AN AMERICAN NATIONAL STANDARD

ASME B18.27b-2000

ADDENDA

to

ASME B18.27-1998
TAPERED AND REDUCED CROSS SECTION RETAINING RINGS (INCH SERIES)

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
Three Park Avenue • New York, NY 10016

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ASME B18.27b-2000

Following approval by the ASME B18 Committee and ASME, and after public review, ASME B18.27b-2000 was approved by the American National Standards Institute on February 11, 2000.

Addenda to the 1998 edition of ASME B18.27 are issued in the form of replacement pages. Revisions, additions, and deletions are incorporated directly into the affected pages. It is advisable, however, that this page, the Addenda title and copyright pages, and all replaced pages be retained for reference.

SUMMARY OF CHANGES

This is the second Addenda to be published to ASME B18.27-1998. A previous Addenda was published in May 2000.

Replace or insert the pages listed. Changes given below are identified on the pages by a margin note, **(b)**, placed next to the affected area. Previous Addenda changes are indicated by **(a)**. The pages not listed are the reverse sides of the listed pages and contain no changes.

Page	*Location*	*Change*
iii	Foreword	Updated to reflect Addenda
ix	Preface	Updated to reflect Addenda
xi	Contents	Updated to reflect Addenda
4	3.2.1	Revised
5	Table 1	Revised in its entirety
	3.3.1	Revised
191–224	ASME B18.27.5	Added

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FOREWORD

(a)
(b)

American National Standards Committee B27 for the standardization of plain and lock washers was organized in March 1926 as Sectional Committee B27, under the aegis of the American Standards Association (later the United States of America Standards Institute and, as of October 6, 1969, the American National Standards Institute, Inc.), with the Society of Automotive Engineers and The American Society of Mechanical Engineers as joint secretariats. In 1950, this Committee was designated as responsible for the standardization of washers and machine rings.

At a meeting of ANSI B27 Standards Committee held on February 4, 1971, it was recommended to the secretariats (ASME and SAE) that Subcommittees 1, 2, and 4 on Washers be merged into ANSI B18 Standards Committee and that Subcommittee 3 on Retaining Rings become a separate Standards Committee retaining the B27 designation. This change was subsequently approved by ANSI.

Formation of Subcommittee 1 on Tapered and Reduced Section Retaining Rings was authorized by Standards Committee B27 at its meeting on October 15, 1974. At this meeting, it was decided that no further effort should be expended on inch dimensional products and Subcommittee 1 was assigned the responsibility of preparing American metric standards for tapered and reduced section retaining rings.

Subcommittee 1 prepared a draft proposal, General Purpose Tapered and Reduced Cross Section Retaining Rings, which was balloted on June 16, 1975. At a subcommittee meeting held on February 17, 1976, results from the letter ballot were reviewed. The proposal was accepted by the Subcommittee and presented to the B27 Standards Committee at its May 7, 1976, meeting. At that meeting, a letter ballot of the entire committee was authorized. The Standard was duly approved by the Committee and its sponsors and submitted to the American National Standards Institute for designation as an American Standard. This designation was granted on October 20, 1977.

It was recommended that American National Standards Committee B27 be made part of ASME B18 Main Committee. As a result, Subcommittee 27 of ASME B18 has the responsibility of developing and maintaining standards for retaining rings.

A need evolved for commercial and military requirements to develop inch series standards for General Purpose Tapered and Reduced Cross Section Type Retaining Rings. It was agreed by the ASME B18 Main Committee to have Subcommittee 27 develop these required inch series standards. The first of the inch standards, B18.27.1, covering External Type NA1, Internal Type NA2, and E-Ring Type NA3 rings, was approved by ANSI on July 16, 1998.

The second of the inch standards, B18.27.2, covering Heavy Duty External Type NA4, Reinforced E-Rings NA5, and C-Rings Type NA6, was approved by ANSI on July 16, 1998.

