PINS

MACHINE DOWEL PINS – HARDENED GROUND [METRIC SERIES]

ASME B18.8.5M 1994

IFI NOTES:

1. *ASME B18.8.5M is a standard developed through the procedures of The American Society of Mechanical Engineers. B18.8.5M is under the jurisdiction of ASME Standards Committee B18 and is the direct responsibility of Subcommittee 8.*

2. *Published for the first time in 1994, this presentation does not include the government part numbering system which is in Appendix B of the ASME standard. A discussion of the relationship to ISO 8734: Parallel Pins of Hardened Steel and Martensitic Steel (Dowel Pins) is included in Para. 1.6. All paragraphs are numbered identically to those in the standard.*

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1. INTRODUCTORY NOTES

1.1 Scope

1.1.1 This standard covers the dimensional and general data for hardened ground dowel pins in sizes 1.5 – 25 mm in two series recognized as American National Standard, which are widely used in general industrial applications.

1.1.2 The inclusion of dimensional data in this standard is not intended to imply that all products described are stock production sizes. Consumers are requested to consult with suppliers concerning the availability of the product.

1.2 Description

Hardened ground dowel pins are straight pins designed to be force-fitted into a part to provide alignment or location in the assembly. The hardness and closely controlled diameter provide controlled fit and wear resistance for pin applications. One end of the pin is chamfered to assist in insertion while the opposite end has a crown profile to minimize edge damage during insertion.

1.3 Dimensions

All dimensions in this standard are in millimeters unless otherwise noted and apply before plating or coating.

1.4 Options

Options, where specified, shall be at the discretion of the supplier, unless otherwise agreed upon by the supplier and purchaser.

1.5 Terminology

For definitions of terms relating to fasteners or component features thereof used in this standard, refer to ASME B18.12, Glossary of Terms for Mechanical Fasteners. See page K–37.

1.6 Comparison with ISO 8734

The standard series outside diameter dimensions are within the dimensional limits of ISO 8734, but the ISO 8734 pins may exceed the maximum standard pin diameter for 4 mm and larger sizes. ISO 8734 has only one series,

but this standard includes on Oversize series. The standard length increments in this standard are fewer than those in ISO 8734. On pin lengths less than 35 mm only, the even lengths match the ISO lengths. For lengths over 50 mm the standard increment in length is 10 mm, whereas ISO 8734 has 5 mm as a standard increment. The pin length tolerance is unilateral, at –0.5 mm, but ISO 8734 has bilateral tolerances. Thus, pins of lengths 10 mm and shorter may be shorter than the minimums in ISO 8734, but all longer pins will meet the ISO requirements. The standard surface roughness requirements are finer than the ISO 8734 requirements. ISO 8734 has a spherical radius on the entrance end of through hardened pins while this standard has only one configuration. The standard pin minimum core hardness is 2 HRC less than the ISO 8734.

2. GENERAL DATA FOR DOWEL PINS

2.1 Diameter

2.1.1 Size. Hardened ground dowel pins are described in two series, the Standard series having minimum diameters 0.003 to 0.008 mm over the nominal diameter, intended for initial installation; and the Oversize series having minimum diameters 0.025 to 0.030 mm over the nominal diameter, intended for replacement use. For both series the diameter shall be ground, or ground and lapped, to the outside diameter dimensions specified in Table 1.

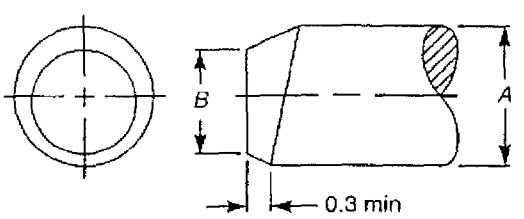

Fig. 1 Point Concentricity

2.1.2 Roundness. The outer periphery of hardened ground machine dowel pins shall conform to true round about the longitudinal axis of the pin within 0.0025 mm when measured with equipment that will detect a lobed surface.

2.2 Ends

2.2.1 End Contours. The ends of hardened ground machine dowel pins shall be reasonably flat and perpendicular to the axis of the pin. One end of the pin shall be pointed and the other end crowned to the dimensions specified in Table 2. On the pointed end, the edge formed by the surface of point and the end of the pin may be slightly rounded or broken.

2.2.2 Point Concentricity. For pins having nominal lengths equal to four times the basic pin diameter and longer, the concentricity between the diameter of point and the pin diameter shall be such that the minimum length of point on the pin is not less than 0.3 mm (see Fig. 1).

2.3 Length

2.3.1 Measurement. The length of hardened ground machine dowel pins shall be measured overall from end-to-end, parallel to the pin axis.

2.3.2 Tolerance on Length. The tolerance on the length of hardened ground machine dowel pins shall be +0.0–0.5 mm for all sizes and lengths.

