ASME B18.29.2M-2005

Helical Coil Screw Thread Inserts: Free Running and Screw Locking (Metric Series)

REAFFIRMED 2017

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

Intentionally left blank

ASME B18.29.2M-2005

Helical Coil Screw Thread Inserts: Free Running and Screw Locking (Metric Series)

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

Three Park Avenue • New York, NY 10016

Date of Issuance: February 6, 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.

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

CONTENTS

FOREWORD

The helical coil screw thread insert was invented in the 1930s and found acceptance in aircraft manufactured and serviced by the Allied air forces during World War II. Since that time, applications for helical coil inserts have come into broad usage in aerospace, automotive, and industrial original equipment design, production salvage (repair), and in service repair. Although this usage did include metric spark plug sizes, the regular metric series was delineated in Europe in the 1950s and came into production in the Customary units–using countries in the 1960s.

Subcommittee 29, Threaded Inserts, met initially in May 1989 after authorization by the ASME B18 Committee to proceed with the development of standards covering screw thread inserts. This ASME Standard for the metric series of helical coil screw thread inserts follows ASME B18.29.1-1993, Helical Coil Screw Thread Inserts — Free Running and Screw Locking (Inch Series).

ASME B18.29.2M-2005 was approved as an American National Standard on May 26, 2005.

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

SUBCOMMITTEE 29 — THREADED INSERTS

W. J. Lutkus, *Chair,* Emhart Industrial Heli-Coil
R. L. Crane, *Secretary,* The American Society of Mechanical Engineers
R. C. Caponi, Spirol International Corp.
R. L. Davis, Kato Fastening Systems, Inc.
W. Giannakakos, Emhart Industrial Heli-Coil
A. Herskovitz, Consultant
M. W. Holubecki, Electric Boat Corp.
J. Jennings, Naval Surface Warfare Center
M. Keller, Paracad Technology Co.
H. Lo, Defense Industrial Supply Center Philadelphia
L. L. Lord, *Corresponding Member,* Consultant
A. Qaqish, Kato Fastening Systems, Inc.
R. D. Strong, General Motors Corp.
C. J. Wilson, Industrial Fasteners Institute

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 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 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.

HELICAL COIL SCREW THREAD INSERTS: FREE RUNNING AND SCREW LOCKING (METRIC SERIES)

1 GENERAL

1.1 Scope

This Standard delineates the dimensional, mechanical, and performance data for the metric series helical coil screw thread insert and threaded hole into which it is installed. Appendices that describe insert selection, STI (screw thread insert) taps, insert installation, and removal tooling are also included.

The inclusion of dimensional data in this Standard is not intended to imply that all products described are stock sizes.

2 COMPARISON WITH ISO STANDARDS

At this time, no ISO Standard for metric helical coil screw threads exists. Further, no work within ISO is expected for some time.

3 REFERENCES

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

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 B1.16M, Gages and Gaging for Metric M Profile Screw Threads
ASME B1.21M, Metric Screw Threads — MJ Profile
ASME B18.12, Glossary of Terms for Mechanical Fasteners
ASME B18.18.1M, Inspection and Quality Assurance for General Purpose Fasteners
ASME B18.24, Part Identifying Number Code System Standard for B18 Fastener Products
ASME B46.1, Surface Texture (Surface Roughness, Waviness, and Lay)
ASME B47.1, Gage Blanks
ASME B94.9, Taps — Cut and Ground Threads
ASME Y14.5M, Dimensioning and Tolerancing
ASME Y14.36M, Surface Texture Symbols
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

ASTM B 209M, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate
ASTM E 290, Standard Test Method for Bend Testing of Material for Ductility
ASTM A 370, Standard Test Methods and Definitions for Mechanical Testing
ASTM F 568M, Carbon and Alloy Steel Externally Threaded Metric Fasteners
Publisher: The American Society for Testing and Materials (ASTM), 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959

SAE AMS 4120, Aluminum Alloy, Rolled or Cold Finished Bars, Rods, and Wire
SAE AS5272, Lubricant, Solid Dry Film, Heat Cured, Corrosion Inhibiting
SAE J417, Hardness Tests and Hardness Number Conversions
Publisher: Society of Automotive Engineers (SAE), 400 Commonwealth Drive, Warrendale, PA 15096-0001

4 TERMINOLOGY

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

5 DIMENSIONS

(a) Unless otherwise stated, all dimensions in this Standard are in millimeters and apply before any coating. When plating or coating is specified, the finished product dimensions shall be as agreed upon by the supplier and purchaser.

(b) Symbols specifying geometric characteristics are in accordance with ASME Y14.5M.

6 DESCRIPTION

Helical coil inserts are screw thread bushings coiled from wire of diamond-shape cross-section. Inserts are screwed into STI-tapped holes to form nominal size internal threads. Inserts are installed by torquing through a diametral tang. This tang is notched for removal after installation. In the free state, they are larger in diameter than the tapped hole into which they are

installed. In the assembly operation, the torque applied to the tang reduces the diameter of the leading coil and permits it to enter the tapped thread. The remaining coils are reduced in diameter as they, in turn, are screwed into the tapped hole. When the torque or rotation is stopped, the coils expand with a spring-like action anchoring the insert in place against the tapped hole.

7 CLASS OF FIT

7.1 Tolerance Classes 4H5H and 5H

Since helical coil inserts are flexible, the class of fit of the final assembly is a function of the size of the tapped hole. Helical coil STI taps are available for both Tolerance Class 4H5H– (or Class 4H6H–) and Class 5H–tapped holes. Tolerance Class 5H–tapped holes provide maximum production tolerances but result in lower locking torques when screw-locking inserts are used. The higher and more consistent torques given in Table 5 are met by the screw-locking inserts when assembled and tested in Tolerance Class 4H5H– (or Class 4H6H–) tapped holes in accordance with para. 9.

7.2 Compatibility

Assembled helical coil inserts will mate properly with items that have M Profile external threads in accordance with ASME B1.13M. Also, due to the radius on the crest of the insert at the minor diameter, the assembled insert will mate with MJ Profile externally threaded parts with controlled radius root threads per ASME B1.21M.

8 TYPES OF INSERTS

8.1 Free-Running

The free-running insert provides a smooth, hard, and free-running thread.

8.2 Screw-Locking

The screw-locking insert provides a resilient locking thread produced by a series of chords on one or more of the insert coils.

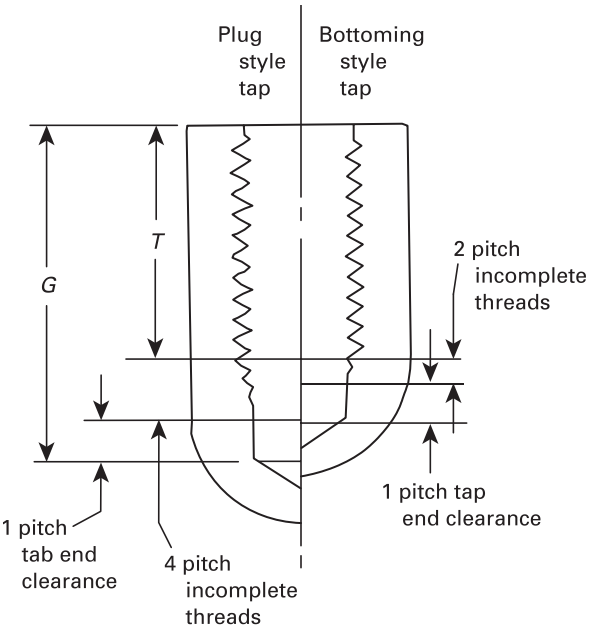
9 STI-TAPPED HOLE

The tapped hole into which the insert is installed shall be in accordance with ASME B1.13M, except that diameters are larger to accommodate the wire cross-section of the insert (see Fig. 1). Dimensions of the STI-tapped hole are shown in Table 1 and are calculated per General Note (c) to Table 1.

9.1 Screw Thread Designation

9.1.1 Designation for Tapped Hole. The drawing note for the STI-threaded hole per Table 1 to accept the helical coil insert shall be in accordance with the following example:

EXAMPLE: M8 × 1.25-5H STI; 23.5 *T* per ASME B18.29.2M.



GENERAL NOTE: See Table 1 and accompanying notes.

Fig. 1 Tapping Depths

9.1.2 Designation for a Helical Coil Insert

(a) Helical coil inserts shall be designated by the following data, in the sequence shown:

(1) product name
(2) designation of the standard
(3) nominal diameter and thread pitch
(4) nominal length
(5) insert type (free-running or screw-locking)

EXAMPLES:

Helical Coil insert, ASME B18.29.2M, M8 × 1.25 × 12.0 free-running.

Helical Coil insert, ASME B18.29.2M, M5 × 0.8 × 7.5 screw-locking.

(b) The recommended B18 part number (PIN) code system for helical coil inserts is included in ASME B18.24. This system may be used by any user needing a definitive part-numbering system.

9.1.3 Designation for STI-Threaded Hole Including Installed Helical Coil Insert. The drawing note for the STI-threaded hole per Table 1 having a helical coil insert installed shall be in accordance with this example.

EXAMPLE:

M8 × 1.25 STI 23.5 deep;

Helical Coil insert, ASME B18.29.2M, M8 × 1.25 × 12.0, free-running

9.2 Gages and Gaging

Acceptance of the threaded hole is determined by gaging with STI GO, NOT GO (HI), and plain cylindrical gages designed and applied in accordance with System 21 of ASME B1.3M and with ASME B1.16M.

