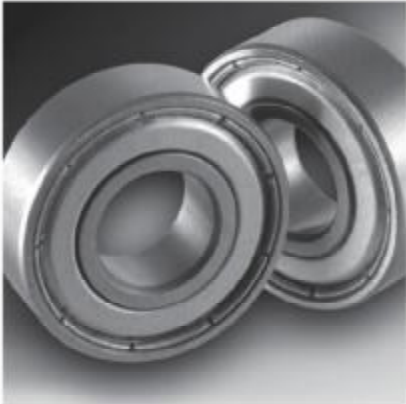


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Tapered Roller Bearings, Radial Inch Design

Secretariat

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Tapered Roller Bearings — Radial Inch Design

CONTENTS

SECTION	PAGE
1. Scope	1
2. Part Numbering Systems	1
2.1 Identification Code	1
2.2 ABMA Standard 19.2 Designation System	1
3. Symbols and Nomenclature	5
3.1 Dimension Symbols	6
3.2 Cone and Cup Chamfer Dimensions	7
4. Boundary Dimensions	9
4.1 General	9
4.2 Cup Small Inside Diameter	9
4.3 Cup Large Inside Diameter	9
4.4 Contact Angle	9
4.5 Cage Axial Clearance	9
4.6 Effective Load Center	9
4.7 Bearing Assembly Types	9
4.8 Spacers	9
5. Tolerances	30
5.1 General	30
5.2 Component Stand Gauging and Overall Bearing Width Tolerance	30
5.3 Tolerance Classes	33
5.4 Tolerance Symbols	33
6. Fitting Practices	37
6.1 Scope	37
6.2 Surface Finish of Bearing Seats	37
6.3 Definition of Operating Characteristics	37
6.4 Heavy Duty Fitting Practice for Shafts	37
6.5 Heavy Duty Fitting Practice for Precision Bearings	37
Appendix	
Appendix A – Previous Part Numbering System of Tapered Roller Bearings – Radial, Inch Design	41
List of Tables	iv
List of Figures	iv

LIST OF TABLES

TABLE NUMBER	PAGE
1. Bearing Assembly Types	10
2. Spacer Type Designations	10
3. Type TS Boundary Dimensions	11
4. Type TSF Boundary Dimensions	21
5. Type TDI Boundary Dimensions	25
6. Type TDO, TDOCD Boundary Dimensions	27
7. Bearing Tolerances	34
8. Recommended Fitting Practices	38

LIST OF FIGURES

FIGURE NUMBER	PAGE
1. Single-row Tapered Roller Bearing Nomenclature	5
2. Boundary Dimension Symbols	5
3. Chamfer Symbols	7
4. Special Cone Back Face Compound Radius	8
5. TDO Assembly	27
6. TDOCD Assembly	27
7. Single Cup, High Stand, Back face, Non-flanged	32
8. Single Cup, Low Stand, Back face, Non-flanged	32
9. Single Cup, High Stand, Back face, Flanged	32
10. Single Cup, Low Stand, Back face, Flanged	32
11. Double Cup, Stand over Double Plugs	32
12. Single Cone, High Stand, Back face	32
13. Single Cone, Low Stand, Back face	32
14. Double Cone, Stand over Master Cups	32

Tapered Roller Bearings — Radial Inch Design

1. SCOPE

This standard covers inch design radial tapered roller bearings of various types, part numbering systems, boundary dimensions, tolerances, and fitting practices. Tapered roller thrust bearings are covered in a separate ABMA standard.

General ABMA standards which apply to various types of bearings should be consulted for tolerance definitions, gauging practices, mounting accessories, and method of evaluating load ratings.

2. PART NUMBERING SYSTEMS

2.1 Identification Code. Inch design tapered roller bearings are numbered in an identical manner or reference is made to the universal number by all producers. Therefore, an identification code for the use of bearing users to provide a universal language for describing and identifying these products is not required.

2.1.1 Individual Component Part Numbers. Unlike other bearing types, tapered roller bearing cones and cups are individually numbered. The cone is assembled with rollers and a cage, and when used with a cup, makes a complete bearing assembly. Both cone and cup numbers are required to identify a complete bearing assembly. The cone number followed by the cup number is the preferred practice.

2.2 ABMA Standard 19.2 Designation System. The current part numbering system for tapered roller bearings attempts to describe each bearing on the basis of dimensional and functional interchangeability. The system has been in use since 1950. Another system for bearings designated prior to 1950 is described in Appendix A.

