

IFI NOTES:

1. *IFI-504 was originally published in 1976. Since that time several changes were made, all of which were incorporated in the 1997 edition. This latest edition (2007) includes additional changes to bring the standard current with existing practice.*

1. Scope

1.1 This standard covers requirements for metric steel, self-drilling, tapping screws suitable for use in general engineering applications.

The objective of this standard is to ensure that self-drilling tapping screws, by meeting the mechanical and performance requirements specified, shall drill a hole and form or cut mating threads in materials into which they are driven, without deforming their own thread and without breaking during assembly.

NOTE: *The performance requirements covered in this standard apply only to the combination of laboratory conditions described in the testing procedures. If other conditions are met in an actual service application (such as different materials, thicknesses, etc.) drilling speed, drill load, starting torque, failure torque, and driving time values may require adjustment.*

2. Requirements

2.1 Material and Process Requirements

2.1.1 Material and Chemistry. Screws shall be made from cold heading quality, killed steel wire conforming to the requirements of IFI-140. Selection of a steel grade from IFI-140 shall be based on compliance with the following chemical composition limits:

Analysis (1)	Composition Limits (% by weight) (2)			
	Carbon		Manganese	
	Min	Max	Min	Max
Ladle	0.15	0.25	0.70	1.65
Check	0.13	0.27	0.64	1.71

NOTES:

1. Ladle analysis may be used for routine reporting. Check analyses shall be used in case of dispute or as required.
2. Boron is permitted in the range of 0.0005-0.003.

2.1.2 Heat Treatment. Screws shall be heat treated in a carbonitriding or gas carburizing system.

2.1.3 Tempering Temperature. Minimum tempering temperature shall be 330°C.

IFI STANDARD ®	METRIC SELF-DRILLING TAPPING SCREWS	IFI-504 Page 1 of 11
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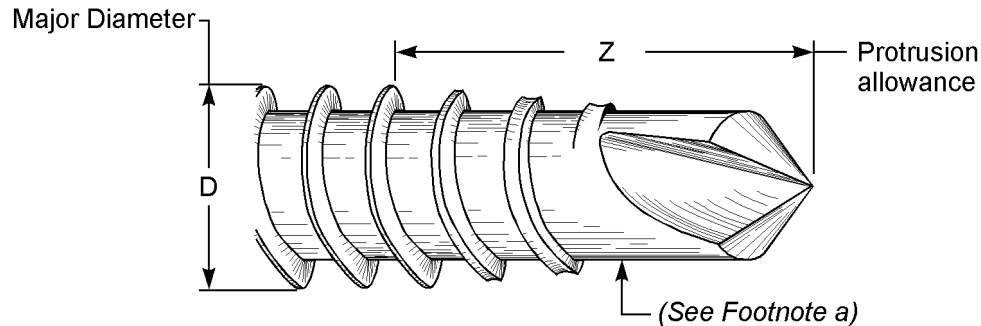


Fig. 1 Typical Self-Drilling Tapping Screw Point

Table 1 Dimensions of Threads and Points for Self-Drilling Tapping Screws

Nom Screw Size	Thread Pitch	D Major Dia		d Minor Dia		(b) Z Protrusion Allowance (Ref)		L Minimum Practical Nom Screw Length (Ref)			
								Style 2 Points (c)		Style 3 Points (c)	
								Formed		Formed	
		Max	Min	Max	Min	Style 2 Point	Style 3 Point	Pan & Hex Washer Heads	Flat & Oval CTSK Heads	Pan & Hex Washer Heads	Flat & Oval CTSK Heads
M2.9	1.06	2.90	2.79	2.18	2.08	4.1	—	8.0	9.5	—	—
M3.5	1.27	3.53	3.43	2.64	2.51	4.8	5.6	8.0	9.5	9.5	11.0
M4.2	1.41	4.22	4.09	3.10	2.95	5.4	6.4	9.5	11.0	11.0	12.5
M4.8	1.59	4.80	4.65	3.58	3.43	6.0	7.6	11.0	12.5	12.5	14.0
M5.5	1.81	5.46	5.31	4.17	3.99	7.0	9.0	12.5	16.0	12.5	16.0
M6.3	1.81	6.25	6.10	4.88	4.70	8.1	10.0	12.5	16.0	12.5	16.0

NOTES:

- Drill portion of points may be milled and/or cold formed and details of point taper and flute design shall be optional with the manufacturer, provided the screws meet the performance requirements specified in this standard and are capable of drilling the maximum panel thicknesses shown in Table 6 prior to thread pick-up.
- Protrusion allowance Z is the distance, measured parallel to the axis of screw, from the extreme end of the point to the first full form thread beyond the point and encompasses the length of drill point and the tapered incomplete threads. It is intended for use in calculating the maximum effective design grip length Y on the screw in accordance with the following: $Y = L \text{ min} - Z$.
- Style 3 points have larger diameters and longer flutes than Style 2 in order to accommodate the drilling and tapping of thicker materials.
- All dimensions are in millimeters.