Table 1 STI-Threaded Hole Data

Nominal Thread Size	Minimum Drilling Depth for Each Insert Length, *G*										Countersink Diameter, *M* (120 deg ± 5 deg Included Angle)		Minor Diameter		Pitch Diameter				Min. Major Diam.	Minimum Tapping Depth, *T*				
	Plug Taps					Bottoming Taps										4H	5H	6H	All	Insert Length				
	1*D*	1.5*D*	2*D*	2.5*D*	3*D*	1*D*	1.5*D*	2*D*	2.5*D*	3*D*	Min.	Max.	Min.	Max.	Min.	Max.	Max.	Max.	Classes	1*D*	1.5*D*	2*D*	2.5*D*	3*D*
M2 × 0.4	5.40	6.40	7.40	8.40	9.40	3.60	4.60	5.60	6.60	7.60	2.30	2.70	2.087	2.199	2.260	2.295	2.310	2.329	2.520	2.40	3.40	4.40	5.40	6.40
M2.5 × 0.45	6.45	7.70	8.95	10.20	11.45	4.30	5.55	6.80	8.05	9.30	2.90	3.40	2.597	2.722	2.792	2.832	2.847	2.867	3.084	2.95	4.20	5.45	6.70	7.95
M3 × 0.5	7.50	9.00	10.50	12.00	13.50	5.00	5.00	8.00	9.50	11.00	3.40	4.00	3.108	3.248	3.326	3.367	3.384	3.404	3.650	3.50	5.00	6.50	8.00	9.50
M3.5 × 0.6	8.86	10.60	12.35	14.10	15.85	5.90	7.65	9.40	11.15	12.90	4.10	4.70	3.630	3.790	3.890	3.940	3.959	3.981	4.280	4.10	5.85	7.60	9.35	11.10
M4 × 0.7	10.20	12.20	14.20	16.20	18.20	6.80	8.80	10.80	12.80	14.80	4.70	5.30	4.162	4.332	4.455	4.508	4.529	4.522	4.910	4.70	6.70	8.70	10.70	12.70
M5 × 0.8	12.30	14.80	17.30	19.80	22.30	8.20	10.70	13.20	15.70	18.20	5.80	6.40	5.174	5.374	5.520	5.577	5.597	5.622	6.040	5.80	8.30	10.80	13.30	15.80
M6 × 1	15.00	18.00	21.00	24.00	27.00	10.00	13.00	16.00	19.00	22.00	7.10	7.70	6.217	6.407	6.650	6.719	6.742	6.774	7.300	7.00	10.00	13.00	16.00	19.00
M7 × 1	16.50	20.00	23.50	27.00	30.50	11.00	14.50	18.00	21.50	25.00	8.10	8.70	7.217	7.407	7.650	7.719	7.742	7.774	8.300	8.00	11.50	15.00	18.50	22.00
M8 × 1	18.00	22.00	26.00	30.00	34.00	12.00	16.00	28.00	20.00	24.00	0.10	9.70	8.217	8.407	8.650	8.719	8.742	8.774	9.300	9.00	13.00	17.00	21.00	25.00
M8 × 1.25	19.50	23.60	27.50	31.50	35.50	13.00	17.00	29.00	21.00	25.00	9.50	10.10	8.271	8.483	8.812	8.886	8.911	8.946	9.624	9.26	13.25	17.26	21.25	25.25
M10 × 1	16.00	21.00	26.00	31.00	36.00	14.00	19.00	34.00	24.00	29.00	11.10	11.70	10.217	10.407	10.650	10.719	10.742	10.774	11.300	11.00	16.00	21.00	26.00	31.00
M10 × 1.25	17.50	22.60	27.50	32.50	37.50	15.00	20.00	35.00	25.00	30.00	11.50	12.10	10.271	10.483	10.812	10.886	10.911	10.946	11.624	11.26	16.25	21.26	26.25	31.25
M10 × 1.5	19.00	24.00	29.00	34.00	39.00	16.00	21.00	38.00	26.00	31.00	11.80	12.40	10.324	10.580	10.974	11.061	11.089	11.129	11.948	11.50	16.50	21.50	26.50	31.50
M12 × 1.25	19.50	25.50	31.50	37.50	43.50	17.00	23.00	29.00	35.00	41.00	13.50	14.10	12.271	12.483	12.812	12.896	12.926	12.966	13.624	13.25	19.25	25.25	31.25	37.25
M12 × 1.5	21.00	27.00	33.00	39.00	45.00	18.00	24.00	30.00	36.00	42.00	13.00	14.40	12.324	12.560	12.974	13.067	13.099	13.139	13.948	13.50	19.50	25.50	31.50	37.60
M12 × 1.75	22.50	28.50	34.50	40.50	48.50	19.00	25.00	31.00	37.00	43.00	14.20	14.80	12.379	12.644	13.137	13.236	13.271	13.311	14.274	13.75	19.75	25.75	31.75	37.75
M14 × 1.5	23.00	30.00	37.00	44.00	51.00	20.00	27.00	34.00	41.00	48.00	15.80	16.40	14.324	14.560	14.974	15.067	15.099	15.139	15.940	15.50	22.50	29.50	38.50	43.50
M14 × 2	26.00	33.00	40.00	47.00	54.00	22.00	29.00	36.00	43.00	50.00	16.50	17.10	14.433	14.733	15.299	15.406	15.444	15.486	16.958	16.00	23.00	30.00	37.00	44.00
M16 × 1.5	25.00	33.00	41.00	49.00	57.00	22.00	30.00	38.00	46.00	50.00	17.80	18.40	16.324	16.560	16.974	17.067	17.099	17.139	17.948	17.50	25.50	33.50	41.50	49.50
M16 × 2	28.00	36.00	44.00	52.00	60.00	24.00	32.00	40.00	48.00	56.00	18.50	19.10	16.433	16.733	17.299	17.406	17.444	17.486	18.598	18.00	26.00	34.00	42.00	50.00
M18 × 1.5	27.00	36.00	45.00	54.00	63.00	24.00	33.00	42.00	51.00	60.00	19.80	20.40	18.324	18.560	18.974	19.067	19.099	19.139	19.948	19.50	28.50	37.50	46.50	55.50
M18 × 2	30.00	39.00	48.00	57.00	66.00	26.00	35.00	44.00	53.00	62.00	20.50	21.10	18.433	18.733	19.299	19.406	19.444	19.486	20.598	20.00	29.00	38.00	47.00	56.00
M18 × 2.5	33.00	42.00	51.00	60.00	69.00	28.00	37.00	46.00	55.00	64.00	21.20	21.80	18.541	18.896	19.624	19.738	19.778	19.822	21.248	20.50	29.50	38.50	47.50	56.50
M20 × 1.5	29.00	39.00	49.00	59.00	69.00	26.00	36.00	46.00	56.00	66.00	21.80	22.40	20.324	20.560	20.974	21.067	21.099	21.139	21.940	21.50	31.50	41.50	51.50	61.50
M20 × 2	32.00	42.00	52.00	62.00	72.00	28.00	38.00	48.00	58.00	68.00	22.50	23.10	20.433	20.733	21.299	21.406	21.444	21.486	22.598	22.00	32.00	42.00	52.00	62.00
M20 × 2.5	35.00	45.00	55.00	65.00	75.00	30.00	40.00	50.00	60.00	70.00	23.20	23.80	20.541	20.896	21.624	21.738	21.778	21.822	23.248	22.50	32.50	42.50	52.50	62.50
M22 × 1.5	31.00	42.00	53.00	64.00	75.00	28.00	39.00	50.00	61.00	72.00	23.80	24.40	22.324	22.560	22.974	23.067	23.099	23.139	23.948	23.50	34.50	45.50	56.50	67.50
M22 × 2	34.00	45.00	56.00	67.00	78.00	30.00	41.00	52.00	63.00	74.00	24.50	25.10	22.433	22.733	23.299	23.406	23.444	23.486	24.598	24.00	35.00	46.00	57.00	68.00
M22 × 2.5	37.00	48.00	59.00	70.00	81.00	32.00	43.00	54.00	65.00	76.00	25.20	25.80	22.541	22.896	23.624	23.738	23.778	23.822	25.248	24.50	35.50	46.50	57.50	68.50
M24 × 2	38.00	48.00	60.00	72.00	84.00	32.00	44.00	56.00	68.00	80.00	26.50	27.10	24.433	24.733	25.299	25.414	15.454	25.498	26.598	26.00	38.00	50.00	62.00	74.00
M24 × 3	42.00	54.00	66.00	78.00	90.00	36.00	48.00	60.00	72.00	84.00	27.90	28.50	24.649	25.049	25.948	26.093	26.135	26.188	27.897	27.00	39.00	51.00	63.00	75.00
M27 × 2	39.00	52.50	66.00	79.50	93.00	35.00	48.50	62.00	75.50	89.00	29.50	30.10	27.433	27.733	28.299	28.414	28.454	28.498	29.598	29.00	42.50	58.00	69.50	83.00
M27 × 3	45.00	68.50	72.00	85.50	99.00	39.00	52.50	66.00	79.50	93.00	30.90	31.50	27.649	28.049	28.948	29.093	29.135	29.188	30.897	30.00	43.50	57.00	70.50	84.00
M30 × 2	42.00	67.00	72.00	87.00	102.00	38.00	53.00	68.00	83.00	98.00	32.50	33.10	30.433	30.733	31.299	31.414	31.454	31.489	32.598	32.00	47.00	62.00	77.00	92.00
M30 × 3	48.00	63.00	78.00	93.00	108.00	42.00	57.00	72.00	87.00	102.00	33.90	34.50	30.649	31.049	31.948	32.093	32.136	32.188	33.897	33.00	48.00	63.00	78.00	93.00

Table 1 STI-Threaded Hole Data (Cont'd)

Nominal Thread Size	Minimum Drilling Depth for Each Insert Length, *G*										Countersink Diameter, *M* (120 deg ± 5 deg Included Angle)		Minor Diameter		Pitch Diameter				Min. Major Diam.	Minimum Tapping Depth, *T*				
	Plug Taps					Bottoming Taps										4H	5H	6H	All	Insert Length				
	1D	*1.5D*	*2D*	*2.5D*	*3D*	*1D*	*1.5D*	*2D*	*2.5D*	*3D*	Min.	Max.	Min.	Max.	Min.	Max.	Max.	Max.	Classes	*1D*	*1.5D*	*2D*	*2.5D*	*3D*
M30 × 3.5	51.00	66.00	81.00	96.00	111.00	44.00	59.00	74.00	89.00	104.00	34.60	35.20	30.767	31.207	32.273	32.428	32.472	32.628	34.546	33.50	48.50	63.50	78.50	93.50
M33 × 2	45.00	61.60	78.00	94.50	111.00	41.00	57.50	74.00	90.50	107.00	35.50	36.10	33.433	33.733	34.299	34.414	34.454	34.498	35.598	35.00	51.50	68.00	84.50	101.00
M33 × 3	51.00	67.60	84.00	104.50	117.00	45.00	61.50	78.00	94.50	111.00	36.90	37.50	33.649	34.049	34.948	35.093	35.135	36.188	36.897	36.00	52.50	69.00	85.50	102.00
M36 × 2	48.00	66.00	84.00	102.00	120.00	44.00	62.00	80.00	98.00	116.00	38.50	39.10	36.433	36.733	37.299	37.414	37.464	37.498	38.598	38.00	58.00	74.00	92.00	110.00
M36 × 3	54.00	72.00	90.00	108.00	126.00	48.00	66.00	84.00	102.00	120.00	39.90	40.50	36.649	37.049	37.948	38.093	38.135	38.188	39.897	39.00	57.00	75.00	93.00	111.00
M36 × 4	60.00	78.00	96.00	114.00	132.00	52.00	70.00	88.00	106.00	124.00	41.30	41.90	36.866	37.341	28.598	38.763	38.809	38.873	41.196	40.00	58.00	76.00	94.00	112.00
M39 × 2	51.00	70.50	90.00	109.50	129.00	47.00	66.50	88.00	105.50	125.00	41.50	42.10	39.433	39.733	40.299	40.414	40.454	40.498	41.598	41.00	60.50	80.00	99.50	119.00
M39 × 3	57.00	76.50	96.00	115.50	135.00	51.00	70.50	90.00	109.50	129.00	42.90	43.50	39.649	40.049	40.948	41.093	41.136	41.188	42.897	42.00	61.50	81.00	100.50	120.00

