break Mandrels (Metric Series) B18.30.1M-2000
Metric Continuous and Double-Ended Studs B18.31.1M-2005

The ASME Publications Catalog shows a complete list of all the Standards published by the Society. For a complimentary catalog, or the latest information about our publications, call 1-800-THE-ASME (1-800-843-2763).

Copyright ASME International
Provided by IHS under license with ASME
No reproduction or networking permitted without license from IHS
Not for Resale

ASME B18.5.2.1M-2006

ISBN 0-7918-3018-7





L06406

Copyright ASME International
Provided by IHS under license with ASME
No reproduction or networking permitted without license from IHS

Not for Resale