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AMERICAN NATIONAL STANDARD

Spindle Noses and Tool Shanks for Horizontal Boring Machines

ANSI B5.40 - 1977

(REVISION OF B5.40-1968)

SECRETARIAT

SOCIETY OF AUTOMOTIVE ENGINEERS
SOCIETY OF MANUFACTURING ENGINEERS
NATIONAL MACHINE TOOL BUILDERS' ASSOCIATION
THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

PUBLISHED BY

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

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FOREWORD

The first committee organized to consider standard spindle nose construction for horizontal boring machines was one appointed by the National Machine Tool Builders' Association. This was in the year of 1947. In August of 1948, the ASA was petitioned by this committee to assume responsibility for further work; and in January, 1949, Sectional Committee B5 set up Technical Committee 29 for this purpose. Mr. K. F. Gallimore of Giddings & Lewis was appointed chairman. Producer companies were represented by Mr. Charles De Vlieg of the De Vlieg Machine Company, Mr. John M. Walter of the G. A. Gray Company, and Mr. H. N. Stephan of Lucas Machine Tool Company, all of whom had worked with Mr. Gallimore on the NMTBA committee. At the same time Mr. C. R. Phiffer of General Electric, Mr. F. E. Walton of General Motors Corporation, and a representative from the Bureau of Ships were added to the committee to represent users.

Mr. Gallimore turned over the chairmanship to Mr. R. M. Woytych of Giddings & Lewis in September, 1950. The committee, during this time and until the end of 1953, was unable to resolve the problem of holding tools in the milling machine taper series because of the number of "quick change" devices developed by producers at this time, although agreement was obtained in setting up the milling machine taper as standard, excluding the self-holding tapers as represented by the Morse and 3/4 inch per foot tapers.

The NMTBA was successful in reviving interest in the committee work, and Mr. E. L. McFerren of Giddings & Lewis was appointed chairman of TC 29 in February, 1954. In meetings held in 1955, this committee attempted standardization following current practice using the self-holding tapers as well as the milling machine tapers and invited other producer companies to send representatives. These included Morton Manufacturing Company, Ohio Machine Company, The Bullard Company, Kempsmith Machine Company, and Ingersoll Milling Machine Company, in addition to the regular members of TC 29.

In October, 1956, the chairmanship passed to Mr. W. L. McCann of Giddings & Lewis, and the membership was revised during 1958 as follows: Mr. Carl Pearson of General Motors replaced Mr. F. E. Walton, Mr. R. A. Jerue of De Vlieg Machine Company replaced Mr. Charles De Vlieg, Mr. D. I. Alkire of Aluminum Company of America replaced Mr. W. J. Pearson of Bethlehem Steel Company, and Mr. W. E. Meinke of Lucas replaced Mr. H. N. Stephan. After several meetings held in 1958 and 1959, this committee was successful in setting up the present standard. Acceptance by committee members was made by June, 1960.

After review of the first draft of the standard, the committee met February 7, 1967 and added an optional simultaneous fit between tool shank and spindle nose. This construction has obtained considerable use where more rigidity of the tool shank is desired compared to that obtained by contact of taper only.

Following approval by the sponsor organizations the proposal was approved by the American Standards Association on August 8, 1962.

In June 1966 the committee met and proposed that the standard be changed so that the dimensional data conform to the USA Standard Decimal Inch, USAS B87.1–1965. Following approval of the changes by the Technical Committee the proposed revision was approved by the USA Standards Committee (formerly, Sectional Committee) and the sponsors. It was approved by the USA Standards Institute on April 5, 1968.

Mr. E. E. Johnson of Giddings & Lewis was appointed Chairman of the committee in March 1967 replacing Mr. W. L. McCann.

Mr. S. E. Klabunde of Giddings & Lewis was appointed chairman of the committee in November, 1974 replacing Mr. E. E. Johnson.

During 1975, the committee membership was revised. Mr. Richard Carroll of Lucas replaced Mr. J. H. Stephan of Lucas. Mr. Peter J. Cassaro of Ingersoll replaced Mr. K. B. Kaiser of Ingersoll. Mr. A. Grau, Jr. of ALCOA replaced Mr. David I. Alkire of ALCOA. Mr. J. R. Ruff of the Navy replaced Mr. J. N. Cornette of the Navy.

In May 1976, the committee proposed a revised version of the standard. The revisions involved a metric standard for Type D steep tapers and several minor revisions.

The revision was approved by American National Standards Committee B5 and by ANSI as an American National Standard on January 20, 1977.

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AMERICAN NATIONAL STANDARD

SPINDLE NOSES AND TOOL SHANKS FOR HORIZONTAL BORING MACHINES

1. GENERAL

1.1 Object and Scope

This standard establishes (1) the American practice for the construction of spindle noses for horizontal boring machines by showing a number of types of such construction, (2) the important dimensions for self-holding and steep machine tapers as well as drive keys, draw bolts, drift and keeper key slots, bolt circles for face mounting of milling cutters, etc., (3) the corresponding dimensions for the taper shanks for construction of tools (boring bars, arbors, etc.) to fit the spindle nose tapers.

The purpose of such construction is to provide an accurately machined socket to locate tools with means to positively hold them in position in the spindle as well as with means to positively drive the tools.

In many of the tables, reference is made to another standard on machine tapers, American National Standard Machine Tapers B5.10–1963 (R1972), in which basic dimensions and tolerances for tapers used in this standard are tabulated. Other tolerances pertaining only to horizontal boring machine spindle noses are given in tables of this standard. The object is to establish data for tapers that will be universally used. Wherever keys are used as a driving means, they are detailed completely with the purpose that these perishable parts can be made to fit all spindles complying with the standard.

Because of the lack of such a standard as this, many spindle nose constructions have appeared and are in use. This standard limits the accepted number of constructions; and for those other constructions that have wide use, an appendix is supplied so that dimensions and tolerances can be applied.

1.2 Definition

Horizontal boring machines are built with a number of constructions for the spindle, but in all of them, the spindle itself moves out horizontally from the headstock. It may be supported by a rotating sleeve which can also move out horizontally as a quill, or it may be mounted in a square or rectangular ram which moves out horizontally. Perhaps the most common construction is the former, and an attempt will be made in the future to standardize dimensions for the rotating sleeve which supports the spindle, because tools, especially milling cutters, are manufactured to be mounted directly on the sleeve. Another spindle mounting construction for horizontal boring machines, which has greater usage in Europe than in the U.S., is the face plate drive with or without continuous facing slides. Unless there is a demand for it, no attempt will be made to standardize this construction.

The types of spindle nose construction herein standardized make use of two series of tapers as defined in American National Standard Machine Tapers B5.10–1963 (R1972). They are the Self-Holding Taper series and the Steep Taper series. In all types, a means of holding the taper shank securely in the socket is used, either a keeper key or a draw bolt. The driving means of the tool is a variant in the different types beginning with Type A which has only the friction between the self-holding taper socket and shank to transmit driving torque. Types B, C1, and C2 depend on the positive drive from keys embedded in the spindle nose. Type D is also a positive drive from keys either integral with the spindle or embedded in it; however, the taper is a steep taper. The Appendix shows a third variation of driving means in Type E.

Arbitrarily, this standard shows and recommends spindle nose constructions for sizes of spindles in integral inches, with the exception of the fractional sizes of 2½ and 3½ inches. There have been many variations from this practice, notably 3¾ and $5^{1}/_{16}$ inches in this country. Spindle diameters in integral millimeters are also recommended for steep taper spindle nose units. Tapers are ISO 297 Standard.

Many designs of "Quick Change" constructions using the steep taper series have been eliminated in

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favor of the standard draw bar construction as shown in ANSI Standard Spindle Noses and Arbors for Milling Machines, B5.18–1972. This is possible because of the wide use of power draw bolt constructions using this shank.

Shown in this standard are tabulated data for obtaining simultaneous fits for each of the different types of tapers. The tool shank flange bears against the face of the spindle at the same time as the tool shank taper bears within the spindle taper socket. Such a fit results in the maximum rigidity for the tool shank. Simultaneous fits restrict the amount of "Draw" or axial movement of the tool shank after mating tapered surfaces have contacted. This restriction prevents the sticking of the tool shank in the spindle taper socket and is especially desirable when using power draw bolts with slow tapers.

1.3 Gaging

As stated in American National Standard B5.10–1963 (R1972), and repeated here, the reference gage for ANSI self-holding tapers and steep tapers is a tapered plug gage for sockets in spindles and tapered ring gage for tools, etc., to fit them. Tables 6, 7, 9, and 10 of American National Standard B5.10–1963 (R1972) give the dimensions and tolerances for plug and ring gages applying to the above mentioned tapers. Reference is made in each of the tables of this standard to the above tables.

Special variations of the plug and ring gages must be used to produce the "Simultaneous Fit." This variation is shown in Table 12 of this standard.

1.4 Appendix

Tables A1 and A2 are a widely used "Slot Nose Drive" construction, but discarded for standardization in favor of the key drive construction of Type B. Tables A3 and A4 are Type D construction of intermediate sizes which are not standard and their use is to be discouraged, but use has been sufficient to include here for the purpose of standardization of dimensions.

2. NOMENCLATURE

2.1 Basic Size

The nominal size from which the limits of size for a dimension are derived by the application of the allowance and tolerance.

2.2 Draw

Is the amount of axial movement of the tool shank within the spindle taper socket after the mating tapered surfaces have contacted.

2.3 Drift or Drift Key

A flat tapered bar for forcing the taper shank out of its socket.

2.4 Drift Slot

A slot through the socket at the small end of the tapered hole to receive a drift for forcing taper shanks out of the socket.

2.5 Exposed Length

The distance the large end of the taper shank projects from the drive socket or large end of the taper ring gage.

2.6 Gage Line

The axial position on a taper where the diameter is equal to the basic large end diameter of the specified taper.

2.7 Keeper Key

A method of retaining a shank in the socket by means of a tapered retaining key placed through the shank and spindle.

2.8 Keeper Slot

A cross slot in a tool shank or adapter to receive a tapered retaining key.

2.9 Key Drive

A method of driving the tool by an external rectangular key.

2.10 Morse Taper

A system of tapers originated by the Morse Twist Drill and Machine Company with a nominal taper per foot of $\frac{5}{8}$ inch, on which ANSI Tapers Numbers 4, 5, 6, and 7 are based.

2.11 Over-all Length of Shank

Total length from large end of taper to end of tang.

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2.12 Self-Holding Taper

A taper with an angle small enough to hold a shank in place ordinarily by friction without other holding means (sometimes referred to as slow taper) and one which insures the rotation of the tool with the socket.

2.13 Simultaneous Fit

Special tolerances and dimensions applied to tool shank and spindle taper socket. The resulting construction allows the tool shank taper to make initial contact with the spindle taper socket, and upon tightening by draw bolt, front spindle bolts, or keeper key, the back flange of the tool is drawn tight against the front spindle face.

2.14 Slot Nose Drive

Spindle nose construction with integral projections standing out from the gage line to drive tools with corresponding flats.

2.15 Socket

The part of a machine tool spindle or adapter which is designed to receive and locate the tapered shank of a tool, or arbor.

2.16 Spindle

The cylindrical tool holding part of a horizontal boring machine in which the various types of nose constructions, as described in this standard, are used.