2.2.1 General Arrangement. The cone and cup part numbers, consisting of prefix letters, numerical designators, and suffix letters, are divided into five sections as shown below and described in the following paragraphs.

COMPONENT PART NUMBER				
Section 1	Section 2	Section 3	Section 4	Section 5
Series Prefix	Angle Code	Basic Series	Component Number	Modification Suffix
HM	9	032	49	A
HM	9	032	10	

2.2.2 Section 1 – Series Prefix. The series prefix consists of one or two letters which designate the duty class of the series based on the 1948 radial capacity formula. A complete list of prefixes and their designation follows;

Series Prefix	Series Designation
EH	Extra Heavy Series
EL	Extra Light Series
H	Heavy Series
HH	Heavier than Heavy Series
HM	Heavy-Medium Series
L	Light Series
LL	Lighter than Light Series
LM	Light-Medium Series
M	Medium Series
J	Indicates a metric component. Refer to ABMA standard 19.1.
A prefix other than shown above, or the absence of a prefix, indicates the original part numbering system. Refer to Appendix A.	

2.2.3 Section 2 – Angle Code. The 1st digit following the series prefix is an indicator of the angularity of the bearing series according to the following code.

Included Cup Angle	Code
0 to 23° 59' 59.99"	1
24° to 25° 29' 59.99"	2
25° 30' to 26° 59' 59.99"	3
27° to 28° 29' 59.99"	4
28° 30' to 30° 29' 59.99"	5
30° 30' to 32° 29' 59.99"	6
32° 30' to 35° 59' 59.99"	7
36° to 44° 59' 59.99"	8
45° and over, excluding thrust	9

2.2.4 Section 3 – Basic Series. The 2nd, 3rd, and 4th digits following the series prefix letters are reserved for the basic series indication, which can be indicated by one digit, or by two digits, or by three digits. It can be indicated by a single digit 0 to 9 inclusive, or by a double digit 00 to 99 inclusive, or by a triple digit 000 to 999 inclusive.

The basic series indication is related to the diameter of the cone raceway at the small end of the roller, in order that smaller numbers will indicate smaller sizes of bearings and larger numbers will indicate larger sizes of bearings.

For the present, the series numbers indicated by the absence of any digit or by the single digit 0 to 9 inclusive are reserved for future development of extremely small sized tapered roller bearings, if required.

Likewise, the numbers 900 to 999, inclusive, are reserved for future development of extremely large bore tapered roller bearings, if required.

The selection of the basic series indication in relation to the cone raceway diameter at the roller small end is in accordance with the following tabulation.

Cone Raceway Diameter at the Roller Small End (inches)		Basic Series Indication
Over	Incl.	
0	1	00 - 19 incl.
1	2	20 - 99 incl.
		000 - 029 incl.
2	3	030 - 129 incl.
3	4	130 - 189 incl.
4	5	190 - 239 incl.
5	6	240 - 289 incl.
6	7	290 - 339 incl.
7	8	340 - 389 incl.
8	9	390 - 429 incl.
9	10	430 - 469 incl.
10	11	470 - 509 incl.
11	12	510 - 549 incl.
12	13	550 - 579 incl.
13	14	580 - 609 incl.
14	15	610 - 639 incl.

Cone Raceway Diameter at the Roller Small End (inches)		Basic Series Indication
Over	Incl.	
15	16	640 - 659 incl.
16	17	660 - 679 incl.
17	18	680 - 694 incl.
18	19	695 - 709 incl.
19	20	710 - 724 incl.
20	21	725 - 739 incl.
21	22	740 - 754 incl.
22	23	755 - 769 incl.
23	24	770 - 784 incl.
24	25	785 - 799 incl.
25	30	800 - 829 incl.
30	35	830 - 859 incl.
35	40	860 - 879 incl.
40	50	880 - 889 incl.
50	72.5	890 - 899 incl.

2.2.5 Section 4 – Component Number. The last two numeric digits indicate the part number of the bearing component.

Roller numbers are indicated by the digits 01 to 04, inclusive, but these numbers do not appear on the bearings. They are used for manufacturing identification.

Cage numbers are indicated by the digits 05 to 09, inclusive. These numbers do not appear on the bearings. They are used for manufacturing identification.