NOTES:

(1) The minimum drilling depths allow for
- *(a)* countersinking the drilled hole to prevent a feather edge at the start of the tapped hole.
- *(b)* 0.75 to 1.5 pitch of insert set-down to allow for maximum production tolerance.
- *(c)* Dimensions are shown for both plug and bottoming taps. Plug taps 8 mm and smaller have a male center, and the drilled hole depth dimensions allow for this length (one-half of the diameter of the bolt). Calculation of dimension *G* is as follows:

For plug taps 8 mm and smaller

G = insert nominal length + 0.5 x bolt nominal diameter + 4 pitch (tap chamfer) + 1 pitch (tap end clearance) + 1 pitch (allowance for countersink and maximum insert set-down).

For plug taps larger than 8 mm

G = insert nominal length + 4 pitch (tap chamfer) + 1 pitch (tap end clearance) + 1 pitch (allowance for countersink and maximum insert set-down).

For bottoming taps

G = insert nominal length + 2 pitch (tap chamfer) + 1 pitch (tap end clearance) + 1 pitch (allowance for countersink and maximum insert set-down).

(2) The minimum tapping depth (dimension *T*) is the minimum for countersink holes with insert set-down of 1.5 pitch maximum (see Fig. 1). The calculation for dimension *T* is

T = insert nominal length + 1 pitch

(3) Thread diameters are calculated as follows:

Pitch diam., min. = pitch diam., min., of nominal thread + 2 x H max.
Pitch diam., max. = pitch diam., max., of nominal thread + 2 x H min.

where H min. and H max. are from Table 1.

Major diam., min. = pitch diam., min. + 0.649519 pitch
Minor diam., min. = pitch diam., min. − 0.433013 pitch
Minor diam., max. = minor diam., min. + tolerance

where tolerance is selected from the appropriate table in ASME B1.13M with basic major diameter equal to the minimum major diameter of the STI thread.

Table 2 Chemical Composition

Element	Analysis, %	Check Analysis	
		Under, Min.	Over, Max.
Carbon	0.15 max.	...	0.01
Manganese	2.00 max.	...	0.04
Silicon	1.00 max.	...	0.05
Phosphorous	0.045 max.	...	0.01
Sulphur	0.035 max.	...	0.005
Chromium	17.00 to 20.00	0.20	0.20
Nickel	8.00 to 10.50	0.15	0.15
Molybdenum	0.75 max.	...	0.05
Copper	0.75 max.	...	0.05
Iron	Remainder	...	...

10 HELICAL COIL INSERT

10.1 Material

Chemical composition of the inserts is austenitic corrosion-resistant (stainless) steel within the limits of Table 2.

10.2 Properties

10.2.1 Tensile Strength. Wire, before coiling into inserts, shall have tensile strength not lower than 1035 MPa, determined in accordance with ASTM A 370.

10.2.2 Bending. Wire shall withstand, without cracking, bending in accordance with ASTM E 290 at room temperature through an angle of 180 deg around a diameter equal to twice the cross-sectional dimension of the wire in the plane of the bend.

10.2.3 Workmanship. The formed wire shall be of uniform quality and temper; it shall be smooth, clean, and free from kinks, waviness, splits, cracks, laps, seams, scale, segregation, and other defects that may impair the serviceability of the insert.

10.3 Coatings

10.3.1 Dry Film Lubricant Coating. At the option of the user, dry film lubricant coating can be applied to helical coil inserts. The coating shall meet the requirements of paras. 10.3.1.1 and 10.3.1.2. The color of dry film–lubricated inserts is dark gray to black.

10.3.1.1 Material. The lubricant shall meet the requirements of Aerospace Standard SAE AS5272, Type I, Lubricant, Solid Film Heat Cured, and Corrosion Inhibiting.

10.3.1.2 Thickness. The coating shall be uniformly deposited on the insert with the minimum thickness being complete coverage. The maximum thickness shall be the avoidance of bridging between coils. Slight fill-in between closely wound coils, which immediately separates as the coils are axially pulled apart by hand, shall not be considered bridging.

10.4 Configuration and Dimensions

Insert configurations shall be in accordance with Fig. 2, and dimensions shall be in accordance with Tables 3 and 4.

10.4.1 Nominal Length. Each nominal insert size is standardized in five lengths, which are multiples of the insert's nominal diameter. These are 1, 1.5, 2, 2.5, and 3 times nominal diameter.

Each nominal length is the minimum through-hole length (material thickness), without countersink, into which that insert can be installed. The nominal insert length is a reference value and cannot be measured.

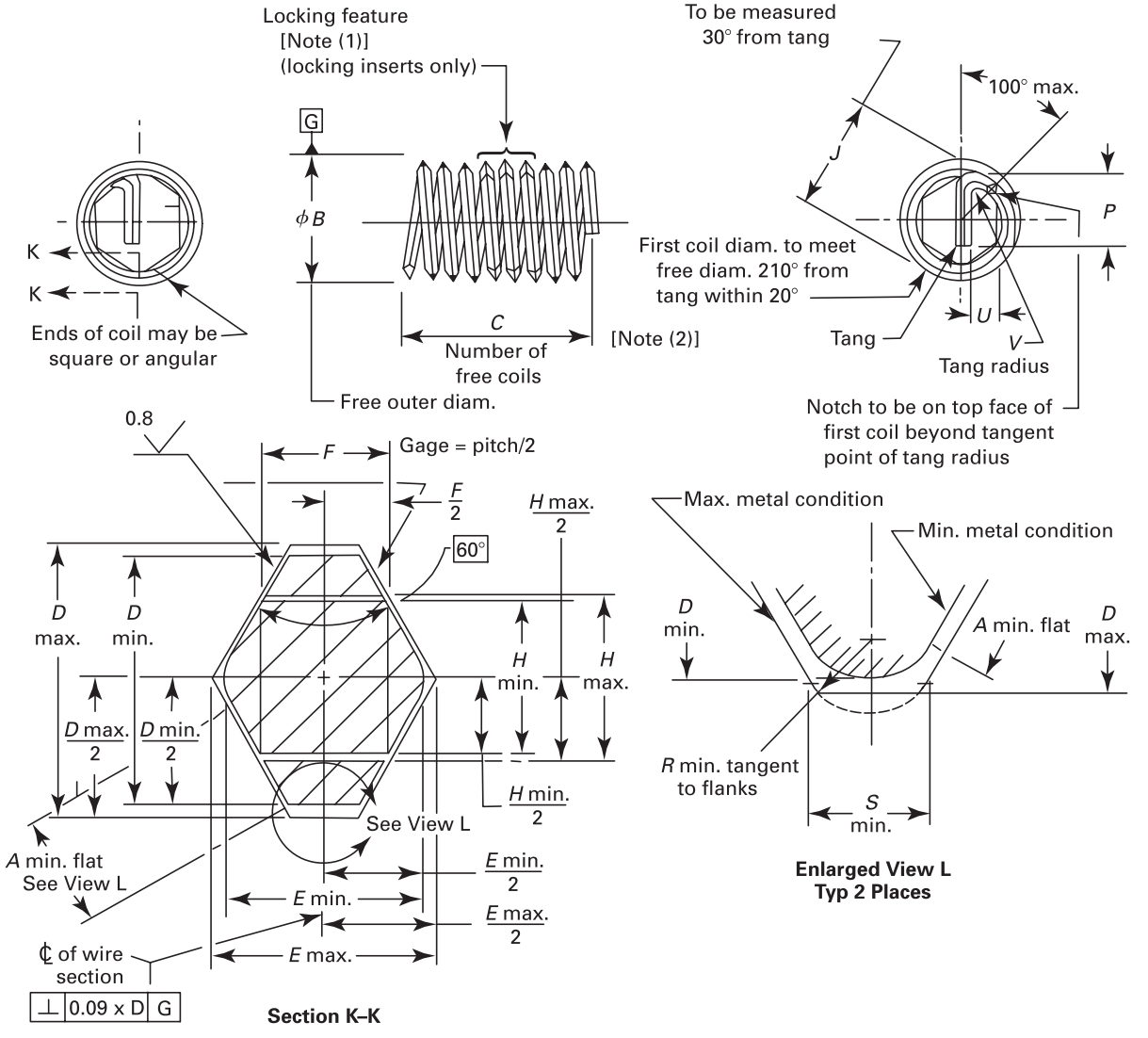
10.4.2 Assembled Length. Actual assembled length of the insert equals nominal length minus 0.5 pitch to minus 0.75 pitch, with insert installed in a basic STI-threaded hole. It cannot be measured in the insert's free state.

11 INSPECTION AND QUALITY ASSURANCE

Unless otherwise specified by the purchaser, the inspection of inserts shall be in accordance with ASME B18.18.1M, with inspection level 3 for the 15-cycle torque test described in para. 11.2.3.

11.1 Inspection (Nondestructive)

11.1.1 Examination of the Product. Inserts shall be visually examined for conformance with drawings and workmanship requirements in accordance with ASME B18.18.1M.



GENERAL NOTES:

(a) Assembled length of insert to be measured from notch.

(b) Dimensions apply before supplementary coating (see Tables 3 and 4).

(c) Surface texture; symbols per ASME Y14.35, requirements per ASME B46.1.

(d) Dimensions and tolerancing; ASME Y14.5M.