2.17 Spindle Sleeve

The cylindrical rotating part of a horizontal boring machine spindle construction mounted in bearings through which the spindle moves horizontally in and out. It projects and usually carries driving keys and tapped hole patterns for bolting tools or attachments.

2.18 Stand Out

The distance which keys extend in front of the gage line.

2.19 Steep Taper

A taper having an angle sufficiently large to insure the easy or self-releasing feature.

2.20 Tang (Tongue)

The flattened end of a taper shank.

2.21 Taper per Foot

The difference in diameter between two points 12 inches apart measured along the axis.

2.22 Taper Shank

The tapered part of a tool which serves to center the tool in a socket.

2.23 Tolerance

The total amount of variation permitted in the size of a part.

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SPINDLE NOSES AND TOOL SHANKS
FOR HORIZONTAL BORING MACHINES

Table 1 Tapers Used in Horizontal Boring Machines Shanks; Methods of Driving, Holding and Ejecting

No. of Taper	Taper per Foot	Taper[2] per Inch	Diameter[1] at Gage Line	Origin of Series	Spindle Diameter Inches	Method Of:						
						Driving		Retaining Shank			Shank Ejection	
						Taper	Key	Self-Holding Taper	Keeper Key	Draw Bolt	Drift	Draw Bolt
						Table Number						
4	0.62326	0.051938	1.23100	Morse Taper Series	2.5, 3	2	4	2, 4	2, 4		2, 4	
5	0.63151	0.052626	1.74800		3, 4	2	4	2, 4	2, 4		2, 4	
6	0.62565	0.052138	2.49400		4, 5	2	4	2, 4	2, 4		2, 4	
7	0.62400	0.052000	3.27000		5, 6, 7, 8, 9, 10, 12	2	4	2, 4	2, 4		2, 4	
200	0.750	0.062500	2.000	¾ Inch per Foot Taper Series	4		6, 8	6, 8	6	8	6	8
250	0.750	0.062500	2.500		5		6, 8	6, 8	6	8	6	8
300	0.750	0.062500	3.000		5, 6, 7		6, 8	6, 8	6	8	6	8
350	0.750	0.062500	3.500		8,9,10,12		6, 8	6, 8	6	8	6	8
400	0.750	0.062500	4.000		9		6	6	6		6	
450	0.750	0.062500	4.500		10		6	6	6		6	
500	0.750	0.062500	5.000		12		6	6	6		6	
40	3.500	0.291667	1.750	NMTBA Milling Machine Taper Series	2.5,3,3.5		10			10		10
45	3.500	0.291667	2.250		4		10			10		10
50	3.500	0.291667	2.750		4, 5, 6, 7		10			10		10
55	3.500	0.291667	3.500		6		10			10		10
60	3.500	0.291667	4.250		8, 10, 12		10			10		10

All dimensions given in inches.
[1] Calculated from taper foot which is basic.
[2] The basic diameter at gage line is at or near large end of taper.

Basic dimensions in Tables 2 through 11 are taken from Tables of American National Standard Machine Tapers, B5.10–1963 (R1972).

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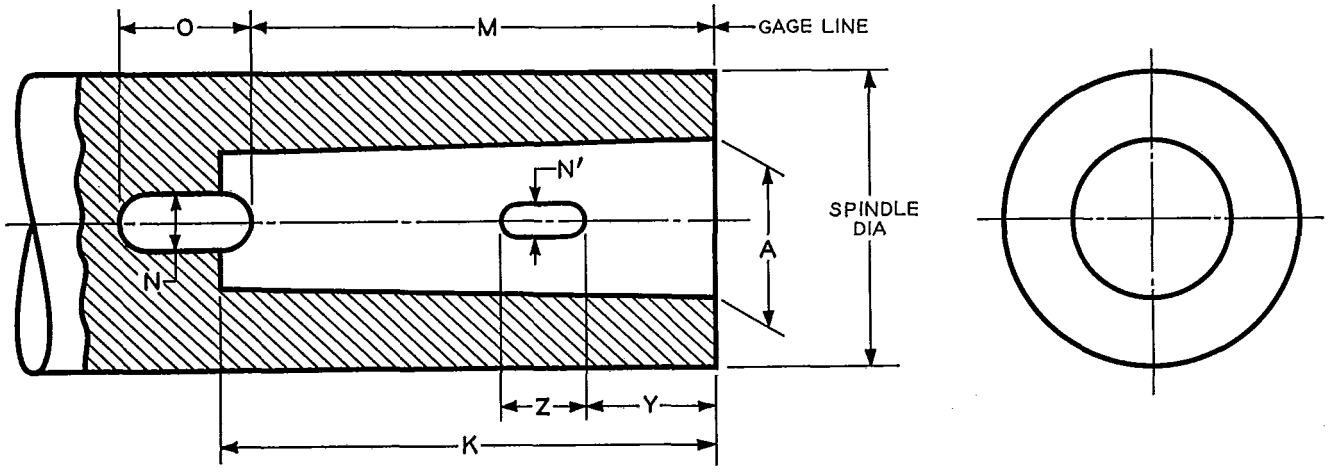


Table 2 Type A: Taper Drive with Shank Retained by Keeper Key

Spindle Diameter	Taper		Taper Socket						
	No.	Diameter[1] at Gage Line	Min. Depth of Tapered Hole	Drift Slot[2]			Keeper Slot[2]		
				Gage Line to Front of Slot	Width	Length	Gage Line to Front of Slot	Length	Width
		A	K	M	N	O	Y	Z	N'
2.5	4	1.231	4.12	3.88	0.484	1.25	1.50	1.25	0.391
3	5	1.748	5.25	4.94	0.656	1.50	2.12	1.50	0.516
4	6	2.494	7.33	7.00	0.781	1.75	2.25	1.75	0.641
5	7	3.270	10.08	9.50	1.156	2.62	2.62	1.81	0.766
6	7	3.270	10.08	9.50	1.156	2.62	2.62	1.81	0.766

All dimensions given in inches.
[1] See Table (6) American National Standard B5.10–1963 (R1972) for Plug Gage Dimensions.
[2] Edges at extreme sides of Slots (N) and (N') shall be chamfered at 45° – 0.06 inch deep.

NOTES

1. Type A Construction not recommended for Spindle diameters over 6 inches.
2. Type A Construction is recommended for drilling and boring Spindles only.
3. These Taper Sockets are identical with Taper Sockets shown in Table (3) American National Standard B5.10–1963 (R1972).

TOLERANCES

(A) Diameter of Hole at Gage Line + 0.000 – 0.002
(N) and (N') width No. 4 and No. 5 Taper + 0.006 – 0.000
No. 6 and No. 7 Taper + 0.008 – 0.000
(N) and (N') centrality with centerline of Taper Hole 0.005 total indicator variation.
Taper Tolerance on Rate of Taper to be 0.001 inch per ft applied only in the direction which decreases Rate of Taper.
Two digit decimal Dimensions ± 0.010 unless otherwise specified.

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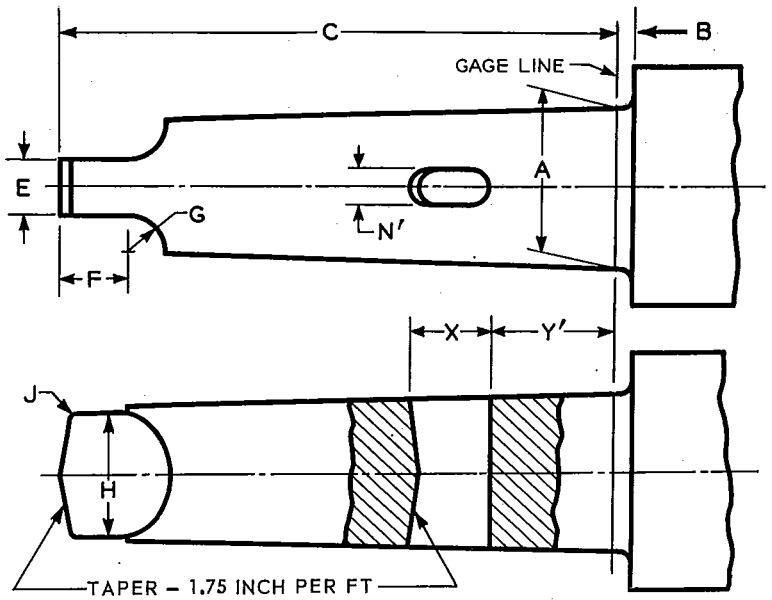


Table 3 Shank for Type A: Taper Drive with Shank Retained by Keeper Key

Taper		Shank							Keeper Slot[2]		
No.	Diameter[1] at Gage Line	Exposed Length	Gage Line to End of Shank	Thick-ness	Length	Radius of Cutter	Width	Radius	Gage Line to Bottom of Slot	Length	Width[2]
	A	B	C	E	F	G	H	J	Y′	X	N′
4	1.231	0.25	4.62	0.469	0.62	0.31	0.97	0.09	1.41	1.19	0.391
5	1.748	0.25	5.88	0.625	0.75	0.38	1.41	0.12	2.00	1.38	0.516
6	2.494	0.31*	8.25	0.750	1.12	0.50	2.00	0.16	2.12	1.62	0.641
7	3.270	0.38	11.25	1.125	1.38	0.75	2.62	0.19	2.50	1.69	0.766

All dimensions given in inches.
[1] See Table 7 of American National Standard B5.10-1963 (R1972) for Ring Gage Dimensions.
[2] Edges at extreme sides of Slot N′ shall be chamfered at 45° – 0.06 deep.

NOTE

These Taper Shanks are identical with Taper Shanks shown in Table (3) American National Standard B5.10-1963 (R1972).

TOLERANCES

(A) Diameter of Shank at Gage Line + 0.002 – 0.000
(E) Thickness of Tang No. 4 and No. 5 + 0.000 – 0.006
No. 6 and No. 7 + 0.000 – 0.008
(N′) Width of Slot No. 4 and No. 5 + 0.006 – 0.000
No. 6 and No. 7 + 0.008 – 0.000
(E) Centrality of Tang 0.005 Total Indicator Variation
(N′) Centrality of Slot 0.005 Total Indicator Variation

Taper Tolerance on Rate of Taper to be 0.001 inch per ft applied only in the direction which increases Rate of Taper.

Two digit Decimal Dimensions ± 0.010 unless otherwise specified.