Cup numbers are indicated by the digits 10 to 19, inclusive, the first cup made to minimum section (minimum OD) in any series starting with the number 10. If more numbers are required in any series, numbers 20 to 29 are utilized where available.

Cone numbers are indicated by the digits 30 to 49, inclusive, the first cone made to minimum section (maximum bore) in any series being numbered 49. If more numbers are required for the cones in any one series, numbers 29 to 20 are utilized where available.

The numbers 20 to 29 are, therefore, reserved for cone and cup number overflow.

The numbers 50 to 99 are reserved for additional overflow in the case of an extremely crowded series. Any major change in a series involving new part numbers which are not interchangeable with the old is accommodated through the use of this upper range of numbers.

2.2.6 Section 5 – Modification Suffix. Following the numbers identifying the bearing component, there may be a suffix. The suffix consists of one, two, or three letters which designate type or external modification from the basic number according to the following tabulation.

Modification Suffix	Cone or Cup	Explanation
A	Cone & Cup	Different bore, OD, width or radius from basic part number.
AB	Cup	Flanged cup.
AS	Cone & Cup	Different bore, OD, width or radius from basic part number.
AX	Cone & Cup	Different bore, OD, width or radius from basic part number.
B	Cup	Flanged cup.
B	Cone	Cone using a brass cage.
CD	Cup	Double cup with lubrication groove and holes, one hole counterbored to accept recommended locking pin.
D	Cone & Cup	Double cone or double cup with lubrication groove and holes.
DC	Cup	Double cup with lubrication hole counterbored to accept recommended locking pin.
NA	Cone	Non-Adjustable. Two single cones with front faces contacting, mated with a double cup to form a double row bearing with internal clearances pre-set.
NW	Cone	"NA" type cone with slotted front face.
S	Cone & Cup	Different bore, OD, width or radius from basic part number.
SW	Cone & Cup	Slot or keyway.
T	Cone	Tapered bore.
TD	Cone	Tapered bore double cone.
W	Cone & Cup	Slot or keyway.
X	Cone & Cup	Different bore, OD, width or radius from basic part number.
XB	Cup	Flanged cup.
XD	Cone & Cup	Double cone or double cup without lubrication groove and holes.
XE	Cup	Different OD, width or radius from basic part number.
YD	Cup	Double cup with lubrication hole but no groove.

2.2.7 Spacer Part Numbering. Multi-row bearing assembly types may use spacers between the cones and/or cups. These spacers generally carry the same basic part number as the cone or cup, with a suffix which is assigned sequentially and has no significance in describing the spacer type.

3. SYMBOLS AND NOMENCLATURE

The symbols shown in Figure 2 and the values given in the Boundary Dimension Tables 3 to 6 refer to nominal dimensions unless otherwise specified.