The third of the inch standards, B18.27.3, covering Bowed External Rings NA7, Bowed Internal Rings NA8, and Bowed External E-Rings NA9, was approved by ANSI on July 16, 1998.

The fourth of the inch standards, B18.27.4, covering Inverted External Rings NA10, Inverted Internal Rings NA11, Beveled External Rings NA12, and Beveled Internal Rings NA13, was approved by ANSI on May 10, 1999.

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The fifth and final of the inch standards, B18.27.5, covering External Self-Locking Rings Type NA14, External Interlocking Rings Type NA15, and External Bowed Locking Prongs Rings NA16, was approved by ANSI on February 11, 2000.

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PREFACE

(a)
(b)

ORGANIZATION OF THIS DOCUMENT

This Standard compiles the following standards:

Standard	*Title*
ASME B18.27.1	External Type NA1, Internal Type NA2, E-Ring Type NA3
ASME B18.27.2	Heavy Duty External Type NA4, Reinforced E-Rings NA5, C-Rings Type NA6
ASME B18.27.3	Bowed External Rings NA7, Bowed Internal Rings NA8, Bowed External E-Rings NA9
ASME B18.27.4	Inverted External NA10, Inverted Internal NA11, Beveled External NA12, Beveled Internal NA13
ASME B18.27.5	External Self-Locking Rings NA14, External Interlocking Rings NA15, External Bowed Locking Prongs Rings NA16

ADDENDA SERVICE

This edition of ASME B18.27-1998 includes an automatic addenda subscription service up to the publication of the next edition. The addenda subscription service will include the additional B18.27 documents not already included in the initial publication and approved revisions to the existing parts.

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EXTERNAL TYPE NA1, INTERNAL TYPE NA2, E-RING TYPE NA3

1 INTRODUCTORY NOTES

1.1 Scope

This Standard covers complete general and dimensional data for three series of general purpose tapered and reduced cross section retaining rings, which may be used with the nominal size shafts and housings listed and in grooves of the recommended dimensions listed. Also included are formulas and tolerances on which dimensional data are based. Three appendices include guidance for assembly and recommended standard drawing formats.

The inclusion of dimensional data in this Standard is not intended to imply that all of the products described are stock production sizes. Consumers should consult with suppliers concerning lists of stock production sizes.

1.2 ISO Standard

There are no existing ISO Standards for these products.

1.3 Ring Types

1.3.1 External Rings. Dimensions of basic external retaining rings and grooves for various shaft sizes are given in Table 6. See Nonmandatory Appendix A for equivalent metric data.

1.3.2 Internal Rings. Dimensions for basic internal retaining rings and grooves for various housing sizes are given in Table 7. See Nonmandatory Appendix C for equivalent metric data.

1.3.3 External E-Rings. Dimensions of E-Type external retaining rings and grooves for various shaft sizes are given in Table 8. See Nonmandatory Appendix E for equivalent metric data.

1.4 Designations

Retaining rings in this Standard shall be designated by the following data in the sequence shown: ring series type number; size; material; protective finish, if required or by, optionally, ASME B18.24.3 PIN Code. See examples below:

NA1-37, Carbon spring steel, phosphate
R271NAA0037NN056NNAA1

NA2-75, Corrosion resistant steel
R271NAB0075NN519NNAB1

NA3-S118, Beryllium copper
R271NACS118NN643NNAA1

1.5 Applicability

The rings covered by this Standard are intended primarily for use with the shaft, housing, and groove sizes recommended; however, in certain cases these diameters may be altered somewhat to suit the requirements of a particular design. When such changes are made, care should be taken to not alter the shaft or housing size to such an extent that the ring will take enough permanent set to allow a loose fit after the ring has been assembled into the groove. Neither should the groove diameter be altered to the extent to permit the ring to fit loosely.

1.6 Dimensions

All dimensions in this Standard are in inches unless otherwise stated.

1.7 Supplementary Information

Allowable loads, maximum radii and chamfers, clearance dimensions, and gaging diameters for all three ring series are included in Mandatory Appendices I, II, and III. RPM limits for external basic and external E-rings are included in Mandatory Appendices I and III.