NOTES:

(1) Number of locking coils, spacing of locking coils, number of locking deformations, shape and orientation optional locking feature for 1, 1.5, and 2 diam. length inserts symmetrically positioned about the center of insert, and for 2.5 and 3 diam. length inserts at 1 diam. from tang end of insert.

(2) Number of free coils to be counted from notch.

Fig. 2 Insert Configuration

Table 3 Insert Length Data

Norminal Thread Size	1 × Diam.				1 ½ × Diam.				2 × Diam.				2 ½ × Diam.				3 × Diam.			
	Nom-	Assembled		*C*	Nom-	Assembled		*C*	Nom-	Assembled		*C*	Nom-	Assembled		*C*	Nom-	Assembled		*C*
	inal	Max.	Min.	(Ref.)	inal	Max.	Min.	(Ref.)	inal	Max.	Min.	(Ref.)	inal	Max.	Min.	(Ref.)	inal	Max.	Min.	(Ref.)
M2 × 0.4	2.00	1.80	1.70	3.250	3.00	2.80	2.70	5.500	4.00	3.80	3.70	7.750	5.00	4.80	4.70	10.125	6.00	5.80	5.70	12.375
M2.5 × 0.45	2.50	2.28	2.16	3.575	3.80	3.52	3.41	5.750	5.00	4.78	4.66	8.125	6.30	6.02	5.91	10.500	7.50	7.28	7.16	12.750
M3 × 0.5	3.00	2.75	2.62	3.750	4.50	4.25	4.12	6.375	6.00	5.75	5.62	8.875	7.50	7.25	7.12	11.375	9.00	8.75	8.62	13.875
M3.5 × 0.6	3.50	3.20	3.05	3.750	5.30	5.00	4.80	6.375	7.00	6.70	6.55	8.750	8.80	8.50	8.30	11.375	10.50	10.20	10.05	13.750
M4 × 0.7	4.00	3.65	3.47	3.625	6.00	5.65	5.47	6.125	8.00	7.65	7.47	8.625	10.00	9.65	9.47	11.125	12.00	11.65	11.47	13.625
M5 × 0.8	5.00	4.60	4.40	4.125	7.50	7.10	6.90	6.875	10.00	9.60	9.40	9.625	12.50	12.10	11.90	12.375	15.00	14.60	14.40	15.125
M6 × 1	6.00	5.50	5.25	4.000	9.00	8.50	8.25	6.750	12.00	11.50	11.25	9.500	15.00	14.50	14.25	12.125	18.00	17.50	17.25	14.875
M7 × 1	7.00	6.50	6.25	4.875	10.50	10.00	9.75	8.000	14.00	13.50	13.25	11.125	17.50	17.00	16.75	14.125	21.00	20.50	20.25	17.250
M8 × 1	8.00	7.50	7.25	5.875	12.00	11.50	11.25	9.375	16.00	15.50	15.25	13.000	20.00	19.50	19.25	16.500	24.00	23.50	23.25	20.125
M8 × 1.25	8.00	7.38	7.06	4.500	12.00	11.38	11.06	7.375	16.00	15.38	15.06	10.250	20.00	19.38	19.06	13.250	24.00	23.38	23.06	16.125
M10 × 1	10.00	9.50	9.25	7.625	15.00	14.50	14.25	12.000	20.00	19.50	19.25	16.500	25.00	24.50	24.25	21.000	30.00	29.50	29.25	25.500
M10 × 1.25	10.00	9.38	9.06	5.875	15.00	14.38	14.06	9.500	20.00	19.38	19.06	13.125	25.00	24.38	24.06	16.750	30.00	29.38	29.06	20.375
M10 × 1.5	10.00	9.25	8.87	4.875	15.00	14.25	13.87	8.000	20.00	19.25	18.87	11.125	25.00	24.25	23.87	14.250	30.00	29.25	28.87	17.375
M12 × 1.25	12.00	11.38	11.06	7.250	18.00	17.38	17.06	11.625	24.00	23.38	23.06	15.875	30.00	29.38	29.06	20.250	36.00	35.38	35.06	24.500
M12 × 1.5	12.00	11.25	10.87	6.000	18.00	17.25	16.87	9.625	24.00	23.25	22.87	13.375	30.00	29.25	28.87	17.000	36.00	35.25	34.87	20.750
M12 × 1.75	12.00	11.12	10.68	5.000	18.00	17.12	16.68	8.250	24.00	23.12	22.68	11.500	30.00	29.12	28.68	14.625	36.00	35.12	34.68	17.875
M14 × 1.5	14.00	13.25	12.87	7.125	21.00	20.25	19.87	11.375	28.00	27.25	26.87	15.625	35.00	4.25	33.87	20.000	42.00	41.25	40.87	24.250
M14 × 2	14.00	13.00	12.50	5.125	21.00	20.00	19.50	8.500	28.00	27.00	26.50	11.750	35.00	34.00	33.50	15.000	42.00	41.00	40.50	18.375
M16 × 1.5	16.00	15.25	14.87	8.250	24.00	23.25	22.87	13.125	32.00	31.25	30.87	18.000	40.00	39.25	38.87	22.750	48.00	47.25	46.87	27.625
M16 × 2	16.00	15.00	14.50	6.125	24.00	23.00	22.50	9.750	32.00	31.00	30.50	13.500	40.00	39.00	38.50	17.250	48.00	47.00	46.50	21.000
M18 × 1.5	18.00	17.25	16.87	9.500	27.00	26.25	25.87	15.000	36.00	35.25	34.87	20.375	45.00	44.25	43.87	25.875	54.00	53.25	52.87	31.375
M18 × 2	18.00	17.00	16.50	7.000	27.00	26.00	25.50	11.125	36.00	35.00	34.50	15.375	45.00	44.00	43.50	19.500	54.00	53.00	52.50	23.625
M18 × 2.5	18.00	16.75	16.12	5.375	27.00	25.75	25.12	8.875	36.00	34.75	34.12	12.250	45.00	43.75	43.12	15.625	54.00	52.75	52.12	19.000
M20 × 1.5	20.00	19.25	18.87	10.750	30.00	29.25	28.87	16.875	40.00	39.25	38.87	22.875	50.00	49.25	48.87	28.875	60.00	59.25	58.87	35.000
M20 × 2	20.00	19.00	18.50	7.875	30.00	29.00	28.50	12.500	40.00	39.00	38.50	17.250	50.00	49.00	48.50	21.875	60.00	59.00	58.50	26.500
M20 × 2.5	20.00	18.75	18.12	6.125	30.00	28.75	28.12	9.875	40.00	38.75	38.12	13.625	50.00	48.75	48.12	17.375	60.00	58.75	58.12	21.125
M22 × 1.5	22.00	21.25	20.87	11.875	33.00	32.25	31.87	18.500	44.00	43.25	42.87	25.125	55.00	54.25	53.87	31.625	66.00	65.25	64.87	38.250
M22 × 2	22.00	21.00	20.50	8.750	33.00	32.00	31.50	13.750	44.00	43.00	42.50	18.875	55.00	54.00	53.50	23.875	66.00	65.00	64.50	29.000
M22 × 2.5	22.00	20.75	20.12	6.750	33.00	31.75	31.12	10.875	44.00	42.75	42.12	14.875	55.00	53.75	53.12	19.000	66.00	64.75	64.12	23.125
M24 × 2	24.00	23.00	22.50	9.500	36.00	35.00	34.50	15.000	48.00	47.00	16.50	20.375	60.00	59.00	58.50	25.875	72.00	71.00	70.50	31.250
M24 × 3	24.00	22.50	21.75	6.125	36.00	34.50	33.75	10.000	48.00	46.50	45.75	13.750	60.00	58.50	57.75	17.500	72.00	70.50	69.75	21.375

Table 3 Insert Length Data (Cont'd)

Norminal Thread Size	1 × Diam.				1 ½ × Diam.				2 × Diam.				2 ½ × Diam.				3 × Diam.			
	Nominal	Assembled		C (Ref.)	Nominal	Assembled		C (Ref.)	Nominal	Assembled		C (Ref.)	Nominal	Assembled		C (Ref.)	Nominal	Assembled		C (Ref.)
		Max.	Min.			Max.	Min.			Max.	Min.			Max.	Min.			Max.	Min.	
M27 × 2	27.00	26.00	25.50	10.875	40.50	39.50	39.00	17.000	54.00	53.00	52.50	23.250	67.50	66.50	66.00	29.375	81.00	80.00	79.50	35.500
M27 × 3	27.00	25.50	24.75	7.000	40.50	39.00	38.25	11.250	54.00	52.50	51.75	15.500	67.50	66.50	65.25	19.750	81.00	79.50	78.75	24.000
M30 × 2	30.00	29.00	28.50	12.250	45.00	44.00	43.50	19.125	60.00	59.00	58.50	25.875	75.00	74.00	73.50	32.750	90.00	89.00	88.50	39.500
M30 × 3	30.00	28.50	27.75	7.875	45.00	43.50	42.75	12.500	60.00	58.50	57.75	17.125	75.00	73.50	72.75	21.875	90.00	88.50	87.75	26.500
M30 × 3.5	30.00	28.25	27.37	6.750	45.00	43.25	42.37	10.750	60.00	58.25	57.37	14.875	75.00	73.25	72.37	18.875	90.00	88.25	87.37	23.000
M33 × 2	33.00	32.00	31.50	13.625	49.50	48.50	48.00	21.125	66.00	65.00	64.50	28.625	82.50	81.50	81.00	35.000	99.00	98.00	97.50	43.500
M33 × 3	33.00	32.50	30.75	8.750	49.50	48.00	47.25	13.875	66.00	64.50	63.75	19.000	82.50	81.00	80.25	24.125	99.00	97.50	96.75	29.250
M36 × 2	36.00	35.00	34.50	15.000	54.00	53.00	52.50	23.250	72.00	71.00	70.50	31.375	90.00	89.00	88.50	39.500	108.00	107.00	106.50	47.750
M36 × 3	36.00	34.50	33.75	9.750	54.00	52.50	51.75	15.250	72.00	70.50	69.75	20.875	90.00	88.50	87.75	26.500	108.00	106.50	105.75	32.000
M36 × 4	36.00	34.00	33.00	7.125	54.00	52.00	51.00	11.375	72.00	70.00	69.00	15.625	90.00	88.00	87.00	19.875	108.00	106.00	105.00	24.250
M39 × 2	39.00	38.00	37.50	16.375	58.50	57.50	57.00	25.250	78.00	77.00	76.50	34.125	97.50	96.50	96.00	43.000	117.00	116.00	115.50	51.875
M39 × 3	39.00	37.50	36.75	10.750	58.50	57.00	56.25	15.750	78.00	76.50	75.75	22.750	97.50	96.00	95.25	28.875	117.00	115.50	114.75	34.875