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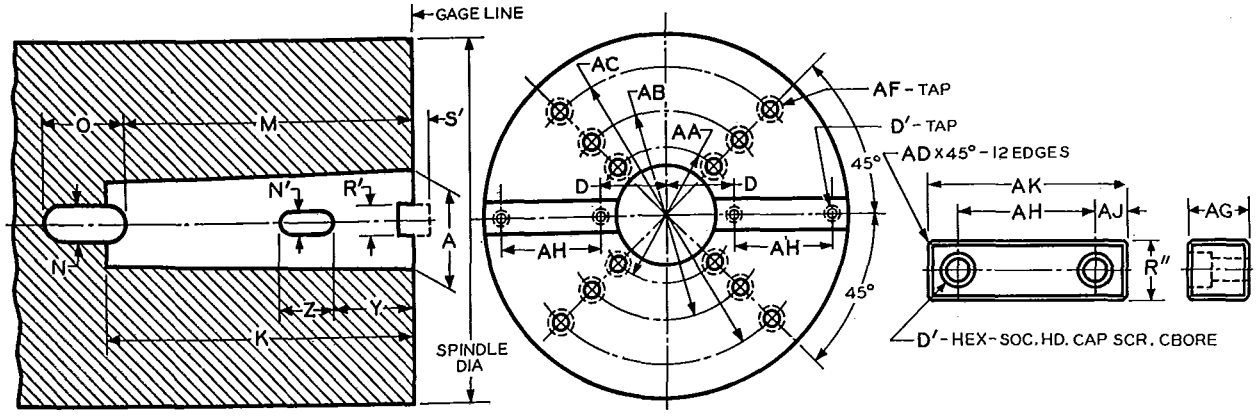


Table 4 Type B: Key Drive with Shank Retained by Keeper Key

Spindle Diameter	Taper		Taper Socket							Keyway			Key							Spindle Face			
	No.	Diameter at[1] Gage Line	Min. Depth of Tapered Hole	Drift Slot[2]			Keeper Slot[2]			Width	First Screw to Center Line	Standout of Key from Gage Line	Width	Distance between Screws	First Screw to Edge of Key	Length	Thickness	UNC-2B Hole UNC-3A Screw	Chamfer	Bolt Circle			UNC-2B Tapped Hole
				Gage Line to Front of Slot	Width	Length	Gage Line to Front of Slot	Length	Width														
		A	K	M	N	O	Y	Z	N'	R'	D	S'	R''	AH	AJ	AK	AG	D'	AD	AA	AB	AC	AF
2.5	4	1.231	4.12	3.88	0.484	1.25	1.50	1.25	0.391	0.500	0.94	0.25	0.499	—	0.25	0.50	0.50	10-24x0.62	0.03	—	—	—	—
3	4	1.231	4.12	3.88	0.484	1.25	1.50	1.25	0.391	0.500	1.06	0.25	0.499	—	0.38	0.75	0.50	10-24x0.62	0.03	—	—	—	—
4	5	1.748	5.25	4.94	0.656	1.50	2.12	1.50	0.516	0.750	1.44	0.38	0.749	—	0.50	1.00	0.75	0.3125-18	0.06	—	—	—	—
5	6	2.494	7.33	7.00	0.781	1.75	2.25	1.75	0.641	1.000	1.88	0.50	0.999	—	0.56	1.12	1.00	0.375-16	0.06	4.00	—	—	0.625-11
6	7	3.270	10.08	9.50	1.156	2.62	2.62	1.81	0.766	1.000	2.19	0.50	0.999	—	0.50	1.25	1.00	0.375-16	0.06	4.75	—	—	0.75-10
7	7	3.270	10.08	9.50	1.156	2.62	2.62	1.81	0.766	1.000	2.19	0.50	0.999	0.75	0.50	1.75	1.00	0.375-16	0.06	4.75	—	—	0.75-10
8	7	3.270	10.08	9.50	1.156	2.62	2.62	1.81	0.766	1.000	2.19	0.50	0.999	1.25	0.50	2.25	1.00	0.375-16	0.06	4.75	—	—	0.75-10
9	7	3.270	10.08	9.50	1.156	2.62	2.62	1.81	0.766	1.000	2.19	0.50	0.999	1.75	0.50	2.75	1.00	0.375-16	0.06	4.75	7.00	—	0.75-10
10	7	3.270	10.08	9.50	1.156	2.62	2.62	1.81	0.766	1.000	2.19	0.50	0.999	2.25	0.50	3.25	1.00	0.375-16	0.06	4.75	7.00	—	0.75-10
12	7	3.270	10.08	9.50	1.156	2.62	2.62	1.81	0.766	1.000	2.19	0.50	0.999	3.25	0.50	4.25	1.00	0.375-16	0.06	4.75	7.00	9.25	0.75-10

All dimensions given in inches.
[1] See Table 6, American National Standard B5.10-1963 (R1972) for Plug Gage Dimensions.
[2] Edges at extreme sides of Slots (N) and (N') shall be chamfered at 45° — 0.06 inch deep.

TOLERANCES

(A) Diameter of Hole at Gage Line + 0.000 — 0.002
(N) and (N') width No. 4 and No. 5 Taper + 0.006 — 0.000
No. 6 and No. 7 Taper + 0.003 — 0.000
(N) and (N') centrality with centerline of Taper Hole 0.005 Total Indicator Variation
(R') Keyway width + 0.000 —0.001
(R'') Key width + 0.000 — 0.001
(R') Centrality of Keyway with centerline of Taper 0.002 Total Indicator Variation.
(AH) Hole Spacing ± 0.005.
Taper Tolerance on Rate of Taper to be 0.001 inch per ft applied only in the direction which decreases Rate of Taper.
Two digit decimal Dimensions ± 0.010 unless otherwise specified.
(AF) Holes located as shown and within 0.010R of true position.

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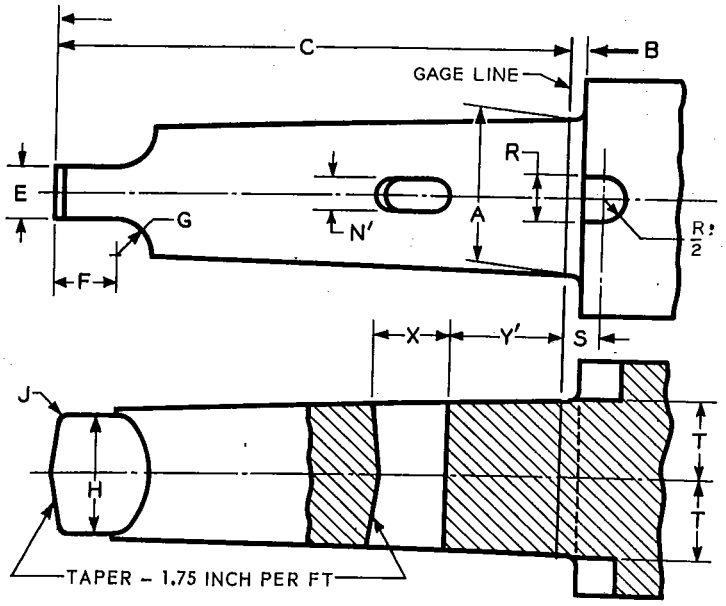


Table 5 Shank for Type B: Key Drive with Shank Retained by Keeper Key

Taper		Shank							Keeper Slot[2]			Keyway (Drive)		
No.	Diameter at[1] Gage Line	Exposed Length	Gage Line to End of Shank	Thickness	Length	Radius of Cutter	Width	Radius	Gage Line to Bottom of Slot	Length	Width[2]	Width	Center Line to Bottom of Keyway	Length to Center Line of Cutter
	A	B	C	E	F	G	H	J	Y'	X	N'	R	T	S
4	1.231	0.06	4.62	0.469	0.62	0.31	0.97	0.09	1.41	1.19	0.391	0.510	0.64	0.31
5	1.748	0.06	5.88	0.625	0.75	0.38	1.41	0.12	2.00	1.38	0.516	0.760	0.88	0.44
6	2.494	0.12	8.25	0.750	1.12	0.50	2.00	0.16	2.12	1.62	0.641	1.010	1.25	0.56
7	3.270	0.12	11.25	1.125	1.38	0.75	2.62	0.19	2.50	1.69	0.766	1.010	1.64	0.56

All dimensions given in inches.
[1] See Table (7) American National Standard B5.10-1963 (R1972) for Ring Gage Dimensions.
[2] Edges at extreme sides of Slot N' shall be chamfered at 45° – 0.06 inch deep.

NOTE

These Taper Shanks are identical with Taper Shanks shown in Table (3) American National Standard B5.10-1963 (R1972).

TOLERANCES

(A) Diameter of Shank at Gage Line + 0.002 – 0.000.
(E) Thickness of Tang No. 4 and No. 5 + 0.000 – 0.006.
No. 6 and No. 7 + 0.000 – 0.008.
(N) Width of Slot No. 4 and No. 5 + 0.006 – 0.000.
No. 6 and No. 7 + 0.008 – 0.000.
(E) Centrality of Tang 0.005 total indicator variation.
(N') Centrality of Slot 0.005 total indicator variation.
(R) Width of Drive Keyway + 0.010 – 0.000.
(R) Centrality of Keyway with centerline of shank 0.004 total indicator variation.
(T) Distance to Bottom of Keyway + 0.010 – 0.000.
Taper Tolerance on Rate of Taper to be 0.001 inch per ft applied only in the direction which increases Rate of Taper.
Two digit decimal Dimensions ± 0.010 unless otherwise specified.

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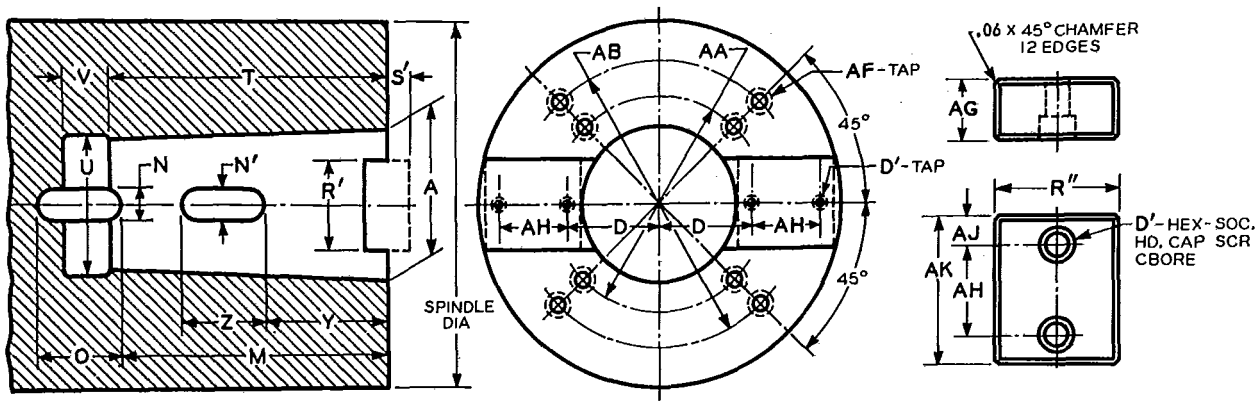


Table 6 Type C1: Key Drive with Shank Retained by Keeper Key

Spindle Diameter	Taper		Taper Socket									Keyway			Key						Spindle Face		
			Relief			Drift Slot[2]			Keeper Slot[2]												Bolt Circle		
	No.	Diameter at[1] Gage Line	Gage Line to Front of Relief	Diameter of Relief	Depth of Relief	Gage Line to Front of Slot	Width	Length	Gage Line to Front of Slot	Length	Width	Width	First Screw to Center Line	Standout of Key from Center Line	Width	Distance between Screws	First Screw to Edge of Key	Length	Thickness	UNC-2B Hole UNC-3A Screw			UNC-2B Tapped Hole
		A	T	U	V	M	N	O	Y	Z	N'	R'	D	S'	R"	AH	AJ	AK	AG	D'	AA	AB	AF
4	200	2.000	4.75	1.81	1.00	4.50	0.656	1.56	2.00	1.69	0.656	1.000	1.41	0.50	0.999	—	0.38	0.88	1.00	0.375-16	—	—	—
5	250	2.500	5.50	2.25	1.00	5.19	0.781	1.94	2.25	1.69	0.781	1.000	1.66	0.50	0.999	—	0.38	1.12	1.00	0.375-16	4.00	—	—
6	300	3.000	6.25	2.75	1.00	5.94	1.031	2.19	2.62	1.69	1.031	2.000	2.25	0.50	1.999	—	0.69	1.25	1.00	0.375-16	4.75	—	0.625-11
7	300	3.000	6.25	2.75	1.00	5.94	1.031	2.19	2.62	1.69	1.031	2.000	2.25	0.50	1.999	—	0.69	1.75	1.00	0.375-16	4.75	—	0.750-10
8	350	3.500	6.94	3.19	1.25	6.75	1.031	2.19	3.00	2.12	1.031	2.000	2.25	0.50	1.999	1.06	0.44	2.00	1.00	0.375-16	4.75	7.00	0.750-10
9	400	4.000	7.69	3.62	1.25	7.50	1.031	2.19	3.25	2.38	1.031	2.000	2.50	0.50	1.999	1.50	0.44	2.33	1.00	0.375-16	7.00	—	0.750-10
10	450	4.500	8.38	4.19	1.50	8.00	1.031	2.75	3.62	2.56	1.031	3.000	2.38	0.75	2.999	1.50	0.56	2.62	1.50	0.500-13	7.00	—	0.750-10
12	500	5.000	9.12	4.62	1.50	8.75	1.031	2.75	4.00	2.75	1.031	3.000	3.12	0.75	2.999	2.00	0.56	3.12	1.50	0.500-13	7.00	9.25	0.750-10

All dimensions given in Inches.