IFI STANDARD ® Published and issued by the Industrial Fasteners Institute of Independence, OH	METRIC SELF-DRILLING TAPPING SCREWS	IFI-504 Page 2 of 11
		Revised: Aug. 1, 2007 Reaffirmed: 2013

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2.1.4 Finish. Screws may be furnished plain or with a protective coating (electrodeposited or mechanical plating or chemical conversion coating) as specified by the user. If an electrodeposited coating is specified, it shall be in accordance with ASTM F1941M. At the option of the manufacturer screws may be provided with an additional supplementary lubricant as necessary to meet the performance requirements.

Electroplated screws shall be baked for a minimum of four hours at a temperature of 204°C with an allowable load temperature tolerance of $\pm 10^{\circ}\text{C}$ within one hour after plating to reduce the risk of hydrogen embrittlement. Alternately, the provisions of ASTM F1940 may be applied.

In cases where screws are plated or coated following delivery to the purchaser (or where plating or coating of screws is otherwise under the control of the purchaser), the screw producer shall not be responsible for failure of the screws to meet mechanical or performance requirements due to plating or coating. In such cases, additional screws from the same lot shall be stripped of plating or coating, baked, lubricated with machine oil and retested in the natural finish.

2.2 Dimensional Requirements

2.2.1 Head Types. The head types covered by this standard include those specified in ASME B18.6.5M.

2.2.2 Recesses. Head recesses shall conform with the dimensional requirements of ASME B18.6.5M.

2.2.3 Positional Tolerances. The positional relationship between the heads and driving provisions of screws and the shanks of screws (formerly defined as Eccentricity) shall be as follows:

2.2.3.1 Position of Hex Washer Heads. The axis of the hex washer head shall be located at true position relative to the axis of the screw shank within a tolerance zone having a diameter equivalent to 6 percent of the basic screw diameter.

2.2.3.2 Position of Recess. The recess in cross recessed head screws shall be located at true position relative to the axis of the screw shank within a tolerance zone having a diameter equivalent to 6 percent of the basic screw diameter.

2.2.4 Length

2.2.4.1 Measurement. The length of screw shall be measured parallel to the axis of the screw from the extreme point to the largest diameter of the bearing surface of the head.

2.2.4.2 Tolerance on Length. The tolerance on length of screws shall conform to the following:

Nom Screw Length	Tolerance on Length
Up to 20 mm incl.	– 0.75 mm
Over 20 mm to 40 mm	– 1.25 mm
Over 40 mm	– 1.50 mm

IFI STANDARD ®	METRIC SELF-DRILLING TAPPING SCREWS	IFI-504 Page 3 of 11
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2.2.5 Points. Points shall be such as to ensure that specified performance requirements are met.

2.2.6 Thread Dimensions. Dimensions of screw threads and points shall conform to those given in Table 1.

2.2.7 Length of Thread

2.2.7.1 For screws of nominal lengths equal to or shorter than 40 mm, the full form threads shall extend close to the head such that the specified minor diameter limits are maintained to within one pitch (thread), or closer if practicable, of the underside of the head. See Fig. 2. For screws of nominal lengths longer than 40 mm, the length of full form thread shall be as specified by the purchaser.

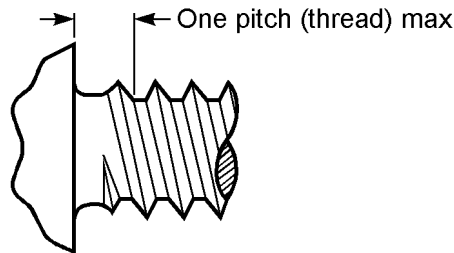


Fig. 2

2.3 Mechanical and Performance Requirements

2.3.1 Hardness

2.3.1.1 Core Hardness. Screws shall have a core hardness of Rockwell C 32-40, when tested as specified in Para. 3.1.

2.3.1.2 Surface Hardness. Screws shall have a case hardness of Rockwell C 52-58, when tested as specified in Para. 3.2.

2.3.1.3 Total Case Depth. Screws shall have a total case depth conforming to the following, when tested as specified in Para. 3.3.

Nom Screw Size (mm)	Total Case Depth (mm)	
	Min	Max
M2.9 thru M3.5	0.05	0.18
M4 thru M5.5	0.10	0.23
M6 and M6.3	0.13	0.28

IFI STANDARD ® Published and issued by the Industrial Fasteners Institute of Independence, OH	METRIC SELF-DRILLING TAPPING SCREWS	IFI-504 Page 4 of 11
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