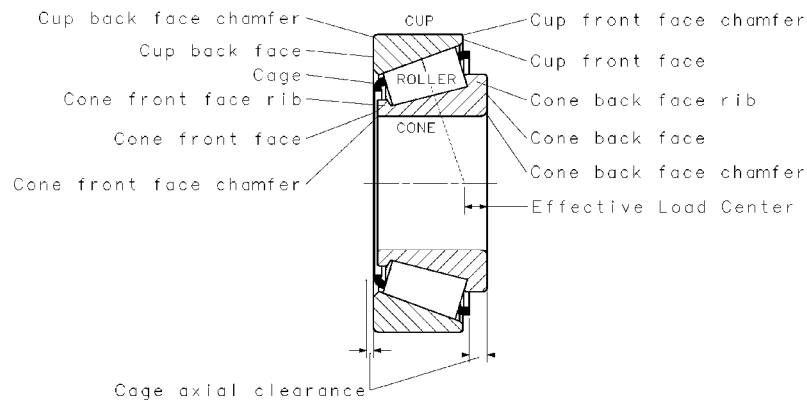


Figure 1 – Single-row Tapered Roller Bearing Nomenclature

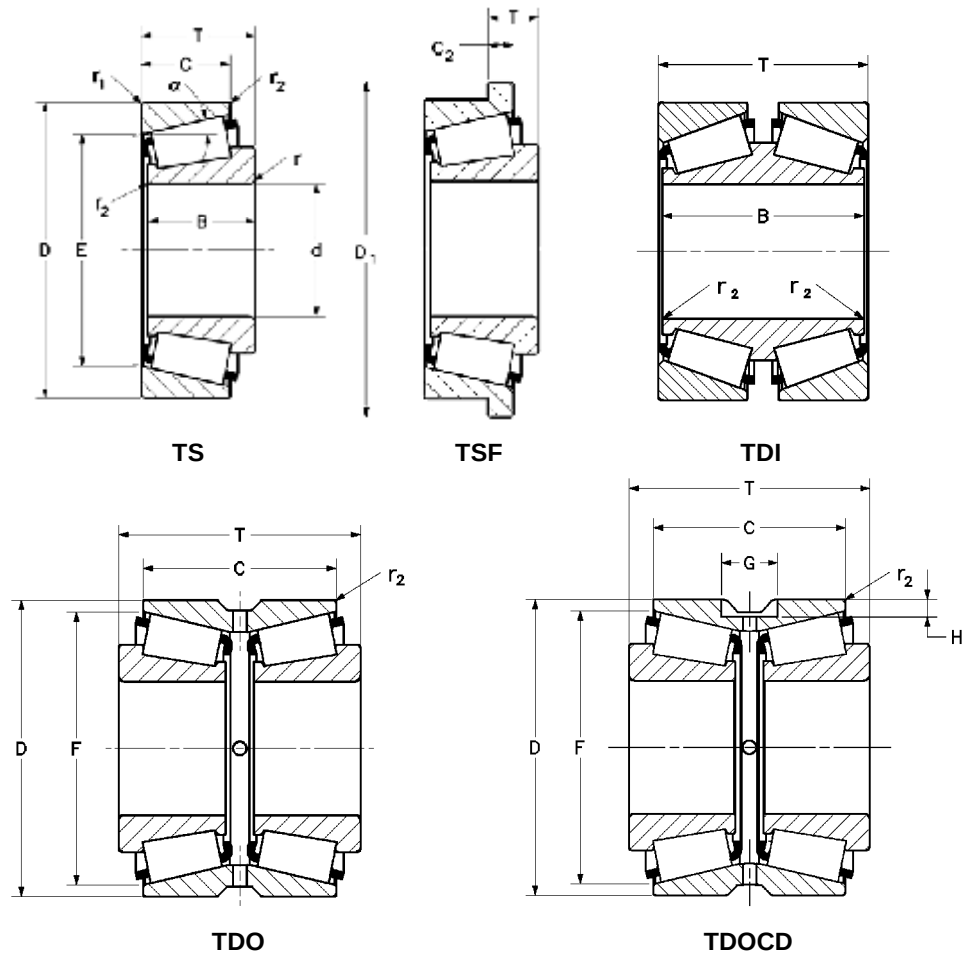


Figure 2 – Boundary Dimension Symbols

3.1 Dimension Symbols.

B = cone width

C = cup width

C₂ = cup flange width

D = cup outside diameter

D₁ = cup flange outside diameter

d = cone bore diameter

E = cup small inside diameter

F = cup large inside diameter

G = double cup, OD counterbore diameter, CD cup type

H = double cup, OD counterbore depth, CD cup type

r = cone back face chamfer dimension

r₁ = cup back face chamfer dimension

r₂ = cone and cup front face chamfer dimension

T = bearing width

α = contact angle

3.2 Cone and Cup Chamfer Dimensions

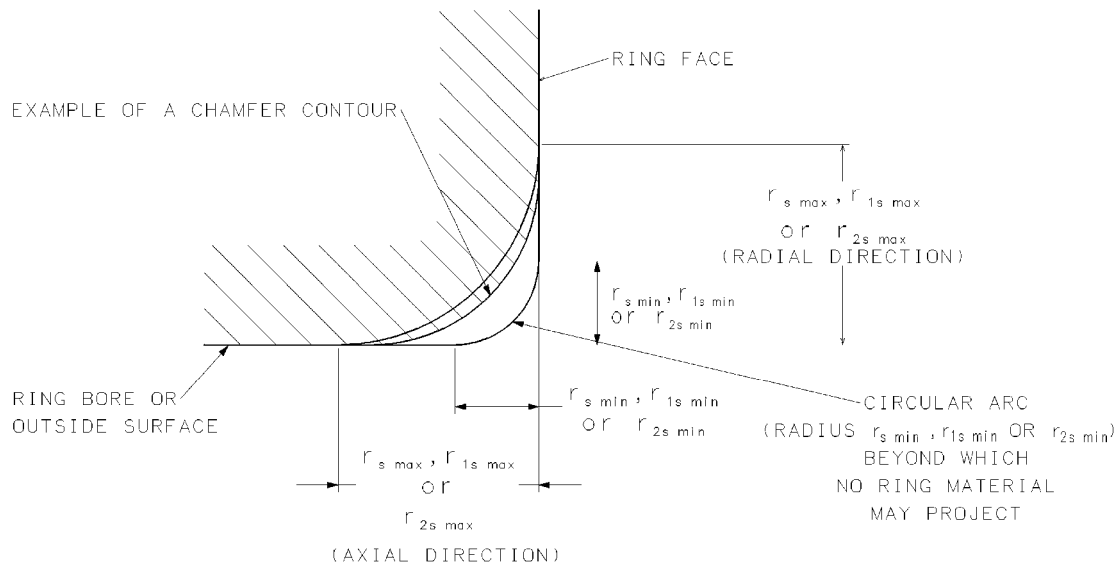


Figure 3 – Chamfer Symbols

- $r_{s \min}$ = smallest permissible single chamfer dimension of cone back face
- $r_{s \max}$ = largest permissible single chamfer dimension of cone back face
- $r_{1s \min}$ = smallest permissible single chamfer dimension of cup back face
- $r_{1s \max}$ = largest permissible single chamfer dimension of cup back face
- $r_{2s \min}$ = smallest permissible single chamfer dimension of cone or cup front face
- $r_{2s \max}$ = largest permissible single chamfer dimension of cone or cup front face

In order to ensure that tapered roller bearing chamfers are compatible with the dimensions of parts which come into contact with the rolling bearings, values of the chamfer dimension limits are required, of which the minimum limit is of primary interest to the bearing user and application designer.