[1] See Table 6 American National Standard B5.10-1963 (R1972) for Plug Gage Dimensions.
[2] Edges at extreme sides of Slots N and N' shall be chamfered at 45° as follows:
Nos. 200 to 350 inclusive, 0.06 inch deep.
Nos. 400 to 500 inclusive, 0.09 inch deep.

TOLERANCES

(A) Diameter of Hole at Gage Line + 0.000 −0.002
(N') Width of Slot + 0.008 −0.000
(R') Width of Drive Keyway + 0.000 −0.001
(R") Width of Key + 0.000 −0.001
(N') Centrality of Slot 0.007 Total Indicator Variation
(R)' Centrality of Keyway 0.002 Total Indicator Variation
(AH) Hole spacing ± 0.005
Taper Tolerance on Rate of Taper to be 0.001 inch per ft applied only in direction which decreases Rate of Taper.
Two digit decimal Dimensions ± 0.010 unless otherwise specified.
(AF) Holes located as shown and within 0.010R of true position.

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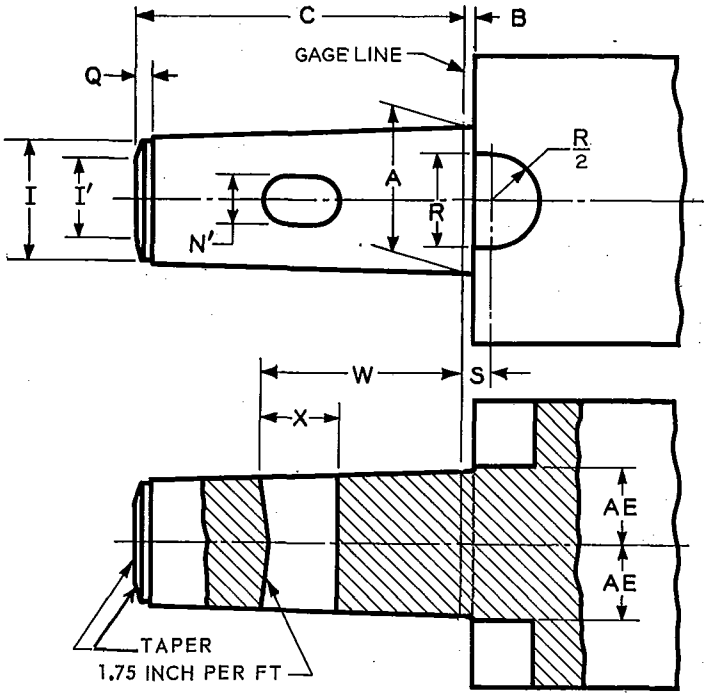


Table 7 Shank for Type C1: Key Drive with Shank Retained by Keeper Key

Taper		Shank					Keeper Slot			Keyway (Drive)		
No.	Dia at Gage Line[1]	Length from Gage Line	Exposed Length	Length of Relief	Dia of Relief	Dia of Flat	Gage Line to Back of Slot	Length	Width[2]	Width	Center Line to Bottom of Keyway	Length to Center Line of Cutter
	A	C	B	Q	I	I'	W	X	N'	R	AE	S
200	2.000	5.12	Min. 0.003 Max. 0.035 For All Sizes	0.25	1.61	1.33	3.44	1.56	0.656	1.010	1.005	0.56
250	2.500	5.83		0.25	2.06	1.38	3.69	1.56	0.781	1.010	1.255	0.56
300	3.000	6.62		0.25	2.50	1.62	4.06	1.56	1.031	2.010	1.505	0.56
350	3.500	7.44		0.31	2.94	2.00	4.88	2.00	1.031	2.010	1.755	0.56
400	4.000	8.19		0.31	3.31	2.12	5.31	2.25	1.031	2.010	2.005	0.56
450	4.500	9.00		0.38	3.81	2.38	5.88	2.44	1.031	3.010	2.255	0.81
500	5.000	9.75		0.38	4.25	2.50	6.44	2.62	1.031	3.010	2.505	0.81

All dimensions given in inches.
[1] See Table 7 American National Standard B5.10-1963 (R1972) for Ring Gage Dimensions.
[2] Edges at extreme sides of Slot N' shall be chamfered at 45° as follows:
Nos. 200–350 inclusive, 0.06 inch deep;
Nos. 400–500 inclusive, 0.09 inch deep.

NOTE

These Taper Shanks are identical with Taper Shanks shown in Table 4 American National Standard B5.10-1963 (R1972).

TOLERANCES

(A) *Dia of Shank at Gage Line* + 0.002 −0.000
(N') Width of Slot + 0.008 −0.000
(N') Centrality of Slot with Center Line of Spindle 0.007 Total Indicator Variation
(R) Width of Drive Keyway + 0.010 −0.000
(AE) Distance of Bottom of Keyway to Center Line of Taper + 0.010 −0.000
(R) Centrality of Keyway with Center Line of Spindle 0.004 Total Indicator Variation
Taper Tolerance on Rate of Taper 0.001 inch per ft applied only in the direction which increases Rate of Taper.
Two digit decimal Dimensions ± 0.010 unless otherwise specified

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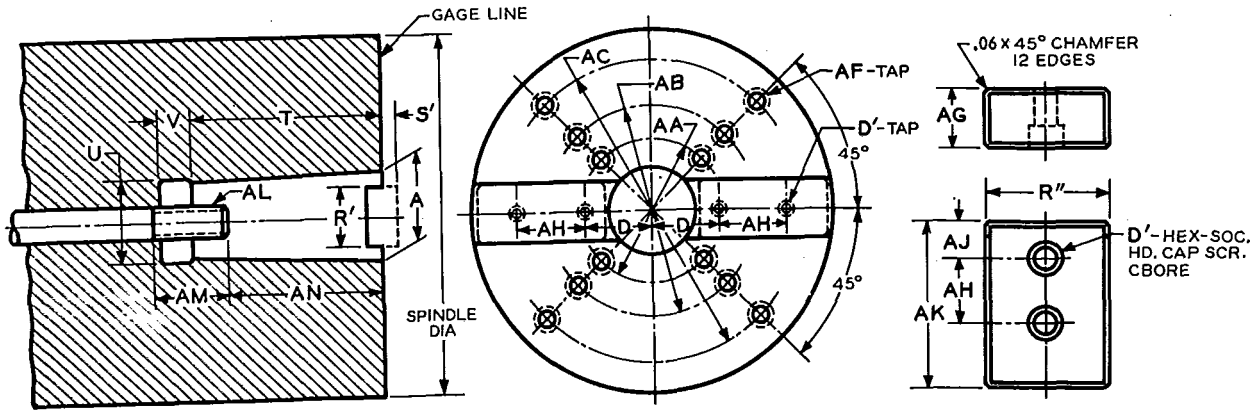


Table 8 Type C2: Key Drive with Shank Retained by Draw Bolt

Spindle Diameter	Taper		Relief			Draw Bolt			Keyway			Key						Spindle Face			
	No.	Diameter at[1] Gage Line	Gage Line to front of Relief	Diameter of Relief	Depth of Relief	Min Distance from Gage Line to D.B.	Length of Effective Thread	UNC-3A Thread	Width	First Screw to Center Line	Standout of Key from Gage Line	Width	Distance between Screws	First Screw to Edge of Key	Length	Thickness	UNC-2B Hole UNC-3A Screw	Bolt Circle			UNC-2B Tapped Hole
		A	T	U	V	AN	AM	AL	R'	D	S'	R"	AH	AJ	AK	AG	D'	AA	AB	AC	AF
4	200	2.000	4.75	1.81	1.00	3.75	2.00	0.875-9	1.000	1.41	0.50	0.999	—	0.38	0.83	1.00	0.375-16	—	—	—	—
5	250	2.500	5.50	2.25	1.00	4.50	2.00	0.875-9	1.000	1.66	0.50	0.999	—	0.38	1.12	1.00	0.375-16	4.00	—	—	0.625-11
6	300	3.000	6.25	2.75	1.00	5.12	2.00	1.000-8	2.000	2.25	0.50	1.999	—	0.69	1.25	1.00	0.375-16	4.75	—	—	0.750-10
7	300	3.000	6.25	2.75	1.00	5.12	2.38	1.000-8	2.000	2.25	0.50	1.999	—	0.69	1.75	1.00	0.375-16	4.75	—	—	0.750-10
8	350	3.500	6.94	3.19	1.25	6.00	2.38	1.000-8	2.000	2.25	0.50	1.999	1.06	0.44	2.00	1.00	0.375-16	4.75	7.00	—	0.750-10
9	350	3.500	6.94	3.19	1.25	6.00	2.38	1.000-8	2.000	2.25	0.50	1.999	1.56	0.44	2.50	1.00	0.375-16	4.75	7.00	—	0.750-10
10	350	3.500	6.94	3.19	1.25	6.00	2.38	1.000-8	2.000	2.25	0.50	1.999	2.06	0.44	3.00	1.00	0.375-16	4.75	7.00	—	0.750-10
12	350	3.500	6.94	3.19	1.25	6.00	2.38	1.000-8	2.000	2.25	0.50	1.999	3.08	0.44	4.00	1.00	0.375-16	4.75	7.00	9.25	0.750-10

All dimensions given in inches.
[1] See Table 6 American National Standard B5.10-1963 (R1972) for Plug Gage Dimensions.

TOLERANCES

(A) Diameter of Hole at Gage Line + 0.000 −0.002
(R') Width of Drive Keyway + 0.000 −0.001
(R") Width of Key + 0.000 −0.001
(R') Centrality of Keyway 0.002 Total Indicator Variation
(AH) Hole Spacing ± 0.005

Taper Tolerance on Rate of Taper to be 0.001 inch per ft applied only in direction which decreases Rate of Taper
Two digit Decimal Dimensions ± 0.010 unless otherwise specified.
(AF) Holes located as shown and within 0.010 R of true position.