Table 4 Insert Dimensions

Nominal Thread Size	*A*, Min.	*B*		*D*		*E*		Gage, *F*	*H*		*J*		*P*		*R*, Min.	*S*, Min.	*U*		*V*, Max.
		Min.	Max.	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.	Min.	Max.			Min.	Max.	
M2 × 0.4	0.074	2.50	2.70	0.389	0.433	0.274	0.350	0.200	0.2495	0.2600	2.50	2.70	1.30	1.90	0.072	0.125	0.66	0.37	0.22
M2.5 × 0.45	0.082	3.20	3.70	0.437	0.487	0.318	0.394	0.225	0.2820	0.2920	3.05	3.65	1.60	2.25	0.081	0.141	1.22	0.81	0.30
M3 × 0.5	0.105	3.80	4.35	0.482	0.541	0.352	0.438	0.250	0.3145	0.3250	3.60	4.30	1.95	2.80	0.090	0.156	1.33	0.56	0.30
M3.5 × 0.6	1.160	4.40	4.95	0.586	0.650	0.449	0.525	0.300	0.3795	0.3900	4.25	4.90	2.20	3.00	0.108	0.158	1.47	0.92	0.30
M4 × 0.7	0.163	5.05	5.60	0.683	0.758	0.510	0.612	0.350	0.4445	0.4550	4.90	5.55	2.50	3.55	0.126	0.219	1.67	1.02	0.45
M5 × 0.8	0.209	6.25	6.80	0.775	0.866	0.598	0.700	0.400	0.5085	0.5200	6.10	6.75	3.15	4.55	0.144	0.250	2.09	1.41	0.60
M6 × 1	0.267	7.40	7.95	0.975	1.083	0.748	0.875	0.500	0.6370	0.6500	7.25	7.90	3.70	4.85	0.180	0.312	2.55	1.65	0.60
M7 × 1	0.267	8.65	9.20	0.975	1.083	0.748	0.875	0.500	0.6370	0.6500	8.40	9.15	4.30	5.50	0.180	0.312	3.10	2.09	0.75
M8 × 1	0.267	9.70	10.25	0.975	1.083	0.748	0.875	0.500	0.6370	0.6500	9.20	9.65	4.75	6.50	0.180	0.312	3.58	2.27	0.75
M8 × 1.25	0.415	9.80	10.35	1.251	1.353	0.967	1.094	0.625	0.7990	0.8120	9.50	9.90	4.75	6.50	0.226	0.391	3.60	2.02	0.75
M10 × 1	0.267	11.95	12.50	0.975	1.083	0.748	0.875	0.500	0.6370	0.6500	11.10	11.55	5.50	8.00	0.180	0.312	4.90	2.95	0.75
M10 × 1.25	0.415	12.10	12.65	1.251	1.353	0.967	1.094	0.625	0.7990	0.8120	11.50	11.95	5.50	8.00	0.226	0.391	4.77	2.56	0.75
M10 × 1.5	0.511	11.95	12.50	1.522	1.624	1.160	1.312	0.750	0.9615	0.9740	11.80	12.25	5.50	8.00	0.271	0.469	4.54	2.56	0.75
M12 × 1.25	0.415	14.30	15.00	1.251	1.353	0.967	1.094	0.625	0.7990	0.8120	13.50	14.00	6.70	9.75	0.226	0.391	5.84	3.77	1.00
M12 × 1.5	0.511	14.25	14.95	1.522	1.624	1.160	1.312	0.750	0.9615	0.9740	13.80	14.30	6.70	9.75	0.271	0.469	5.58	3.50	1.20
M12 × 1.75	0.654	14.30	15.00	1.792	1.894	1.379	1.531	0.875	1.1240	1.1370	14.10	14.60	6.70	9.75	0.316	0.547	5.36	3.23	1.40
M14 × 1.5	0.511	16.55	17.25	1.522	1.624	1.160	1.312	0.750	0.9615	0.9740	15.80	16.30	7.20	11.25	0.271	0.469	6.76	4.34	1.15
M14 × 2	0.799	16.65	17.35	2.063	2.165	1.598	1.750	1.000	1.2865	1.2990	16.40	16.90	7.20	11.25	0.361	0.625	6.26	3.79	1.40
M16 × 1.5	0.511	18.90	19.60	1.522	1.624	1.160	1.312	0.750	0.9615	0.9740	17.80	18.30	8.30	12.75	0.271	0.469	7.78	5.32	1.45
M16 × 2	0.799	18.90	19.60	2.063	2.165	1.598	1.750	1.000	1.2865	1.2990	18.40	18.90	8.30	12.75	0.361	0.625	7.30	4.76	2.70
M18 × 1.5	0.511	21.05	21.75	1.522	1.624	1.160	1.312	0.750	0.9615	0.9740	19.80	20.35	9.30	14.00	0.271	0.469	8.83	6.26	1.75
M18 × 2	0.799	21.15	21.85	2.063	2.165	1.598	1.750	1.000	1.2865	1.2990	20.40	20.95	9.30	14.00	0.361	0.625	8.30	5.74	2.70
M18 × 2.5	1.017	21.30	22.00	2.604	2.706	1.998	2.188	1.250	1.6110	1.6240	20.90	21.45	9.30	14.00	0.451	0.781	7.79	5.20	2.85
M20 × 1.5	0.511	23.15	24.00	1.522	1.624	1.160	1.312	0.750	0.9615	0.9740	21.80	22.50	10.40	14.50	0.271	0.469	9.77	7.19	2.85
M20 × 2	0.799	23.20	24.05	2.063	2.165	1.598	1.750	1.000	1.2865	1.2990	22.40	23.10	10.40	14.50	0.361	0.625	9.40	6.65	2.85
M20 × 2.5	1.017	23.55	24.40	2.604	2.706	1.998	2.188	1.250	1.6110	1.6240	22.90	23.60	10.40	14.50	0.451	0.781	8.89	6.11	2.85

Table 4 Insert Dimensions (Cont'd)

Nominal	*A*,	*B*		*D*		*E*			*H*		*J*		*P*		*R*,	*S*,	*U*		*V*,
Thread Size	Min.	Min.	Max.	Min.	Max.	Min.	Max.	Gage, *F*	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Min.	Min.	Max.	Max.
M20 × 1.5	0.511	23.15	24.00	1.522	1.624	1.160	1.312	0.750	0.9615	0.9740	24.10	24.80	11.40	16.00	0.271	0.469	11.10	8.01	2.85
M22 × 2	0.799	25.60	26.50	2.063	2.165	1.598	1.750	1.000	1.2865	1.2990	24.40	25.10	11.40	16.00	0.361	0.625	10.45	7.61	2.85
M22 × 2.5	1.017	25.90	26.90	2.604	2.706	1.998	2.188	1.250	1.6110	1.6240	24.90	25.60	11.40	16.00	0.451	0.781	9.94	7.07	2.85
M24 × 2	0.799	28.10	29.10	2.063	2.165	1.598	1.750	1.000	1.2865	1.2990	26.40	27.10	12.50	16.50	0.361	0.625	11.48	8.60	2.85
M24 × 3	1.234	28.00	29.00	3.146	3.248	2.396	2.625	1.500	1.9360	1.9485	27.50	28.20	12.50	16.50	0.541	0.938	10.45	7.51	2.85
M27 × 2	0.799	31.30	32.30	2.063	2.165	1.598	1.750	1.000	1.2865	1.2990	29.40	30.10	14.00	17.50	0.361	0.625	13.14	9.93	2.85
M27 × 3	1.234	31.40	32.40	3.146	3.248	2.396	2.625	1.500	1.9360	1.9485	30.50	31.20	14.00	17.50	0.541	0.938	12.13	8.85	2.85
M30 × 2	0.799	34.50	35.70	2.063	2.165	1.598	1.750	1.000	1.2865	1.2990	32.50	33.20	15.00	19.00	0.361	0.625	14.81	11.26	2.85
M30 × 3	1.234	34.90	36.10	3.146	3.248	2.396	2.625	1.500	1.9360	1.9485	33.50	34.20	15.00	19.00	0.541	0.938	13.65	10.32	2.85
M30 × 3.5	1.451	34.90	36.10	3.687	3.789	2.833	3.062	1.750	2.2605	2.2750	34.10	34.60	15.00	19.00	0.631	1.094	13.13	9.65	2.85
M33 × 2	0.799	37.80	39.20	2.063	2.165	1.598	1.750	1.000	1.2865	1.2990	35.80	36.50	17.00	21.00	0.361	0.625	16.35	12.74	2.85
M33 × 3	1.234	38.10	39.50	3.146	3.248	2.396	2.625	1.500	1.9360	1.9485	36.50	37.20	17.00	21.00	0.541	0.938	15.19	11.78	2.85
M36 × 2	0.799	41.00	42.40	2.063	2.165	1.598	1.750	1.000	1.2865	1.2990	39.00	39.70	18.50	22.50	0.361	0.625	17.77	14.29	2.85
M36 × 3	1.234	41.30	42.70	3.146	3.248	2.396	2.625	1.500	1.9360	1.9485	39.50	40.20	18.50	22.50	0.541	0.938	16.73	13.23	2.85
M36 × 4	1.688	41.50	42.90	4.228	4.330	3.271	3.500	2.000	2.5855	2.5980	40.60	41.10	18.50	22.50	0.722	1.250	15.57	12.12	2.85
M39 × 2	0.799	44.30	45.70	2.063	2.165	1.598	1.750	1.000	1.2865	1.2990	42.30	43.00	20.00	24.00	0.361	0.625	19.28	15.77	2.85
M39 × 3	1.234	44.40	45.80	3.146	3.248	2.396	2.625	1.500	1.9360	1.9485	42.50	43.20	20.00	24.00	0.541	0.938	18.28	14.68	2.85

11.1.2 Threads. The inserts, when assembled in STI-threaded holes conforming to Table 1, shall form threads conforming to ASME B1.13M Tolerance Class 4H5H or 5H except for the locking feature of screw-locking inserts. The assembled insert, both types, shall accept and function with parts having external MJ threads per ASME B1.21M.

