

Inch Machine Screws Must Meet ANSI/ASME B18.6.3

By Joe Greenslade

Occasionally I am asked which specifications machine screws must meet. The primary standard covering inch machine screws is the American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME) specification B18.6.3. This standard designates both dimensional and strength requirements for standard machine screws.

Dimensional Requirements

The standard spells out specific requirements for the following dimensional characteristics:

Head Height	Bearing Surface
Penetration Depth	Slot Width
Recess Eccentricity	Underhead Fillet
Thread Length	Flat Head Protrusion
Head Diameter	Recess Depth
Slot Depth	Head Eccentricity
Slot Eccentricity	Length
Flat Head Angles	Threads

ANSI/ASME B18.6.3 does not provide detailed thread dimensions. It refers to ANSI/ASME B1.1 for all thread specifications.

ANSI/ASME B18.6.3 states that unless otherwise specified, machine screws will be provided with class 2A threads before plating or coating. If plating or coating is added, the thread is acceptable provided it falls within the high limits of class 3A and the low limits of class 2A.

This standard states that unless otherwise specified, machine screw points will have straight sheared (non-pointed) points. This means that all machine screws with header points are special and must be specified by the purchaser when the order is placed.

Material and Strength Requirements

ANSI/ASME B18.6.3 states that unless otherwise specified machine screws are to

be fabricated of carbon steel and the screws must have a minimum tensile strength of 60,000 pounds per square inch (PSI).

This means that machine screws can be made from grade 1006 through 1060 carbon steel provided the material yields a finished tensile strength of 60,000 PSI or greater. There are no hardness or torsional strength requirements in this specification.

To assure machine screws meet their minimum strength levels, they should be tested for straight tensile strength. This means that parts with lengths of three diameters or longer should be pulled apart using a flat, and not a wedge, washer under the head of the screws. The minimum required tensile values are shown in Table 1.

One other specification exists that is sometimes referred to regarding machine screw strengths. That is the Society of Automotive Engineers (SAE) J82. It defines two strength levels. The first SAE strength level agrees with the ANSI/ASME B18.6.3 tensile strength of 60,000 PSI. That SAE grade designation is 60M. The second grade level is referred to as 120M, meaning 120,000 PSI minimum tensile strength.

The SAE grade 60M machine screws do not require heat treating. The 120M grade requires the fasteners to be heat treated, quenched, and tempered to meet strength requirements.

Unlike ANSI/ASME B18.6.3, SAE J82 requires hex and hex washer head screws to be wedge tensile tested instead of straight tensile tested. All other head styles are to be tested for straight tensile strength only.

The SAE specification requires hardness in addition to tensile strength. Grade 60M hardness must be Rockwell B70 to B100. Grade 120M must have a hardness of Rockwell C25 to C38.

Some suppliers say, "Machine screws are just commercial fasteners and do not have to meet any requirements." This is incorrect. Machine screws are expected to meet the requirements of at least ANSI/ASME B18.6.3 unless the customer specifies otherwise on their purchase order to the fastener supplier. □

Thread Size	Tensile Stress Area (sq. in.)	Minimum Tensile Strength (lbs.)
0-72.....	0.0018.....	108
1-56.....	0.00263.....	158
1-72.....	0.00278.....	167
2-56.....	0.0037.....	222
2-64.....	0.00394.....	236
3-48.....	0.00487.....	292
3-56.....	0.00523.....	314
4-40.....	0.00604.....	362
4-48.....	0.00661.....	397
5-40.....	0.00796.....	478
5-44.....	0.0083.....	498
6-32.....	0.00909.....	545
6-40.....	0.01015.....	609
8-32.....	0.014.....	840
8-36.....	0.01474.....	884
10-24.....	0.0175.....	1,050
10-32.....	0.02.....	1,200
12-24.....	0.0242.....	1,452
12-28.....	0.0258.....	1,548
1/4-20.....	0.0318.....	1,908
1/4-28.....	0.0364.....	2,184
5/16-18.....	0.0524.....	3,144
5/16-24.....	0.058.....	3,480
3/8-16.....	0.0775.....	4,650
3/8-24.....	0.0878.....	5,268
7/16-14.....	0.1063.....	6,378
7/16-20.....	0.1187.....	7,122
1/2-13.....	0.1419.....	8,514
1/2-20.....	0.1599.....	9,594
9/16-12.....	0.182.....	10,920
9/16-18.....	0.203.....	12,180
5/8-11.....	0.226.....	13,560
5/8-18.....	0.256.....	15,360
3/4-10.....	0.334.....	20,040
3/4-16.....	0.373.....	22,380

Table 1. Minimum required tensile values.



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Joe is an inventor, author, and lecturer. He holds eleven U.S. Patents, has written over 80 technical articles for industrial trade journals, and has spoken frequently at trade association meetings and technical conferences on issues related to industrial quality for

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He is an Associate Member of the Industrial Fastener Institute and a member of the American Society of Mechanical Engineers B1 Thread Specification Committee. In 1992, Joe was recognized for his technical and innovative contributions to the fastener industry when, at age 44, he became the youngest person to be inducted into the National Industrial Fastener Show "Hall of Fame."

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