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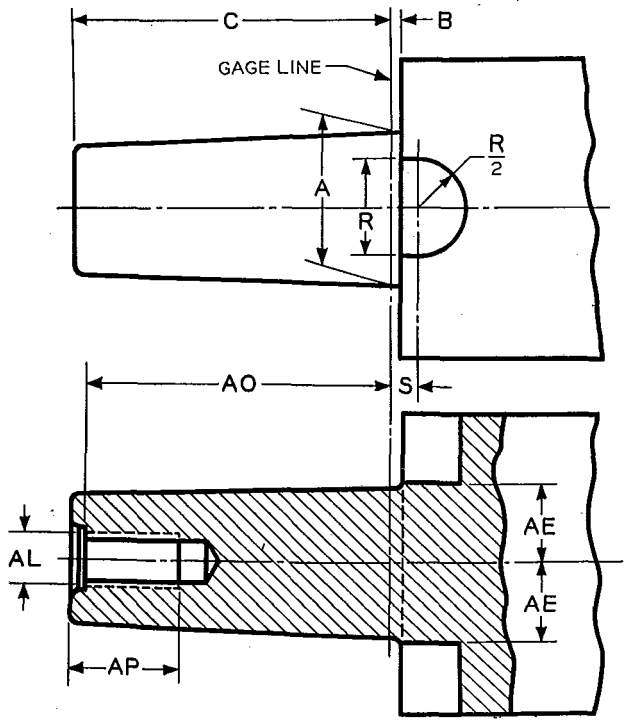


Table 9 Shank for Type C2: Key Drive with Shank Retained by Draw Bolt

Taper		Shank		Keyway (Drive)			Draw Bolt Hole		
No.	Diameter[1] at Gage Line	Length from Gage Line	Exposed Length	Width	Center Line to Bottom of Keyway	Length to Center Line of Cutter	Gage Line to First Thread	Depth of Thread	UNC-2B Hole
	A	C	B	R	AE	S	AO	AP	AL
200	2.000	5.12	Min. 0.003 Max. 0.035 All Sizes	1.010	1.005	0.56	4.78	1.75	0.875-9
250	2.500	5.88		1.010	1.255	0.56	5.53	1.75	0.875-9
300	3.000	6.62		2.010	1.505	0.56	6.19	2.00	1.000-8
350	3.500	7.44		2.010	1.755	0.56	7.00	2.00	1.000-8

All dimensions given in inches.
[1] See Table 7 American National Standard B5.10-1963 (R1972) for Ring Gage Dimensions.

NOTE

These Taper Shanks are identical with Taper Shanks shown in Table 5 American National Standard B5.10-1963 (R1972).

TOLERANCES

(A) Diameter of Shank at Gage Line + 0.002 −0.000
(R) Width of Drive Keyway + 0.010 −0.000
(AE) Distance of Bottom of Keyway to Center Line of Taper + 0.010 −0.000
(R) Centrality of Keyway with Center Line of Shank 0.004 Total Indicator Variation
Taper Tolerance on Rate of Taper 0.001 inch per ft applied only in the direction which increases Rate of Taper
Two digit decimal Dimensions ± 0.010 unless otherwise specified.

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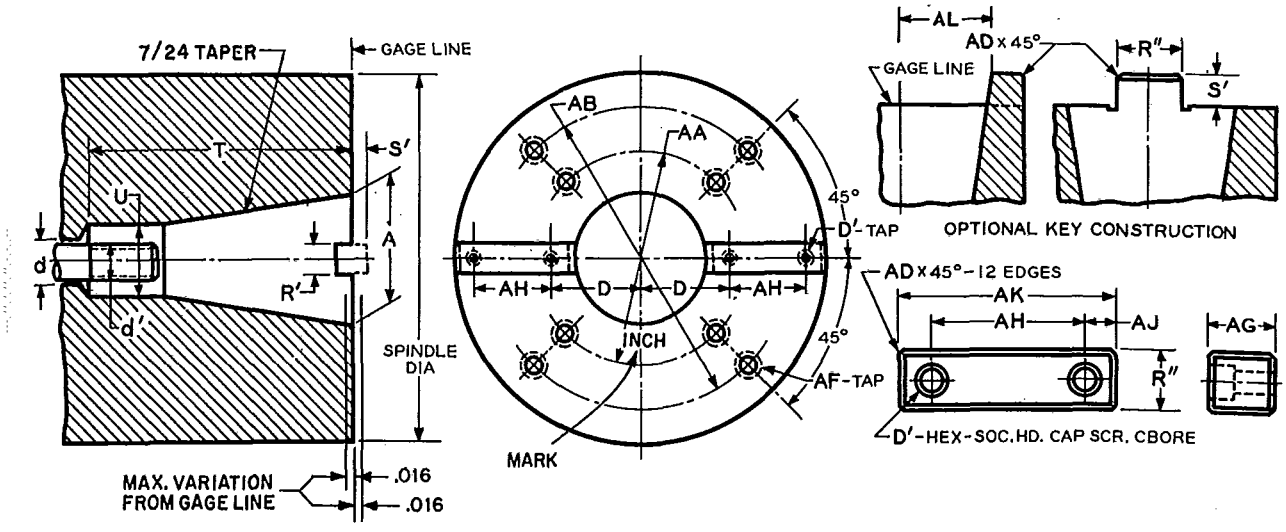


Table 10 Type D: Steep Taper with Key Drive and Draw Bolt

Spindle Diameter	Taper		Taper Socket				Keyway			Key								Spindle Face		
	No.	Diameter at[1] Gage Line	Min Depth of Socket Hole	Pilot Diameter	Draw Bolt: Clearance Hole	Draw Bolt: UNC-2B Thread	Width	Standout of Key from Gage Line	First Screw to Center Line	Width	Distance between Screws	First Screw to Edge of Key	Length	Thickness	UNC-2B Hole UNC-3A Screw	Chamfer	Center Line to Integral Key	Bolt Circle		UNC-2B Tapped Hole
		A	T	U	d	d′	R′	S′	D	R″	AH	AJ	AK	AG	D′	AD	AL	AA	AB	AF
2.5	40	1.750	3.88	0.997	0.66	0.625-11	0.625	0.31	—	0.624	Optional Key Construction Only					0.03	0.91	—	—	—
3	40	1.750	3.88	0.997	0.66	0.625-11	0.625	0.31	1.19	0.624	—	0.28	0.56	0.62	0.3125-18	0.03	0.91	—	—	—
3.5	40	1.750	3.88	0.997	0.66	0.625-11	0.625	0.31	1.28	0.624	—	0.38	0.75	0.62	0.3125-18	0.03	0.91	—	—	—
4	45	2.250	4.75	1.278	0.78	0.750-10	0.750	0.38	1.53	0.749	—	0.38	0.75	0.75	0.3125-18	0.03	1.15	—	—	—
4	50	2.750	5.50	1.560	1.06	1.000-8	1.000	0.50	1.67	0.999	—	0.28	0.56	1.00	0.3125-18	0.03	1.41	—	—	—
5	50	2.750	5.50	1.560	1.06	1.000-8	1.000	0.50	1.91	0.999	—	0.50	1.00	1.00	0.375-16	0.06	1.41	4.00	—	0.625-11
6	50	2.750	5.50	1.560	1.06	1.000-8	1.000	0.50	2.16	0.999	—	0.75	1.50	1.00	0.375-16	0.06	1.41	4.75	—	0.750-10
6	55	3.500	7.00	1.983	1.06	1.000-8	1.000	0.50	2.38	0.999	—	0.50	1.00	1.00	0.375-16	0.06	1.88	4.75	—	0.750-10
7	50	2.750	5.50	1.560	1.06	1.000-8	1.000	0.50	1.91	0.999	1.00	0.50	2.00	1.00	0.375-16	0.06	1.41	4.75	—	0.750-10
8	60	4.250	8.62	2.372	1.38	1.250-7	1.000	0.50	3.16	0.999	—	0.75	1.50	1.00	0.375-16	0.06	2.41	7.00	—	0.750-10
10	60	4.250	8.62	2.372	1.38	1.250-7	1.000	0.50	2.91	0.999	1.50	0.50	2.50	1.00	0.375-16	0.06	2.41	7.00	—	0.750-10
12	60	4.250	8.62	2.372	1.38	1.250-7	1.000	0.50	2.91	0.999	2.50	0.50	3.50	1.00	0.375-16	0.06	2.41	7.00	9.25	0.750-10

All dimensions given in inches.
[1] See Table 9 American National Standard B5.10-1963 (R1972) for Plug Gage Dimensions.

TOLERANCES

(A) Diameter of Hole at Gage Line + 0.000 −0.002.
Taper-Tolerance on Rate of Taper to be 0.001 inch per ft applied only in direction which decreases Rate of Taper.
(R′) Keyway Width + 0.000 −0.001.
(R″) Key Width + 0.000 −0.001.
(R′) Centrality of Keyway with Center Line of Taper 0.002 Total Indicator Variation.
(U) Pilot Diameter + 0.008 −0.000.
(AH) Hole spacing ± 0.005.
Two digit decimal Dimensions ± 0.010 unless otherwise specified.
(R″) Centrality of Key (construction No. 1) with Center Line of Taper 0.002 Total Indicator Variation.
(AF) Holes located as shown and within 0.010R of true position.

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AMERICAN NATIONAL STANDARD
SPINDLE NOSES AND TOOL SHANKS
FOR HORIZONTAL BORING MACHINES