The exact shape of the chamfer surface is not specified, but its contour in an axial plane shall not be allowed to project beyond the imaginary circular arc, of radius $r_{s \min}, r_{1s \min}$ or $r_{2s \min}$ tangential to the ring face and the bore or outside cylindrical surface of the ring. Refer to Figure 3.

The largest single shaft or housing radius must not exceed the smallest single chamfer dimension of the cone or cup.

No values are given in this standard for the single cone or single cup front face chamfer dimension r_2 , however, the front face corners shall not be sharp.

3.2.1 Special Cone Back Face Compound Radius Design. Certain cone part numbers listed in the Boundary Dimension Tables (3-6) incorporate a special compound radius design at the back face. Details of the radius design, and the affected part numbers are shown below.

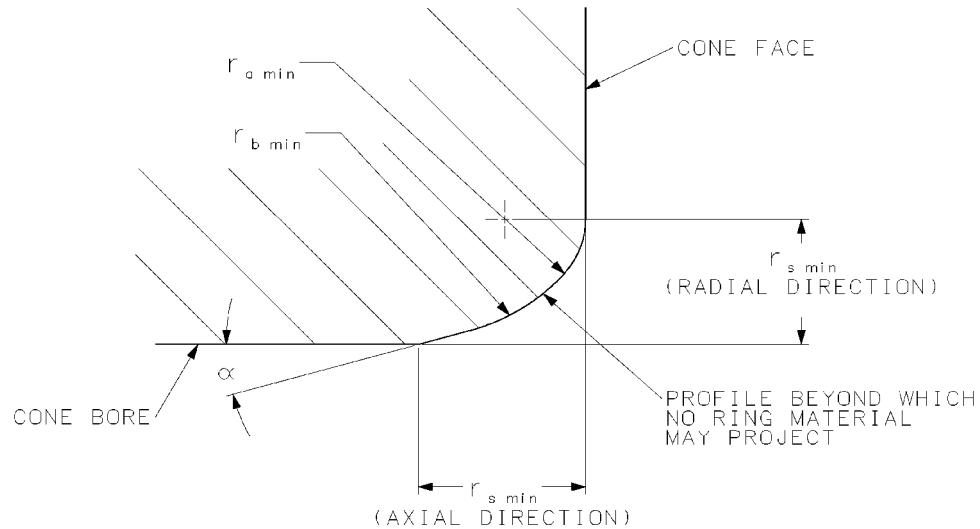


Figure 4 – Special Cone Back Face Compound Radius

Cone Part Number	Minimum Chamfer $r_{s \min}$		Minimum Radius $r_{a \min}$	Minimum Radius $r_{b \min}$	Chamfer Angle α
	Radial Direction	Axial Direction			
LM67048	0.140	0.187	0.09	0.22	15°
15123					
LM48548					
L68149					
LM78349					
LM300849					

4. BOUNDARY DIMENSIONS

4.1 General. The bearings listed in the Boundary Dimension Tables (3-6) are those in common use. The tables are designed to minimize the number of inch design tapered roller bearings, yet satisfy present and future needs of bearing users. These tables do not contain any indication as to availability of bearings. ABMA maintains a clearinghouse of dimensions affecting tapered roller bearing interchangeability for additional part numbers not listed in this standard.