NOTE: The accuracy of the finished thread when the insert is installed depends on the accuracy of the tapped hole. If the finished tapped hole gages satisfactorily, the installed insert will be within the thread tolerance when the insert meets the requirements of the Standard. It is, therefore, not necessary to gage the installed insert. After the insert is installed, the GO thread plug gage may not enter freely because the insert may not have been fully seated in the tapped hole. However, the insert should become seated after a bolt or screw is installed and tightened.

11.1.3 Tang Removal Notch. The tang removal notch shall be located as shown in Fig. 2 and of such depth that the part may be installed without failure of the tang and that the tang may be removed, after assembly, without affecting the function of the installed insert.

11.2 Self-Locking Torque (Destructive)

The screw-locking insert, when assembled in threaded holes conforming to Table 1 and tested in accordance with the following paragraphs, shall provide a frictional lock to retain the bolt threads within the torque limits specified in Table 5.

11.2.1 Torque Test Bolts. Assembled screw-locking inserts shall be torque tested with bolts in accordance with ASME B1.13M or ASME B1.21M, cadmium plated, or having other coating with a similar coefficient of friction and hardness of 36 HRC to 44 HRC. The bolts selected for this test shall be of sufficient length so the thread runout does not enter the insert and that a minimum of one full thread extends past the end of the insert when the bolt is fully seated. Acceptability of bolt threads shall be determined based on System 22 of ASME B1.3M.

NOTE: Until a replacement for cadmium plating on the torque test bolts (as specified in para. 11.2.1) is found, and test data completed, an alternate coating/lubricant can be used to perform the torque test (values may be different from those obtained using cadmium-plated screws) based on agreement between the customer and insert supplier.

11.2.2 Torque Test Block and Spacer. The insert to be tested shall be installed in a Tolerance Class 4H5H– or 4H6H–threaded hole conforming to Table 1 in a test block made from 2024-T4 (SAE AMS4120 or ASTM B 209M) aluminum alloy. After installation, the tang shall be removed. The surface of the test block from which the insert is assembled shall be marked "TOP" and shall be marked to indicate the radial location where the assembled insert begins. A steel spacer meeting the requirements of Fig. 3 and Table 6 shall be used for developing the bolt load.

11.2.3 Torque Test Method. The torque test shall consist of a 15-cycle, room temperature test. A new bolt or screw and new tapped hole shall be used for each complete 15-cycle test. For each of the 15 cycles, bolts shall be assembled and seated to the assembly torque specified in Table 5. Bolts shall be completely disengaged from the locking coils of the insert at the end of each cycle. The test shall be run at less than 40 rpm to yield a dependable measure of torque and avoid heating of the bolt.

11.2.4 Maximum Locking Torque. Maximum locking torque shall be the highest torque value encountered on any installation or removal cycle and shall not exceed the values specified in Table 5. Maximum locking torque readings shall be taken on the first and seventh installation cycles before the assembly torque is applied and on the 15th removal cycle.

11.2.5 Minimum Breakaway Torque. Minimum breakaway torque shall be the torque required to overcome static friction when 100% of the locking feature is engaged and the bolt or screw is not seated (no axial load). It shall be recorded at the start of the 15th removal cycle. The torque value for any cycle shall be not less than the applicable value shown in Table 5.

11.2.6 Acceptance. The inserts shall be considered to have failed if, at the completion of any of the tests and inspection, any of the following conditions exist:

(a) any break or crack in the insert

(b) installation or removal torque exceeds the maximum locking torque value in Table 5

(c) breakaway torque less than the values in Table 5

(d) movement of the insert beyond ±90 deg relative to the TOP surface when installing or removing the test bolt

(e) seizure or galling of the insert or test bolt

(f) tang not broken off, which interferes with the test bolt at installation

(g) tang breaks off during insert installation

Table 5 Self-Locking Torque

Nominal Thread Size	Maximum Locking Torque Installation or Removal, N·m	Minimum Breakaway Torque, N·m	Nominal Thread Size	Maximum Locking Torque Installation or Removal, N·m	Minimum Breakaway Torque, N·m
M2 × 0.4	0.12	0.03			
			M18 × 1.5	42	5.5
M2.5 × 0.45	0.22	0.06	M18 × 2	42	5.5
			M18 × 2.5	42	5.5
M3 × 0.5	0.44	0.1			
M3.5 × 0.6	0.68	0.12	M20 × 1.5	54	7
M4 × 0.7	0.9	0.16	M20 × 2	54	7
			M20 × 2.5	54	7
M5 × 0.8	1.6	0.3			
M6 × 1	3	0.4	M22 × 1.5	70	9
M7 × 1	4.4	0.6	M22 × 2	70	9
			M22 × 2.5	70	9
M8 × 1	6	0.8			
M8 × 1.25	6	0.8	M24 × 2	80	11
M10 × 1	10	1.4	M24 × 3	80	11
M10 × 1.25	10	1.4			
M10 × 1.5	10	1.4	M27 × 2	95	12
			M27 × 3	95	12
M12 × 1.25	15	2.2			
M12 × 1.5	15	2.2	M30 × 2	110	14
M12 × 1.75	15	2.2	M30 × 3	110	14
			M30 × 3.5	110	14
M14 × 1.5	23	3			
M14 × 2	23	3	M33 × 2	125	16
			M33 × 3	125	16
M16 × 1.5	32	4.2			
M16 × 2	32	4.2	M36 × 2	140	18
			M36 × 3	140	18
			M36 × 4	140	18
			M39 × 2	150	20
			M39 × 3	150	20

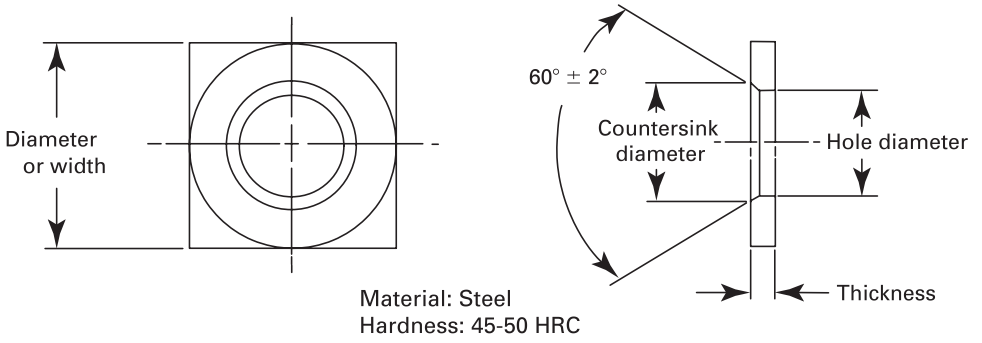


Fig. 3 Torque Test Spacer

Table 6 Torque Test Spacer Dimensions

Nominal Insert Size	Minimum Diameter or Width	Hole Diameter		Countersink Diameter		Minimum Thickness
		Max.	Min.	Max.	Min.	
2	**7.0**	**2.3**	**2.1**	**2.7**	**2.5**	**1.5**
2.5	8.0	2.8	2.6	3.3	3.1	1.5
3	9.0	3.5	3.3	3.8	3.6	2.0
3.5	10.0	4.0	3.8	4.3	4.1	2.0
4	11.0	4.5	4.3	4.9	4.7	3.0
5	12.0	5.5	5.3	5.9	5.7	3.0
6	14.0	6.5	6.3	7.0	6.8	3.5
7	17.0	7.6	7.3	8.4	8.2	3.5
8	19.0	8.6	8.3	9.5	9.2	4.0
10	23.0	10.7	10.4	11.5	11.2	4.0
12	27.0	12.7	12.4	14.5	14.2	4.5
14	31.0	14.8	14.4	16.5	16.2	4.5
16	35.0	16.8	16.4	18.5	18.2	4.5
18	39.0	18.8	18.4	20.7	20.4	4.5
20	43.0	20.8	20.4	22.7	22.4	5.0
22	47.0	22.8	22.4	24.7	24.4	5.0
24	51.0	24.8	24.4	26.7	26.4	5.0
27	56.0	28.3	27.9	29.8	29.4	5.0
30	62.0	31.3	30.9	33.8	33.4	6.0
33	67.0	34.3	33.9	36.8	36.4	6.0
36	72.0	37.3	36.9	39.8	39.4	6.0
39	77.0	40.3	39.9	42.8	42.4	6.0

Intentionally left blank

NONMANDATORY APPENDIX A
INSERT LENGTH SELECTION

A-1 ENGAGED LENGTH OF BOLT

Normally, the engaged length of bolt in an insert is determined by strength considerations.

A-2 MATERIAL STRENGTHS

The standard engineering practice of balancing the tensile strength of the bolt material against the shear strength of the parent or boss material also applies to helical coil inserts. Tables A-1 and A-2 will aid in developing the full load value of the bolt rather than stripping the parent or tapped material.

In using this table, the following factors must be considered:

(a) The parent material shear strengths are for room temperature. Elevated temperatures call for significant shear value reductions; compensation should be made when required. Shear values are appropriate because the parent material is subject to shearing stress at the major diameter of the tapped threads.

(b) When parent material shear strength falls between two tabulated values, use the lower of the two.

(c) Bolt thread length, overall length, insert length, and full tapped thread depth must be adequate to ensure full-thread engagement when assembled to comply with its design function.

Table A-1 Insert Length Selection

Parent Material Shear Strength, MPa	Bolt Property Class						
	4.6	4.8	5.8	8.8	9.8	10.9	12.9
	Insert Length in Terms of Diameters						
70	3	3	3	...	...	...	...
100	2	2	2	3	...	...	...
150	1.5	1.5	1.5	2	2.5	2.5	3
200	1.5	1.5	1.5	2	2	2	2
250	1	1	1	1.5	1.5	1.5	1.5
300	1	1	1	1.5	1.5	1.5	1.5
350	1	1	1	1	1	1.5	1.5

Table A-2 Hardness Number Conversion

Bolt Property Class	Max. Rockwell Hardness	Max. Tensile Strength, MPa
4.6	95 HRB	705
4.8	95 HRB	705
5.8	95 HRB	705
8.8	34 HRC	1055
9.8	36 HRC	1115
10.9	39 HRC	1215
12.9	44 HRC	1435

GENERAL NOTE: Bolt strength upon which insert length recommendations are based is developed by taking the maximum hardness per ASTM F568M Carbon and Alloy Steel Externally Threaded Metric Fasteners and the equivalent tensile strength from SAE J417 Hardness Tests and Hardness Number Conversions.