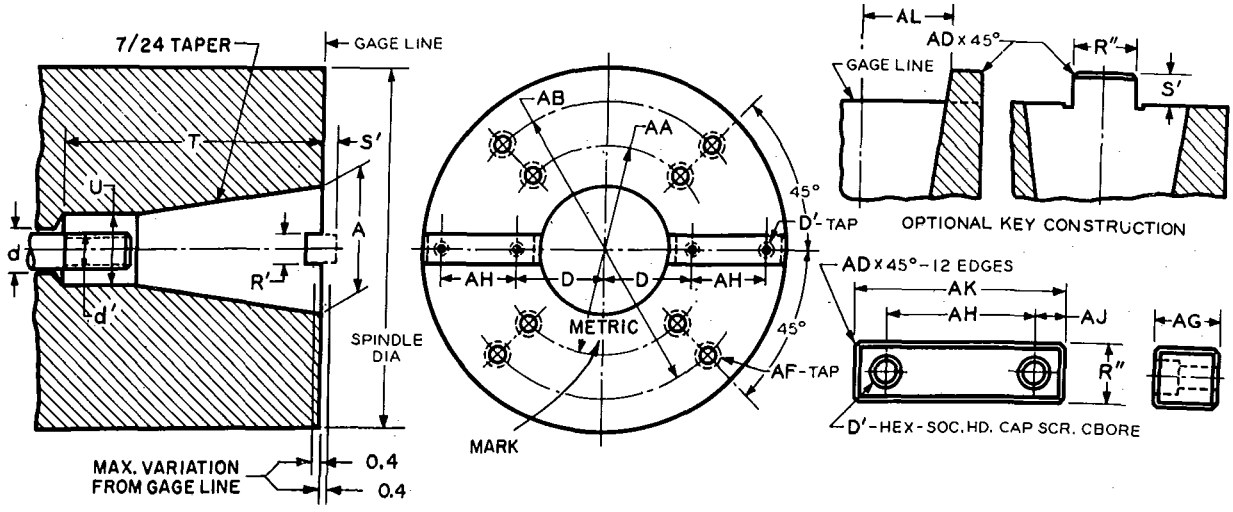


Table 10A Type D: Metric Steep Taper with Key Drive and Draw Bolt

Spindle Diameter	Taper		Taper Socket				Keyway			Key								Spindle Face		
	ISO Designation	Diameter at Gage Line	Minimum Depth of Socket Hole	Pilot Diameter Tolerance–H12	Draw Bolt: Clearance Hole	Draw Bolt: Thread ISO Coarse	Width Tolerance–M6	Standout of Key from Gage Line	First Screw to Center Line	Width Tolerance–h5	Distance between Screws	First Screw to Edge of Key	Length	Thickness	Socket Head Cap Screw	Chamfer	Center Line to Integral Key	Bolt Circle		Thrad ISO Coarse
		A	T	U	d	d'	R'	s'	D	R"	AH	AJ	AK	AG	D'	AD	AL	AA	AB	AF
63	40	44.45	100	25.3	17	M16	15.9	8	–	15.9	Optional Key Construction Only					1	23	–	–	–
75	40	44.45	100	25.3	17	M16	15.9	8	29.5	15.9	–	6.5	13	16	M5	1	23	–	–	–
90	40	44.45	100	25.3	17	M16	15.9	8	33	15.9	–	10	20	16	M6	1	23	66.7	–	M12
100	45	57.15	120	32.4	21	M20	19	9.5	39	19	–	9	18	19	M8	1.2	30	80	–	M12
100	50	69.85	140	39.6	27	M24	25.4	12.5	–	25.4	Optional Key Construction Only					1.5	36	–	–	–
110	50	69.85	140	39.6	27	M24	25.4	12.5	44.5	25.4	–	8.5	17	25	M8	1.2	36	–	–	–
130	50	69.85	140	39.6	27	M24	25.4	12.5	49.5	25.4	–	13.5	27	25	M10	1.5	36	101.6	–	M16
155	50	69.85	140	39.6	27	M24	25.4	12.5	56	25.4	–	20	40	25	M10	1.5	36	120.6	–	M20
155	55	88.9	178	50.4	27	M24	25.4	12.5	60	25.4	–	15	30	25	M10	1.5	45	120.6	–	M20
180	50	69.85	140	39.6	27	M24	25.4	12.5	48	25.4	28	12	52	25	M10	1.5	36	120.6	–	M20
180	55	88.9	178	50.4	27	M24	25.4	12.5	67	25.4	–	22	44	25	M10	1.5	45	120.6	–	M20
205	60	107.95	220	60.2	35	M30	25.4	12.5	81.5	25.4	–	19.5	39	25	M10	1.5	62	177.8	–	M20
225	60	107.95	220	60.2	35	M30	25.4	12.5	74	25.4	25	12	49	25	M10	1.5	62	177.8	–	M20
250	60	107.95	220	60.2	35	M30	25.4	12.5	74	25.4	37	12	61	25	M10	1.5	62	177.8	–	M20
300	60	107.95	220	60.2	35	M30	25.4	12.5	74	25.4	63	12	87	25	M10	1.5	62	177.8	235	M20

All dimensions given in millimeters.

TOLERANCES

Tolerance codes are specified per ANSI B4.1-1967 (R1974) Preferred Limits and Fits for Cylindrical Parts.

(A) Diameter of Hole at Gage Line + 0 – 0.05

Taper – Tolerance on Rate of Taper to be 0.025 per 300 applied only in direction which decreases Rate of Taper

(R') Centrality of Keyway with Center Line of Taper 0.05 Total Indicator Variation.

(AH) Hole Spacing ± 0.12

All other dimensions ± 0.25 unless otherwise specified.

(R") Centrality of Key (Construction No. 1) with Center Line of Taper 0.05 Total Indicator Variation

(AF) Holes Located as shown and within 0.25 of True Position.

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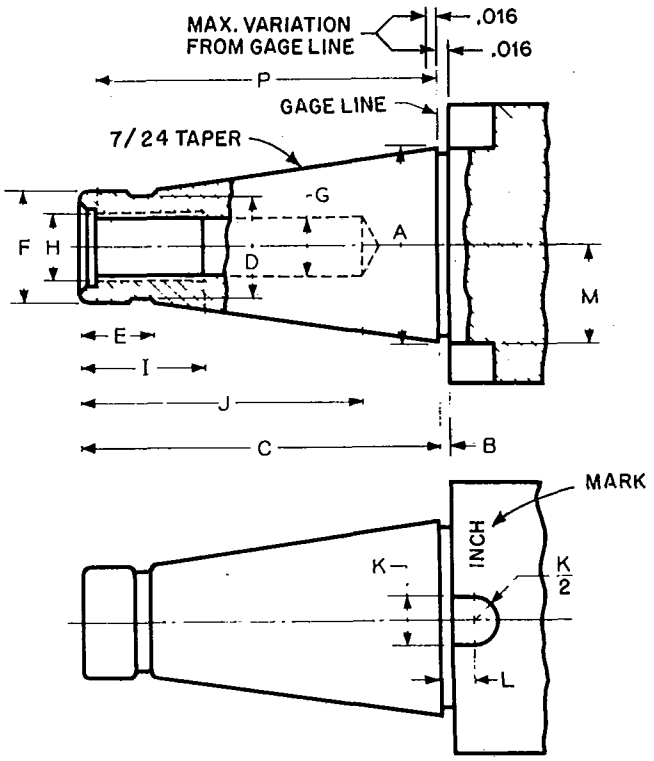


Table 11 Shank for Type D: Steep Taper with Key Drive and Draw Bolt

Taper	Shank					Draw-in Bolt Thread					Drive Keyway		
No.	Diameter[1] at Gage Line	Length from Gage Line	Exposed Length	Pilot Diameter	Neck Diameter	Length of Pilot	Drill Diameter for Tap	Thread Size	UNC-2B Tapped Hole	Depth of Drill Hole	Depth of C' Bore	Center Line to Keyway	Length of Keyway	Width
	A	C	B	F	D	E	G	H	I	J	P	M	L	K
40	1.750	3.69	0.06	0.987	0.94	1.00	0.53	0.625-11	1.12	2.25	3.50	0.890	0.44	0.635
45	2.250	4.25	0.12	1.268	1.19	1.00	0.66	0.750-10	1.50	2.75	4.06	1.140	0.50	0.760
50	2.750	5.00	0.12	1.549	1.50	1.00	0.88	1.000-8	1.75	3.50	4.75	1.390	0.62	1.010
55	3.500	6.50	0.12	1.973	1.94	1.50	0.88	1.000-8	1.75	3.50	6.25	1.765	0.62	1.010
60	4.250	8.12	0.12	2.361	2.28	1.75	1.11	1.250-7	2.25	5.91	7.81	2.400	0.62	1.010

All dimensions given in inches.
[1] See Table 10 American National Standard B5.10-1963 (R1972) for Ring Gage Dimensions.

NOTE

These Taper Shanks are identical with Taper Shanks shown in Table 2 American National Standard B5.18-1960 (R1972).

TOLERANCES

Taper-Tolerance on Rate of Taper to be 0.001 inch per ft applied only in direction which increases Rate of Taper.

(F) Pilot Diameter + 0.000 −0.004.

(M) Center Line to Keyway + 0.000 −0.015.

(A) Diameter of Shank at Gage Line + 0.002 −0.000.

(K) Width of Drive Keyway + 0.010 −0.000 .

(K) Centrality of Keyway with Center Line of Shank 0.004 Total Indicator Variation.

Two digit decimal Dimensions ± 0.010 unless otherwise specified.

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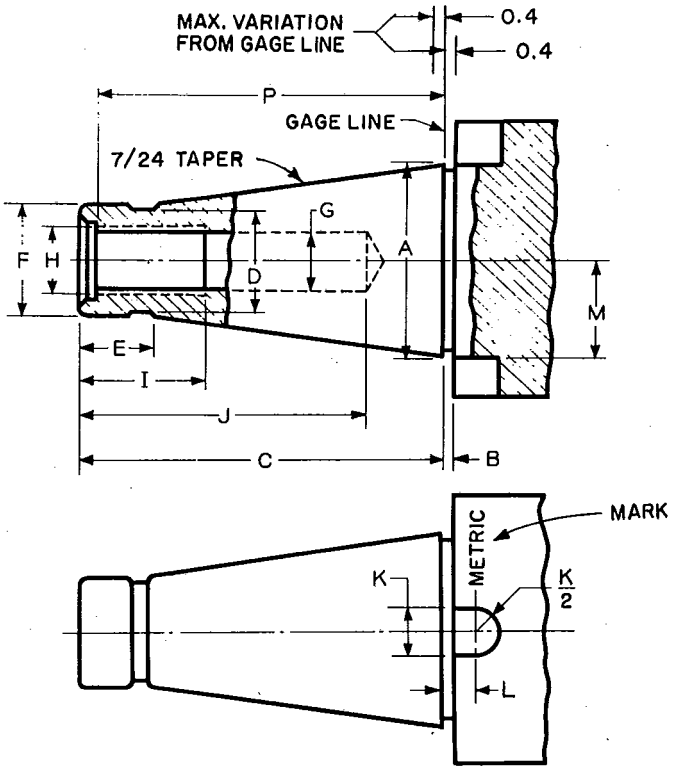


Table 11A Metric Shank for Type D: Steep Taper with Key Drive and Draw Bolt

Taper		Shank					Draw-In Bolt Thread					Drive Keyway		
ISO Designation	Diameter at Gage Line	Length from Gage Line	Exposed Length	Pilot Diameter Tolerance–a10	Neck Diameter	Length of Pilot	Drill Diameter for Tap	Thread ISO Coarse	Thread Depth	Tap Drill Depth	Depth of Counterbore	Center Line to Keyway	Length of Keyway	Width Tolerance–H12
	A	C	B	F	D	E	G	H	I	J	P	M	L	K
40	44.45	93.4	1.6	25.3	24	25	14	M16	30	70	88.9	22.2	11.2	16.1
45	57.15	107.9	3.2	32.4	30	25	17.5	M20	38	70	103.1	28.6	12.7	19.1
50	69.85	127	3.2	39.6	38	25	21	M24	45	90	120.6	34.9	15.8	25.7
55	88.9	165.1	3.2	50.4	49	38	21	M24	45	90	158.7	44.5	15.8	25.7
60	107.95	206.3	3.2	60.2	58	45	21	M30	56	150	198.4	60.6	15.8	25.7

All dimensions given in millimeters.

TOLERANCE

Tolerance codes are specified per ANSI B4.1-1967 (1974) Preferred Limits and Fits for Cylindrical Parts.

Taper Tolerance on Rate of Taper to be 0.025 per 300 applied only in direction which increases taper.

(A) Diameter of Shank at Gage Line + 0.05 −0.

(K) Centrality of Keyway with Center Line of Shank 0.10 Total Indicator Variation.

All Dimensions ± 0.25 unless otherwise specified.

(P) Depth of Counterbore from Gage Line + 0 −0.25.

(M) Center Line to Keyway + 0.35 −0.