2.3.3 Preferred Lengths. The preferred sizes and lengths in which hardened ground machine dowel pins are normally available are depicted in Table 2. Other sizes and lengths are produced as required by the purchaser.

2.3.4 Effective Length. The effective length, L_e, (that portion of the pin length bounded by the length of point on one end and the radius of crown on the other) on short dowel pins shall

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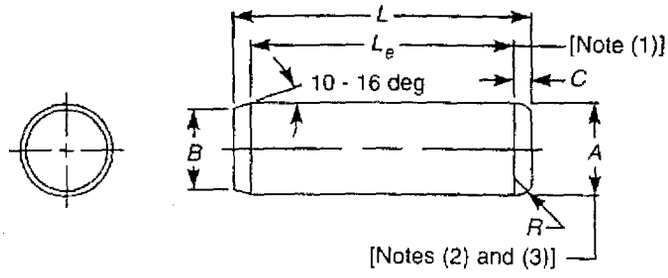

Table 1 Dimensions of Hardened Ground Machine Dowel Pins

Nominal Pin Size	Pin Diameter — A				B		C	R	L[1]
	Standard Series		Oversize Series		Point Diameter		Crown	Radius	Nom
	Max	Min	Max	Min	Max	Min	Max	Min	Min
1.5	1.508	1.503	1.530	1.525	1.4	1.2	0.6	0.2	3.5
2.0	2.008	2.003	2.030	2.025	1.9	1.7	0.6	0.2	3.5
2.5	2.508	2.503	2.530	2.525	2.4	2.2	0.7	0.3	4.0
3.0	3.008	3.003	3.030	3.025	2.9	2.6	0.8	0.3	4.0
4.0	4.009	4.004	3.031	4.026	3.9	3.6	0.9	0.4	4.5
5.0	4.009	5.004	5.031	5.026	4.9	4.6	1.0	0.4	4.5
6.0	6.010	6.004	6.032	6.026	5.8	5.4	1.1	0.4	5.0
8.0	8.012	8.006	8.034	8.028	7.8	7.4	1.3	0.5	5.5
10.0	10.012	10.006	10.034	10.028	9.8	9.4	1.4	0.6	6.0
12.0	12.013	12.007	12.035	12.029	11.8	11.4	1.6	0.6	6.0
16.0	16.013	16.007	16.035	16.029	15.8	15.3	1.8	0.8	7.0
20.0	20.014	20.008	20.036	20.030	19.8	19.3	2.0	0.8	7.0
25.0	25.014	25.008	25.036	25.030	24.8	24.3	2.3	1.0	7.5

NOTES:
1. See Para. 2.3.4.
2. See Para. 2.3.5.
3. Reference ANSI Y14.5M Dimensioning & Tolerancing:

Characteristic	Symbol
Straightness	—
Diameter	ø

not be less than 75% of the overall length of the pin. For the pin lengths affected, it may be necessary to deviate from the specified dimensions by reducing the crown radius and height, or increasing the point angle, or both. The minimum nominal length listed in Table 1 is the shortest standard length to accommodate the minimum effective requirement with standard end configurations.

2.3.5 Straightness. Machine dowel pins shall be straight over the effective length within a cumulative total of 0.013 mm per 25 mm of length for nominal lengths, up to and including 100 mm, and within 0.05 mm total for all nominal lengths over 100 mm.

2.4 Surface Roughness

The surface roughness on hardened ground machine dowel pins shall not exceed 0.2 µm arithmetical average on the effective length nor 3.2 µm arithmetical average on all other surfaces. Refer to ANSI/ASME B46.1.

Table 2 Preferred Sizes and Lengths of Hardened Ground Machine Dowel Pins

Nominal Length	Nominal Size												
	1.5	2	2.5	3	4	5	6	8	10	12	16	20	25
6	×	×	×										
8	×	×	×	×									
10	×	×	×	×	×								
12	×	×	×	×	×	×							
16		×	×	×	×	×	×	×					
20		×	×	×	×	×	×	×	×				
25			×	×	×	×	×	×	×	×			
30				×	×	×	×	×	×	×	×		
35					×	×	×	×	×	×	×		
40					×	×	×	×	×	×	×	×	
45						×	×	×	×	×	×	×	
50						×	×	×	×	×	×	×	×
60							×	×	×	×	×	×	×
70								×	×	×	×	×	×
80								×	×	×	×	×	×
90								×	×	×	×	×	×
100									×	×	×	×	×
110										×	×	×	×
120										×	×	×	×
130											×	×	×
140											×	×	×
150											×	×	×

Surface Texture. For pins having additive finishes, these limits shall apply prior to coating or plating.