NONMANDATORY APPENDIX B
SCREW THREAD INSERT TAPS

B-1 SCOPE

This Appendix covers design and dimensions for taps for producing Metric Series STI–threaded holes required for the installation of helical coil screw thread inserts. Threaded hole dimensions are shown in Table 1 of this Standard.

B-2 NOMENCLATURE

Helical coil screw thread insert taps are identified by the designation STI.

B-3 DESIGNS AND DIMENSIONS

B-3.1 Types of Taps

Various types and styles of STI taps are available. General dimensions and tolerances are in accordance with ASME B94.9.

B-3.2 Tap Thread Limits

Ground thread taps are recommended for screw thread inserts. Tap thread limits are in accordance with ASME B94.9. Basic pitch diameter used for determining values is the “Pitch Diameter, min.” from Table 1.

B-4 MARKING

Taps are marked in accordance with ASME B94.9.

EXAMPLE: M6 × 1 STI HS G H2.

Other information may be added at the discretion of the manufacturer.

NONMANDATORY APPENDIX C
INSTALLATION

C-1 INSERT INSTALLATION

Helical coil inserts are greater in diameter than the STI-tapped holes into which they are installed. The installation process applies torque to the tang to reduce the diameter of the leading coil and permit it to enter the tapped hole. The remaining coils are reduced in diameter as they, in turn, are screwed into the tapped hole. When the torque or rotation is stopped, the insert coil expands with a spring-like action to anchor the insert permanently in place against the threads of the tapped hole.

Finer pitch inserts are proportionally larger (before installation) than coarse pitch inserts and thus have to be "prewound" to a smaller diameter for installation. Large, coarse pitch inserts need only a threaded mandrel tool for installation.

C-2 STRIP FEED

Helical coil inserts are normally furnished in bulk containers. However, they are also normally available in feeding belts known as strip feed.

Strip feed consists of a belt or strip of pliable plastic such as polyethylene through which holes have been punched, and into which the helical coil inserts are positioned, the ends of the inserts protruding from each side of the strip. The strip is coiled on a reel or spool.

The purpose for, and advantage of strip feed is to ease handling of the insert and to increase installation rates.

Inserting tools are available for handling strip feed, wherein the strip passes through a slot in the prewinder thus locating each insert for engagement with the mandrel. After each insert has been driven through the tool and installed into the work, the strip indexes the next insert into position.

Helical coil inserts are normally available in strip feed in sizes up through 8 mm nominal diameter.

C-3 INSERTING TOOLS

C-3.1 Manual Inserting Tools

Various types of manual inserting tools are available. Examples are shown in Table C-1. These manual inserting tools will install helical coil inserts up to 3 diameters long for thread sizes up through 22 mm. Tools for sizes 24 mm and larger will install inserts up to 2 diameters long.

C-3.2 Power Inserting Tools — Air Driven

For installing large quantities of helical coil inserts, power inserting tools are available. A typical tool is comprised of three basic assemblies: a reversible air motor, an adapter, and a front-end assembly. The air motor provides the driving torque. The adapter couples the motor to the front-end assembly. The front-end assembly holds the insert and, in operation, reduces the diameter of the insert (prewinds), then drives it into its tapped hole. A foot-activated air valve may be used as an alternative to the hand-activated lever.

Two sizes of adapters are available: one for the smaller range of thread sizes and one for the larger sizes. These tools will install 1, 1.5, and 2 diameter length inserts. Front-end assemblies are also available for longer length inserts or larger sizes.

Examples of air-driven power inserting tools are shown in Table C-2.

C-4 TANG BREAK-OFF TOOLS

If the bolt is to engage the full length of the insert, the driving tang must be removed to eliminate interference with the end of the assembled bolt.

Tang break-off tools are of several types.

C-4.1 Spring-Actuated Manual Tang Break-Off Tool

Spring-actuated tang break-off tools are available for use with inserts through 12 mm nominal diameter. Their operation is automatic, having a spring-loaded, easily triggered punch that strikes a sharp, uniform blow against the tang of the installed insert.

Examples are shown in Table C-3.

C-4.2 Pneumatic Tang Break-Off Tool

Pneumatic tang break-off tools provide rapid tang removal for quantities of installed inserts in sizes up to M12. Supplied 0.414 MPa to 0.551 MPa air, the tool is hand-held. The punch is inserted into the installed insert in contact with the tang. A push button actuates the punch to deliver a sharp, uniform blow, which breaks off the tang. Examples are shown in Table C-4.

C-4.3 Rod-Type Tang Break-Off Tool

Rod-type tools are available for use with inserts through 12 mm nominal diameter. They are actuated by the tap of a hammer. Examples are given in Table C-5.

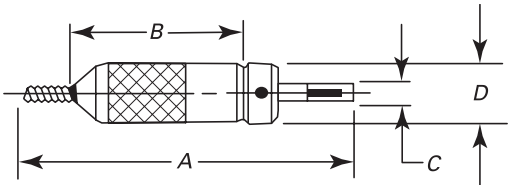
C-4.4 Long-Nose Pliers

For insert nominal sizes larger than 12 mm, use long-nose pliers, bending the tang up and down to snap it off at the notch.

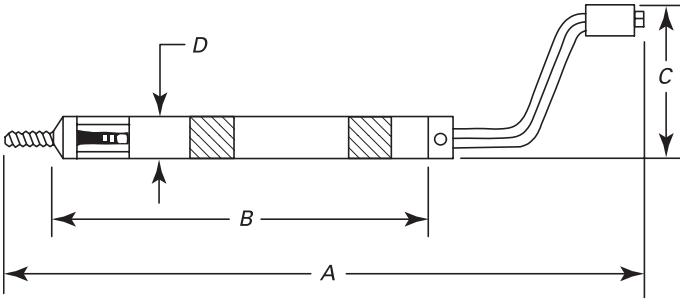
C-5 EXTRACTING TOOLS

Examples of tools to remove helical coil inserts are shown in Table C-6. These operate by applying the tool to the insert, striking the head of the tool a light blow, and turning counterclockwise while maintaining steady downward pressure.

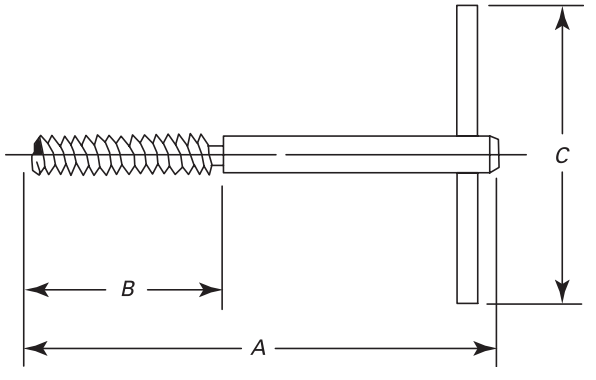
Table C-1 Manual Inserting Tools



Type I



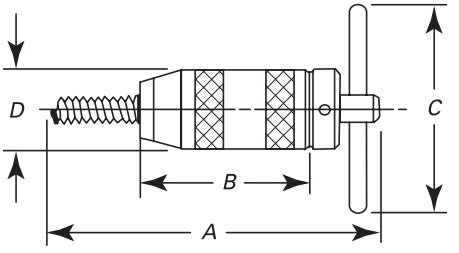
Type II



Type III

Size	A	B	C	D
M2 × 0.4	66.7	19.1	4.8	11.1
M2.5 × 0.45	189.7	117.5	57.9	9.5
M3 × 0.5	189.7	117.5	57.9	9.5
M3.5 × 0.6	189.7	117.5	57.9	9.5
M4 × 0.7	189.7	117.5	57.9	9.5
M5 × 0.8	189.7	117.5	57.9	11.9
M6 × 1	202.4	117.5	64.3	13.1
M7 × 1	202.4	128.0	94.5	17.9
M8 × 1	202.4	127.0	94.5	17.9
M8 × 1.25	202.4	127.0	94.5	17.9
M10 × 1	215.1	133.3	94.5	19.8
M10 × 1.25	215.1	133.3	94.5	19.8
M10 × 1.5	215.1	133.3	94.5	19.8
M12 × 1.25	224.6	139.7	94.5	22.2
M12 × 1.5	224.6	139.7	94.5	22.2
M12 × 1.75	224.6	139.7	94.5	22.2
M18 × 2.5	123.8	60.3	101.6	
M22 × 2.5	123.8	74.6	114.3	
M24 × 3	123.8	57.2	114.3	
M27 × 3	171.5	57.2	152.4	
M30 × 3.5	171.5	69.8	152.4	
M36 × 4	171.5	84.1	152.4	

Table C-1 Manual Inserting Tools (Cont'd)



Type IV

Size	A	B	C	D
M14 × 1.5	146.0	76.2	101.6	22.2
M14 × 2	146.0	76.2	101.6	22.2
M16 × 1.5	149.2	76.2	101.6	25.4
M16 × 2	149.2	76.2	101.6	25.4
M18 × 1.5	155.6	76.2	101.6	28.6
M18 × 2	155.6	76.2	101.6	28.6
M20 × 1.5	160.3	76.2	101.6	28.6
M20 × 2	160.3	76.2	101.6	28.6
M20 × 2.5	160.3	76.2	101.6	28.6
M22 × 1.5	171.4	76.2	114.3	33.3
M22 × 2	171.4	76.2	114.3	33.3
M24 × 2	152.4	76.2	114.3	33.3
M27 × 2	177.8	95.2	152.4	38.1
M30 × 2	184.2	95.2	152.4	46.0
M30 × 3	184.2	95.2	152.4	46.0
M33 × 2	192.1	95.2	152.4	46.0
M33 × 3	192.1	95.2	152.4	46.0
M36 × 2	200.0	95.2	152.4	46.0
M36 × 3	200.0	95.2	152.4	46.0
M39 × 2	206.4	95.2	152.4	50.8
M39 × 3	206.4	95.2	152.4	50.8