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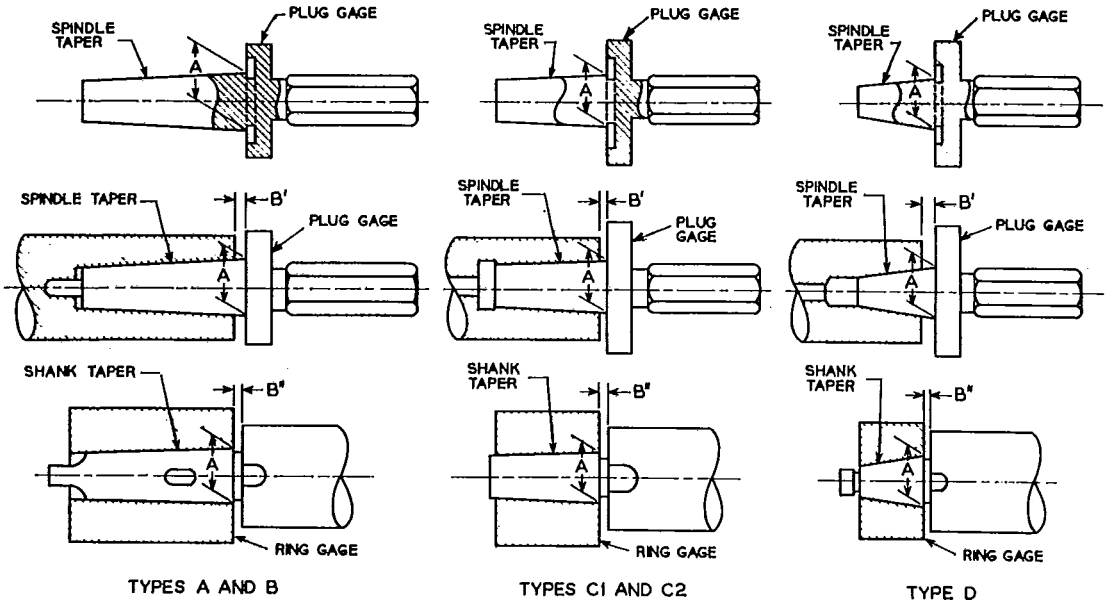


Table 12 Optional Simultaneous Fits for Spindle Nose and Tool Shank for Types A, B, C1, C2 and D (See Nomenclature and General Information)

Spindle Nose Construction	Taper		Gage	Shank
	No.	Diameter[1] at Gage Line	Exposed Length	Exposed Length
		A	B′	B″
Type A and Type B	4 5 6 7	1.23100 1.74800 2.49400 3.27000	0.002 0.006	0.002 0.006
Type C1 and Type C2	200 250 300 350 400 450 500	2.000 2.500 3.000 3.500 4.000 4.500 5.000	0.002 0.006	0.002 0.006
Type D	40 45 50 55 60	1.750 2.250 2.750 3.500 4.250	0.0000 0.0005	0.0005 0.0010

All dimensions given in inches.
[1] See American National Standard B5.10-1963 (R1972) for Plug and Ring Gage dimensions.

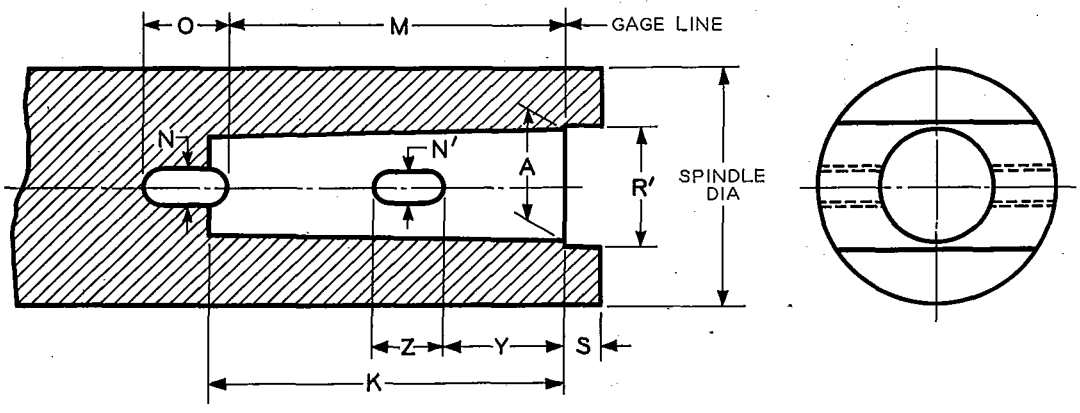
Tolerance for Rate of Taper in Spindle 0.0003 inch per ft applied only in the direction which decreases Rate of Taper.

Tolerance for Rate of Taper of Tool Shank 0.0003 inch per ft applied only in the direction which increases Rate of Taper.

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APPENDIX 1

This appendix includes data on spindle nose construction that are sometimes used by industry. The data given herein are presented with the sole purpose of giving information relative to such spindle nose construction.



Appendix Table A1 Type E: Slot Nose Drive with Tang

Spindle Diameter	Taper		Taper Socket							Nose Slot	
				Drift Slot[2]			Keeper Slot[2]				
	No.	Diameter[1] at Gage Line	Min Depth of Tapered Hole	Gage Line to Front of Slot	Length	Width	Gage Line to Front of Slot	Length	Width	Nose Slot Depth	Width
		A	K	M	O	N	Y	Z	N′	S	R′
3	5	1.748	5.25	4.94	1.50	0.656	2.12	1.50	0.516	0.62	1.750
4	5	1.748	5.25	4.94	1.50	0.656	2.12	1.50	0.516	0.62	1.750
5	6	2.494	7.33	7.00	1.75	0.781	2.25	1.75	0.641	0.75	2.500

All dimensions given in inches.
[1] See Table 6 American National Standard B5.10-1963 (R1972) for Plug Gage Dimensions.
[2] Edges at extreme sides of Slots N and N′ shall be chamfered at 45° — 0.06 inch deep.

TOLERANCES:

(A) Diameter of Hole at Gage Line + 0.000 −0.002

(N & N′) Width No. 5 Taper + 0.006 −0.000
No. 6 Taper + 0.008 −0.000

(N & N′) Centrality with Center Line of Taper Hole 0.005 Total Indicator Variation

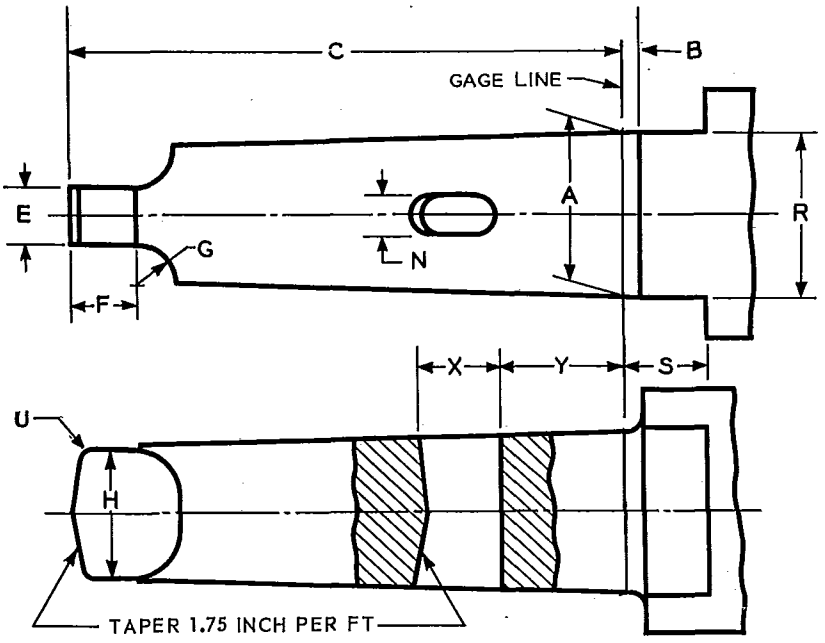
(R′) Nose Slot Width + 0.000 −0.001

(R′) Nose Slot Centrality of Keyway with Center Line of Taper 0.001 Total Indicator Variation

Taper Tolerance on Rate of Taper to be 0.001 inch per ft applied only in the direction which decreases Rate of Taper.

Two digit decimal Dimensions ± 0.010.

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Appendix Table A2 Type E: Shank for Slot Nose Drive

Taper		Shank							Keeper Slot			Flat (Drive)	
No.	Diameter[1] at Gage Line	Exposed Length	Length from Gage Line	Thickness	Length	Radius of Cutter	Width	Radius	Gage Line to Bottom of Slot	Length[2]	Width	Width	Slot Depth
	A	B	C	E	F	G	H	J	Y	X	N	R	S
5	1.748	0.06	5.88	0.625	0.75	0.38	1.41	0.12	2.00	1.38	0.516	1.748	0.62
6	2.494	0.12	8.25	0.750	1.12	0.50	2.00	0.16	2.12	1.62	0.641	2.498	0.75

All dimensions given in inches.
[1] See Table 7 American National Standard B5.10-1963 (R1972) for Ring Gage Dimensions.
[2] Edges at extreme sides of Slot N shall be chamfered at 45° — 0.06 inch deep.

TOLERANCES

(A) Diameter of Shank at Gage Line + 0.002 —0.000
(E) Thickness of Tang No. 5 + 0.000 —0.006
No. 6 + 0.000 —0.008
(N) Width of Slot No. 5 + 0.006 —0.000
No. 6 + 0.008 —0.000
(E) Centrality of Tang 0.005 Total Indicator Variation.
(N) Centrality of Slot 0.005 Total Indicator Variation

(R) Width of Drive Flats + 0.000 —0.002
Taper Tolerance on Rate of Taper 0.001 inch per ft applied in the direction which increases Rate of Taper
Two digit decimal Dimensions ± 0.010.
(R) Centrality with Center Line of Taper Shank 0.001 Total Indicator Variation.

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APPENDIX 2

TABLE A3, CONVERSION TABLES FROM INCH TO MILLIMETER

Any dimension in this standard can be converted by the addition of its components from the tables in this Appendix.

Consider the actual or implied precision of the values in customary units in determining the number of significant digits to be retained in the SI equivalents. (For an explanation of conversion techniques, see American National Standard Metric Practice Guide, ANSI Z210.1-1972).

inch	mm
1	25.40
2	50.80
3	76.20
4	101.60
5	127.00
6	152.40
7	177.80
8	203.20
9	228.60
10	254.00
11	279.40
12	304.80

inch	mm
1/64	0.40
1/32	0.79
3/64	1.19
1/16	1.58
5/64	1.98
3/32	2.38
7/64	2.78
1/8	3.18
9/64	3.57
5/32	3.97
11/64	4.37
3/16	4.76
13/64	5.16
7/32	5.56
15/64	5.95
1/4	6.35
17/64	6.75
9/32	7.14
19/64	7.54
5/16	7.94
21/64	8.33
11/32	8.73
23/64	9.13
3/8	9.52
25/64	9.92
13/32	10.32
27/64	10.72
7/16	11.11
29/64	11.51
15/32	11.91
31/64	12.30

inch	mm
1/2	12.70
33/64	13.10
17/32	13.49
35/64	13.89
9/16	14.29
37/64	14.68
19/32	15.08
39/64	15.48
5/8	15.88
41/64	16.27
21/32	16.67
43/64	17.07
11/16	17.46
45/64	17.86
23/32	18.26
47/64	18.65
3/4	19.05
49/64	19.45
25/32	19.84
51/64	20.24
13/16	20.64
53/64	21.04
27/32	21.43
55/64	21.83
7/8	22.22
57/64	22.62
29/32	23.02
59/64	23.42
15/16	23.81
61/64	24.21
31/32	24.61
63/64	25.00

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Inch to Millimeter (for decimal inch values of less than one inch) [Do not interpolate]