2.5 Materials

2.5.1 Steel. Hardened ground machine dowel pins shall be made from any carbon or alloy steel capable of being heat treated to a core hardness of 50 HRC minimum and having sulphur and phosphorus content not in excess of 0.05 and 0.04%, respectively.

2.5.2 Heat Treatment. Pins shall be hardened by quenching in oil from the austenitizing temperature and tempering to meet the following conditions:

2.5.2.1 Case Hardened Pins. Pins shall be case hardened to a minimum case depth of 0.25 mm for nominal pin sizes 4 mm or smaller and 0.38 mm for nominal pins larger than 4 mm. The case shall have a minimum surface hardness of 90HR15N (60 HRC) or equivalent, and the core hardness shall be 50-58 HRC. The microstructure shall be tempered martensite.

2.5.2.2 Through Hardened Pins. Pins smaller than 3 mm nominal size may be tempered martensite through hardened to a hardness of

50-58 HRC as an option to Para. 2.5.2.1. However, in no instance shall the hardness of the pin surface be softer than that of the core. The microstructure shall be tempered martensite.

2.6 Finishes

Unless otherwise specified, machine dowel pins shall be furnished with a ground (as processed) finish or with black oxide coating as an option. Other protective or decorative finishes, where required, shall be subject to agreement between the manufacturer and purchaser. However, where a finish applied to carbon or alloy steel pins is such that it might produce hydrogen embrittlement, the pins shall be baked for a suitable time at a temperature that will minimize such embrittlement. Baking shall be accomplished as soon as possible following the plating or coating operation inasmuch as delay is detrimental to achievement of the desired results. Where additive type finishes are used, the tabulated dimensions and tolerances shall apply to the pins prior to application of the plating or coating, unless otherwise specified by the purchaser.

2.7 Workmanship

Hardened ground machine dowel pins shall be free from detrimental burrs, cracks, seams or nicks, and other defects affecting their serviceability or properties.

2.8 Designation

Hardened ground machine dowel pins conforming to this standard shall be designated by the following data in the sequence shown:

(a) specification (ASME/ANSI document) number followed by a dash;
(b) nominal pin diameter followed by "x";
(c) length;
(d) product name, including "Standard" or "Oversize" as needed;
(e) protective finish, if required

Examples:

B18.8.5M — 1.5 x 12, Oversize Dowel Pin.

B18.8.5M — 16 x 45, Standard Dowel Pin, Zinc Plated, ASTM B633 Type II.

3. QUALITY ASSURANCE PROVISIONS

Unless otherwise specified by the purchaser, acceptability of hardened ground machine dowel pins shall be based on conformance with the requirements specified in ASME/ANSI B18.18.1M, Inspection and Quality Assurance for General Purpose Fasteners, page L–5.

4. APPLICATION INFORMATION

4.1 Responsibility for Modifications

The manufacturer shall not be held responsible for malfunctions of pins determined to be due to plating or other modifications when such plating or modification is not accomplished under the manufacturer's control or direction.

4.2 Installation Warning

Dowel pins should **not** be installed by striking or hammering and when installing with a press, a shield should be used and safety glasses worn. Hardened ground machine dowel pins shall have sufficient ductility to withstand being pressed into the recommended holes without cracking or shattering.

APPENDIX A

APPLICATION INFORMATION

(This Appendix is an integral part of ASME B18.8.5M-1994 and is placed after the main text for convenience.)

A1 Hole Sizes

Because of the wide variety of materials in which dowel pins are used and the many design requirements which must be considered, it is not possible to provide hole size recommendations that will be suitable for all applications. However, the suggested hole sizes in Table A1 have been commonly used for press fitting Standard series dowel pins into materials such as mild steels and cast iron. In soft materials, such as aluminum or zinc die castings, hole size limits are usually decreased by 0.013 mm to increase the press fits. Holes for Oversize series machine dowel pins may best be determined by the user to suit the particular application.

A2 Shear Strength

For design calculations, the shear strength of these Standard pins should be based on the values listed in Table A2.

Table A1 Suggested Hole Sizes

Nominal Pin Size	Hole Diameter Standard Series Pins	
	Max	Min
1.5	1.500	1.487
2.0	2.000	1.987
2.5	2.500	2.487
3.0	3.000	2.987
4.0	4.000	3.987
5.0	5.000	4.987
6.0	6.000	5.987
8.0	8.000	7.987
10.0	10.000	9.987
12.0	12.000	11.985
16.0	16.000	15.985
20.0	20.000	19.983
25.0	25.000	24.983

Table A2 Shear Strength — kN

Nominal Pin Size	Calculated Single Shear Load for Steel Material
1.5	1.86
2.0	3.30
2.5	5.15
3.0	7.40
4.0	13.2
5.0	20.6
6.0	29.7
8.0	52.5
10.0	82.5
12.0	119
16.0	211
20.0	330
25.0	515