Tolerances for the dimensions shown in the tables are provided in section 5.

4.2 Cup Small Inside Diameter is the raceway extension diameter at the cup back face. (Reference dimension E in Figure 2)

4.3 Cup Large Inside Diameter is the raceway extension diameter at the cup front face. This dimension is provided for bearing types with double cups. (Reference dimension F in Figure 2)

4.4 Contact Angle. The bearing contact angle is the cup raceway angle in relation to the axial centerline. (Reference dimension α in Figure 2)

4.5 Cage Axial Clearance. Bearing mounting designs must afford adequate clearance for the cage. It should be noted that often the small end of the cage extends beyond the faces of the cup and cone. Consult the bearing manufacturer for additional information and application. See Figure 1.

4.6 Effective Load Center. The effective load center of the bearing is a theoretical point about which moments are taken to determine bearing loads or reactions. In using the effective load center, only externally applied loads need to be considered. The location of the effective load center is shown in the manufacturer's catalogue. Consult the bearing manufacturer for additional information and application. See Figure 1.

4.7 Bearing Assembly Types. Table 1 shows the types of tapered roller bearing assemblies which appear in the Boundary Dimension Tables, with a brief description and a typical illustration of each type. Other types of single row, two row, and four row tapered roller bearing assemblies, with or without spacers, are available. Individual bearing manufacturers should be consulted for further details.

4.8 Spacers. Bearing assembly types TDI, TDO and TDOCD listed in Table 1 are not shown with spacers. These bearing assembly types can be furnished by the manufacturer with spacers. Spacers are made of both hardened and unhardened steel of numerous configurations. Table 2 lists common types of spacer design along with their type designations. Consult individual manufacturers for availability. When these bearing assembly types are fitted with spacers, they are furnished as pre-set assemblies in which the spacers have been finished to size to establish a pre-determined axial clearance within each bearing assembly. Therefore component parts from one assembly are not interchangeable with similar assemblies even if made by the same manufacturer. Because spacer assemblies are pre-set by the manufacturer, spacers are generally not sold separately.

TABLE 1: BEARING ASSEMBLY TYPES

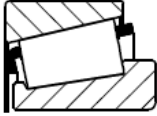
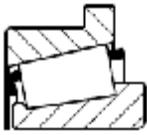
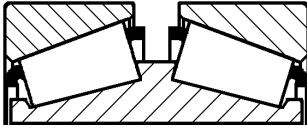
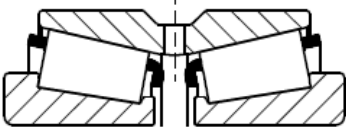
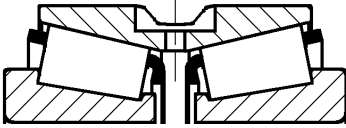
Bearing type	Description	Boundary dimension table	
TS	Single row, straight bore.	3	
TSF	Single row, straight bore, flanged cup.	4	
TDI	Double row, straight bore, one double cone, two single cups.	5	
TDO	Double row, straight bore, two single cones, one double cup with lubrication groove and holes.	6	
TDOCD	Double row, straight bore, two single cones, one double cup with lubrication groove and holes. One hole counterbored to accept a locking pin.		

TABLE 2: SPACER TYPE DESIGNATIONS

Cone Spacers	Description	Cup Spacers
A	Solid	R
AA	Oil Holes	S
AI	Oil Holes and Groove	Q
AH	Solid, Hardened	RH
BB	Rectangular Slots and Stepped	P
BBF	Semi-Circular Slots and Stepped	
BH	Rectangular Slots and Hardened	
CH	Rectangular Slots, Hardened, with Pilot	
K	Snap Ring	K
	Solid with Snap Ring Step	RSR
	Semi-Circular Slots with Snap Ring Step	TSR