1.8 Reference Standards

Unless otherwise specified, the referenced standard shall be the most recent issue at the time of order placement.

ASTM E 18, Standard Test Method for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials

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ASTM B 117, Standard Practice for Operating Salt Spray (Fog) Testing Apparatus

ASTM A 380, Standard Practice for Cleaning and Descaling Stainless Steel Parts, Equipment, and Systems

ASTM B 695, Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel

ASTM DS-56F/SAE HS-1086, Unified Numbering System (UNS) for Metal and Alloys

Publisher: The American Society for Testing and Materials (ASTM), 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959

2 GENERAL DATA

2.1 Basic Retaining Rings

Type NA1 retaining rings covered by this Standard are spread over a shaft by means of a pliers or special tool and allowed to relax and seat in a circumferential groove, thereby providing an external protruding shoulder that can be used for locating and retaining a part on the shaft.

Type NA2 retaining rings covered by this Standard are compressed into a housing by means of a pliers or special tool and allowed to relax and seat in a circumferential groove, thereby providing an internal protruding shoulder that can be used for locating and retaining a part contained inside of the housing.

In both cases, the rings have a tapered section to provide a more uniform distribution of stresses during expansion or compression.

2.2 E-Type Retaining Rings

Type NA3 retaining rings covered by this Standard contain three prongs connected by a reduced section bridge to provide greater resilience during installation. The rings are installed radially, usually by means of an applicator, and provide a high shoulder for abutment by a retained part.

3 MATERIAL

Standard materials used in the manufacture of the retaining rings shall be carbon spring steel, corrosion-resistant steel, or beryllium copper.

3.1 Carbon Spring Steel

Retaining rings made from carbon spring steel shall conform to the chemical composition of UNS G10600 to UNS G10900 or equivalent and have the following physical properties.

3.1.1 Heat Treatment. The retaining rings shall be heat treated by austempering up to Size 345. For sizes from 350 to 1000, the rings shall be heat treated by either austempering or by quench and temper. All sizes are to be heat treated to the hardness shown in Table 1.

3.1.2 Surface Treatment

3.1.2.1 Phosphate Coating. Finish shall consist of basic zinc phosphate treatment and subsequent supplementary treatment to enhance Shelf Life (example of supplementary treatment: *wax, light drying oil).*

3.1.2.2 Zinc Plating. Finish shall consist of mechanically applied zinc with a dichromate conversion treatment similar to ASTM B 695 Type II, Class 8. The resulting treatment shall be capable of withstanding 72 hours to white corrosion or red rust. Salt spray corrosion resistance test method shall be similar to ASTM B 117.

NOTE: Electroplating has the potential of introducing Hydrogen Embrittlement. Therefore, its application for retaining rings is not allowed.

3.1.2.3 Oil Finish. To extend Shelf Life, rings shall be coated with a thin film of non-tacky water displacing rust preventative oil.

3.2 Corrosion-Resistant Steel

Retaining rings made from corrosion-resistant steel shall conform to the chemical composition of UNS S15700 or equivalent (AISI 632, AMS 5520).

Optional Material: For rings with thickness of 0.062 or greater, retaining rings may be made from UNS S17700.

3.2.1 Heat Treatment. The retaining rings shall be heat treated to the hardness values as specified in Table 2. **(b)**

3.2.2 Surface Treatment. Retaining rings shall be cleaned free of scale, grease, oil, and other foreign material in conformance to ASTM A 380.

3.3 Beryllium Copper

Retaining rings made from beryllium copper shall conform to the chemical composition of Alloy 25, CDA 172 or equivalent (UNS C17200) and have the following physical properties.