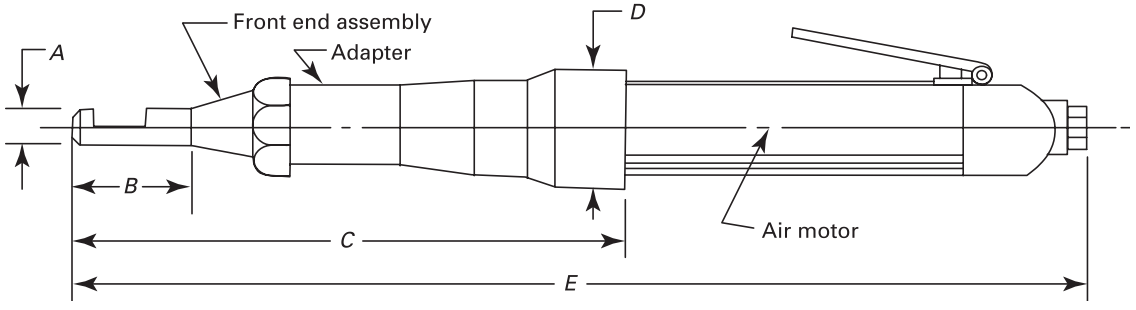


Table C-2 Air Power Inserting Tools

	For Bulk Inserts		For Strip Feed Inserts				
Size	A	B	A	B	C	D	E
M2.5 × 0.45	6.4	14.6	9.5	23.8	112.7	31.8	249.2
M3 × 0.5	7.1	14.6	9.5	23.8	112.7	31.8	249.2
M3.5 × 0.6	7.9	14.6	12.7	23.8	112.7	31.8	249.2
M4 × 0.7	8.7	14.6	12.7	23.8	112.7	31.8	249.2
M5 × 0.8	9.5	23.3	12.7	23.8	112.7	31.8	249.2
M6 × 1	10.7	23.3	15.9	34.9	112.7	31.8	249.2
M7 × 1	14.3	30.5	17.5	30.5	146.0	31.8	282.6
M8 × 1	14.3	33.0	19.2	33.0	146.0	31.8	282.6
M8 × 1.25	14.3	33.0	19.2	33.0	146.0	31.8	282.6
M10 × 1	19.0	34.1	. . .	. . .	162.7	31.8	299.2
M10 × 1.25	19.0	34.1	. . .	. . .	162.7	31.8	299.2
M10 × 1.5	19.0	34.1	. . .	. . .	162.7	31.8	299.2
M12 × 1.25	20.6	44.0	. . .	. . .	169.9	31.8	306.4
M12 × 1.5	20.6	44.0	. . .	. . .	169.9	31.8	306.4
M12 × 1.75	20.6	44.0	. . .	. . .	169.9	31.8	306.4

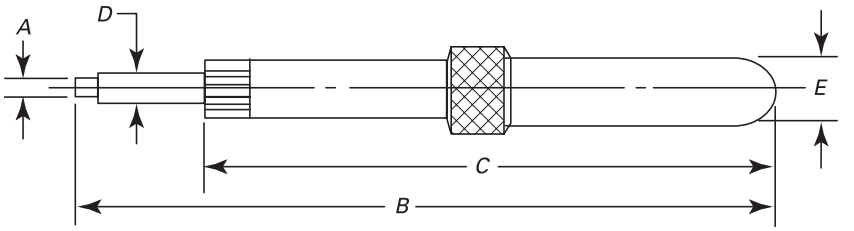


Table C-3 Spring-Actuated Tang Break-Off Tool

Size	A	B	C	D	E
M2 × 0.4	1.32	133.4	127.0	. . .	12.7
M2.5 × 0.45	1.47	138.1	127.0	. . .	12.7
M3 × 0.5	1.93	139.7	127.0	. . .	12.7
M3.5 × 0.6	1.93	139.7	127.0	. . .	12.7
M4 × 0.7	2.84	142.9	127.0	. . .	12.7
M5 × 0.8	3.17	146.0	127.0	. . .	12.7
M6 × 1	3.91	147.6	127.0	. . .	12.7
M7 × 1	3.00	147.6	124.6	5.08	15.9
M8 × 1	3.04	147.6	124.6	5.66	15.9
M8 × 1.25	3.04	147.6	124.6	6.42	15.9
M10 × 1	5.81	183.4	154.8	7.67	19.05
M10 × 1.25	5.81	183.4	154.8	7.67	19.05
M10 × 1.5	5.81	183.4	154.8	7.67	19.05
M12 × 1.25	5.81	186.5	154.8	9.09	19.05
M12 × 1.5	5.81	186.5	154.8	9.09	19.05
M12 × 1.75	5.81	186.5	154.8	9.09	19.05

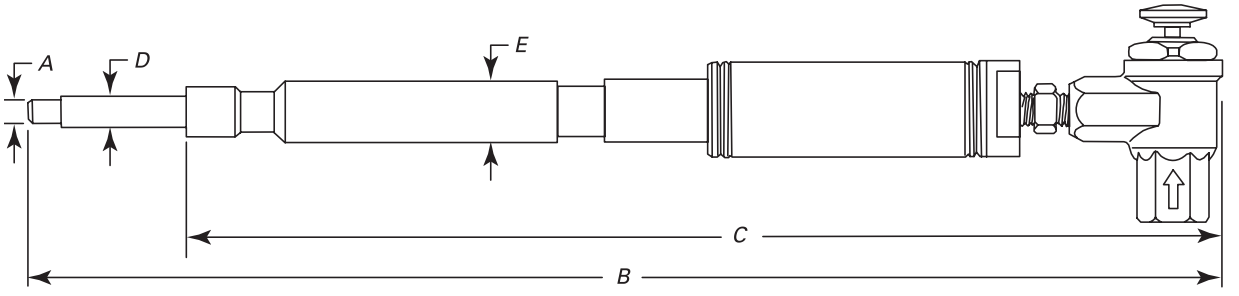


Table C-4 Penumatic Tang Break-Off Tools

Size	A	B	C	D	E
M2 × 0.4	1.32	. . .	. . .	. . .	15.88
M2.5 × 0.45	1.47	. . .	. . .	. . .	15.88
M3 × 0.5	1.93	228.60	215.90	. . .	15.88
M3.5 × 0.6	1.93	228.60	215.90	. . .	15.88
M4 × 0.7	2.84	230.99	215.90	. . .	15.88
M5 × 0.8	3.17	234.16	215.16	. . .	15.88
M6 × 1	3.91	235.74	215.14	. . .	15.88
M7 × 1	3.00	242.89	219.89	5.08	15.88
M8 × 1	3.04	246.06	223.06	5.66	15.88
M8 × 1.25	3.04	246.06	223.06	6.42	15.88
M10 × 1	5.81	269.08	240.48	7.67	19.05
M10 × 1.25	5.81	269.08	240.48	7.67	19.05
M10 × 1.5	5.81	269.08	240.48	7.67	19.05
M12 × 1.25	5.81	271.46	239.76	9.09	19.05
M12 × 1.5	5.81	271.46	239.76	9.09	19.05
M12 × 1.75	5.81	271.46	239.76	9.09	19.05

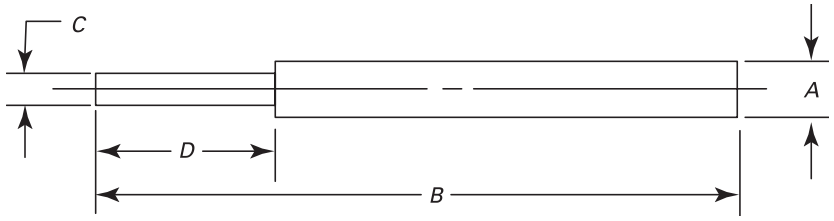


Table C-5 Rod-Type Tang Break-Off Tool

Size	*A*	*B*	*C*	*D*
M2.5 × 0.45	6.4	102	1.47	10
M3 × 0.5	6.4	102	1.93	13
M3.5 × 0.6	6.4	102	2.26	16
M4 × 0.7	6.4	102	2.84	17
M5 × 0.8	6.4	102	3.18	19
M6 × 1	6.4	102	4.47	26
M7 × 1	6.4	102	5.08	26
M8 × 1	6.4	102	5.84	29
M8 × 1.25	6.4	102	5.84	29
M10 × 1	7.1	102	None	None
M10 × 1.25	7.1	102	None	None
M10 × 1.5	7.1	102	None	None
M12 × 1.25	8.7	102	None	None
M12 × 1.5	8.7	102	None	None
M12 × 1.75	8.7	102	None	None

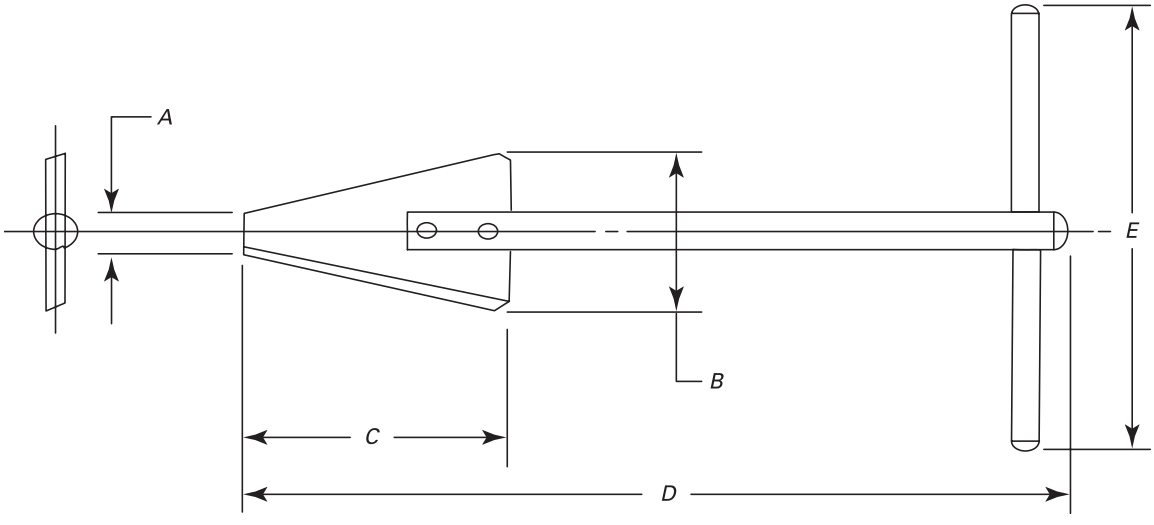


Table C-6 Extracting Tool

Nominal Thread Size Range, mm	*A*	*B*	*C*	*D*	*E*
2	1.27	9.52	15.87	108	76
2.5–4.5	1.98	9.52	15.87	108	76
5–10	3.68	9.52	14.28	108	76
11–24	9.14	25.40	41.27	129	102
27–39	24.63	38.10	33.33	156	102

Intentionally left blank

Intentionally left blank

ASME B18.29.2M-2005

ISBN 0-7918-2973-1

M18805