Inch	0.xx0	0.xx1	0.xx2	0.xx3	0.xx4	0.xx5	0.xx6	0.xx7	0.xx8	0.xx9
0.00	0.00	0.03	0.05	0.08	0.10	0.13	0.15	0.18	0.20	0.22
0.01	0.25	0.28	0.30	0.33	0.36	0.38	0.41	0.43	0.46	0.48
0.02	0.51	0.53	0.56	0.58	0.61	0.64	0.66	0.69	0.71	0.74
0.03	0.76	0.79	0.81	0.84	0.86	0.89	0.91	0.94	0.96	0.99
0.04	1.02	1.04	1.07	1.09	1.12	1.14	1.17	1.19	1.22	1.24
0.05	1.27	1.30	1.32	1.35	1.37	1.40	1.42	1.45	1.47	1.50
0.06	1.52	1.55	1.57	1.60	1.63	1.65	1.68	1.70	1.73	1.75
0.07	1.78	1.80	1.83	1.85	1.88	1.90	1.93	1.96	1.98	2.01
0.08	2.03	2.06	2.08	2.11	2.13	2.16	2.18	2.21	2.24	2.26
0.09	2.29	2.31	2.34	2.36	2.39	2.41	2.44	2.46	2.49	2.51
0.10	2.54	2.57	2.59	2.62	2.64	2.67	2.69	2.72	2.74	2.77
0.11	2.79	2.82	2.84	2.87	2.90	2.92	2.95	2.97	3.00	3.02
0.12	3.05	3.07	3.10	3.12	3.15	3.18	3.20	3.23	3.25	3.28
0.13	3.30	3.33	3.35	3.38	3.40	3.43	3.45	3.48	3.50	3.53
0.14	3.56	3.58	3.61	3.63	3.66	3.68	3.71	3.73	3.76	3.78
0.15	3.81	3.84	3.86	3.88	3.91	3.94	3.96	3.99	4.01	4.04
0.16	4.06	4.09	4.11	4.14	4.17	4.19	4.22	4.24	4.27	4.29
0.17	4.32	4.34	4.37	4.39	4.42	4.44	4.47	4.50	4.52	4.55
0.18	4.57	4.60	4.62	4.65	4.67	4.70	4.72	4.75	4.78	4.80
0.19	4.83	4.85	4.88	4.90	4.93	4.95	4.98	5.00	5.03	5.05
0.20	5.08	5.11	5.13	5.16	5.18	5.21	5.23	5.26	5.28	5.31
0.21	5.33	5.36	5.39	5.41	5.44	5.46	5.49	5.51	5.54	5.56
0.22	5.59	5.61	5.64	5.66	5.69	5.72	5.74	5.77	5.79	5.82
0.23	5.84	5.87	5.89	5.92	5.94	5.97	5.99	6.02	6.05	6.07
0.24	6.10	6.12	6.15	6.17	6.20	6.22	6.25	6.27	6.30	6.32
0.25	6.35	6.38	6.40	6.43	6.45	6.48	6.50	6.53	6.55	6.58
0.26	6.60	6.63	6.65	6.68	6.71	6.73	6.76	6.78	6.81	6.83
0.27	6.86	6.88	6.91	6.93	6.96	6.98	7.01	7.04	7.06	7.09
0.28	7.11	7.14	7.16	7.19	7.21	7.24	7.26	7.29	7.32	7.34
0.29	7.37	7.39	7.42	7.44	7.47	7.49	7.52	7.54	7.57	7.59
0.30	7.62	7.64	7.67	7.70	7.72	7.75	7.77	7.80	7.83	7.85
0.31	7.87	7.90	7.92	7.95	7.98	8.00	8.03	8.05	8.08	8.10
0.32	8.13	8.15	8.18	8.20	8.23	8.26	8.28	8.31	8.33	8.36
0.33	8.38	8.41	8.43	8.46	8.48	8.51	8.53	8.56	8.59	8.61
0.34	8.64	8.66	8.69	8.71	8.74	8.76	8.79	8.81	8.84	8.86
0.35	8.89	8.92	8.94	8.97	8.99	9.02	9.04	9.07	9.09	9.12
0.36	9.14	9.17	9.19	9.22	9.25	9.27	9.30	9.32	9.35	9.38
0.37	9.40	9.42	9.45	9.47	9.50	9.52	9.55	9.58	9.60	9.63
0.38	9.65	9.68	9.70	9.73	9.75	9.78	9.80	9.83	9.85	9.88

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Inch	0.xx0	0.xx1	0.xx2	0.xx3	0.xx4	0.xx5	0.xx6	0.xx7	0.xx8	0.xx9
0.39	9.91	9.93	9.96	9.98	10.01	10.03	10.06	10.08	10.11	10.13
0.40	10.16	10.19	10.21	10.24	10.26	10.29	10.31	10.34	10.36	10.39
0.41	10.41	10.44	10.46	10.49	10.52	10.54	10.57	10.59	10.62	10.64
0.42	10.67	10.69	10.72	10.74	10.77	10.80	10.82	10.85	10.87	10.90
0.43	10.92	10.95	10.97	11.00	11.02	11.05	11.07	11.10	11.13	11.15
0.44	11.18	11.20	11.23	11.25	11.28	11.30	11.32	11.35	11.38	11.40
0.45	11.43	11.46	11.48	11.51	11.53	11.56	11.58	11.61	11.63	11.66
0.46	11.68	11.71	11.73	11.76	11.79	11.81	11.84	11.86	11.89	11.91
0.47	11.94	11.96	11.99	12.01	12.04	12.06	12.09	12.12	12.14	12.17
0.48	12.19	12.22	12.24	12.27	12.29	12.32	12.34	12.37	12.40	12.42
0.49	12.45	12.47	12.50	12.52	12.55	12.57	12.60	12.62	12.65	12.67
0.50	12.70	12.73	12.75	12.78	12.80	12.83	12.85	12.88	12.90	12.93
0.51	12.95	12.98	13.00	13.03	13.06	13.08	13.11	13.14	13.16	13.18
0.52	13.21	13.23	13.26	13.28	13.31	13.34	13.36	13.39	13.41	13.44
0.53	13.46	13.49	13.51	13.54	13.56	13.59	13.61	13.64	13.67	13.69
0.54	13.71	13.74	13.77	13.79	13.82	13.84	13.87	13.89	13.92	13.94
0.55	13.97	14.00	14.02	14.05	14.07	14.10	14.12	14.15	14.17	14.20
0.56	14.22	14.25	14.27	14.30	14.33	14.35	14.38	14.40	14.43	14.45
0.57	14.48	14.50	14.53	14.55	14.58	14.60	14.63	14.66	14.68	14.71
0.58	14.73	14.76	14.78	14.81	14.83	14.86	14.88	14.91	14.94	14.96
0.59	14.99	15.01	15.04	15.06	15.09	15.11	15.14	15.16	15.19	15.21
0.60	15.24	15.27	15.29	15.32	15.34	15.37	15.39	15.42	15.44	15.47
0.61	15.49	15.52	15.54	15.57	15.60	15.62	15.65	15.67	15.70	15.72
0.62	15.75	15.77	15.80	15.82	15.85	15.88	15.90	15.93	15.95	15.98
0.63	16.00	16.02	16.05	16.08	16.10	16.13	16.15	16.18	16.21	16.23
0.64	16.26	16.28	16.31	16.33	16.36	16.38	16.41	16.43	16.46	16.48
0.65	16.51	16.54	16.56	16.59	16.61	16.64	16.66	16.69	16.71	16.74
0.66	16.76	16.79	16.81	16.84	16.87	16.89	16.92	16.94	16.97	16.99
0.67	17.02	17.04	17.07	17.09	17.12	17.14	17.17	17.20	17.22	17.25
0.68	17.27	17.30	17.32	17.35	17.37	17.40	17.42	17.45	17.48	17.50
0.69	17.53	17.55	17.58	17.60	17.63	17.65	17.68	17.70	17.73	17.75
0.70	17.78	17.81	17.83	17.86	17.88	17.91	17.93	17.96	17.98	18.01
0.71	18.03	18.06	18.08	18.11	18.14	18.16	18.19	18.21	18.24	18.26
0.72	18.29	18.31	18.34	18.36	18.39	18.42	18.44	18.47	18.49	18.52
0.73	18.54	18.57	18.59	18.62	18.64	18.67	18.69	18.72	18.75	18.77
0.74	18.80	18.82	18.85	18.87	18.90	18.92	18.95	18.97	19.00	19.02
0.75	19.05	19.08	19.10	19.13	19.15	19.18	19.20	19.23	19.25	19.28
0.76	19.30	19.33	19.35	19.38	19.41	19.43	19.46	19.48	19.51	19.53
0.77	19.56	19.58	19.61	19.63	19.66	19.68	19.71	19.74	19.76	19.79

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Inch to Millimeter (for decimal inch values of less than one inch) [Do not interpolate]

Inch	0.xx0	0.xx1	0.xx2	0.xx3	0.xx4	0.xx5	0.xx6	0.xx7	0.xx8	0.xx9
0.78	19.81	19.84	19.86	19.89	19.91	19.94	19.96	19.99	20.02	20.04
0.79	20.07	20.09	20.12	20.14	20.17	20.19	20.22	20.24	20.27	20.29
0.80	20.32	20.35	20.37	20.40	20.42	20.45	20.47	20.50	20.52	20.55
0.81	20.57	20.60	20.62	20.65	20.68	20.70	20.73	20.75	20.78	20.80
0.82	20.83	20.85	20.88	20.90	20.93	20.96	20.98	21.01	21.03	21.06
0.83	21.08	21.11	21.13	21.16	21.18	21.21	21.23	21.26	21.29	21.31
0.84	21.34	21.36	21.39	21.42	21.44	21.46	21.49	21.51	21.54	21.56
0.85	21.59	21.62	21.64	21.67	21.29	21.72	21.74	21.77	21.79	21.82
0.86	21.84	21.87	21.89	21.92	21.95	21.97	22.00	22.02	22.05	22.07
0.87	22.10	22.12	22.15	22.17	22.20	22.22	22.25	22.28	22.30	22.33
0.88	22.35	22.38	22.40	22.43	22.45	22.48	22.50	22.53	22.56	22.58
0.89	22.61	22.63	22.66	22.68	22.71	22.73	22.76	22.78	22.81	22.83
0.90	22.86	22.89	22.91	22.94	22.96	22.99	23.01	23.04	23.06	23.09
0.91	23.11	23.14	23.16	23.19	23.22	23.24	23.27	23.29	23.32	23.34
0.92	23.37	23.39	23.42	23.44	23.47	23.50	23.52	23.55	23.57	23.60
0.93	23.62	23.65	23.67	23.70	23.72	23.75	23.77	23.80	23.83	23.85
0.94	23.88	23.90	23.93	23.95	23.98	24.00	24.03	24.05	24.08	24.10
0.95	24.13	24.16	24.18	24.21	24.23	24.26	24.28	24.31	24.33	24.36
0.96	24.38	24.42	24.43	24.46	24.49	24.51	24.54	24.56	24.59	24.61
0.97	24.64	24.66	24.69	24.71	24.74	24.76	24.79	24.82	24.84	24.87
0.98	24.89	24.92	24.94	24.97	24.99	25.02	25.04	25.07	25.10	25.12
0.99	25.15	25.17	25.20	25.22	25.25	25.27	25.30	25.32	25.35	25.37

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