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(b) **TABLE 1 HARDNESS RANGES FOR TAPERED AND REDUCED CROSS SECTION RETAINING RINGS (CARBON SPRING STEEL)**

NA1		NA2	
Ring Size	**Hardness**	**Ring Size**	**Hardness**
25 through 46	69.5–73 HR30N (51–55 HRC)	25 and 31	86–88 HR15N (51–55 HRC)
50 through 81	66–71 HR30N (47–53 HRC)	37 through 51	69.5–73 HR30N (51–55 HRC)
84 through 102	47–53 HRC	56 through 77	67.5–72 HR30N (49–54 HRC)
106 through 343	47–52 HRC	81 through 102	66–71 HR30N (47–53 HRC)
350 through 700	44–51 HRC	106 through 347	47–52 HRC
725 through 1000	40–47 HRC	350 through 700	44–51 HRC
		725 through 1000	40–47 HRC

NA3	
Ring Thickness [Note (2)]	**Hardness**
0.010 in. thick [Note (1)]	84.5–87 HR15N (48–53 HRC)
0.015 in. and 0.020 in. thick	84.5–87 HR15N (48–53 HRC)
0.025 in. thick	66.5–71 HR30N (48–53 HRC)
0.035 in., 0.042 in., 0.050 in., and 0.062 in. thick	47–52 HRC

NOTES:
(1) These parts can only be checked by mounting for microhardness testing.
(2) See Table 8 for ring sizes.

(b) **3.3.1 Heat Treatment.** The retaining rings shall be heat treated to the hardness values as specified in Table 3.

3.3.2 Surface Treatment. Retaining rings shall be cleaned to remove oxide formed as a result of the heat treating process. Since these rings have extremely high resistance to most types of atmospheric corrosion, further protective finishes are usually not required.

4 HARDNESS TESTING PROCEDURE

The surfaces of both sides of each sample retaining ring shall be prepared for hardness testing by removal of all plating and other surface conditions that may affect the hardness reading. Hardness testing procedure shall be in conformance to ASTM E 18.

5 PERMANENT SET LIMITS

The following procedures should be used for determining if the permanent set of the ring is within the allowable limits.

5.1 NA1 Basic External Retaining Rings

Step 1. Expand the ring with a plier until it just fits over a shaft 1% larger than the nominal shaft diameter. Repeat this procedure 4 more times with the same ring. The ring shall not crack during this procedure.

Step 2. Measure the ring diameter (D) in the three places shown in Fig. 1.

Step 3. Compute the average of the 3 diameters and compare it to the minimum groove diameter listed in the Table 6 for that ring. In all cases, the average diameter after permanent set shall be less than the minimum groove

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TABLE 2 HARDNESS RANGES FOR TAPERED AND REDUCED CROSS SECTION RETAINING RINGS (CORROSION-RESISTANT STEEL)

NA1		NA2	
Ring Size	**Hardness**	**Ring Size**	**Hardness**
25 through 81	63–69.5 HR30N (44–51 HRC)	25 and 31	82.5–86 HR15N (44–51 HRC)
87 and over	44–51 HRC	37 through 102	63–69.5 HR30N (44–51 HRC)
		106 and over	44–51 HRC

NA3	
Ring Thickness [Note (2)]	**Hardness**
0.010 in. thick	82.5–86 HR15N [Note (1)] (44–51 HRC)
0.015 in. and 0.020 in. thick	82.5–86 HR15N (44–51 HRC)
0.025 in. thick	63–69.5 HR30N (44–51 HRC)
0.035 in., 0.042 in., 0.050 in., and 0.062 in. thick	44–51 HRC

NOTES:
(1) These parts can only be checked by mounting for microhardness testing.
(2) See Table 8 for ring sizes.

TABLE 3 HARDNESS RANGES FOR TAPERED AND REDUCED CROSS SECTION RETAINING RINGS (BERYLLIUM COPPER)

NA1		NA2	
Ring Size	**Hardness**	**Ring Size**	**Hardness**
12 through 23	77–82 HR15N [Note (1)] (34–43 HRC)	25 and 31	77–82 HR15N (34–43 HRC)
25 through 102	56.5–62 HR30N (37–43 HRC)	37 through 102	54–62 HR30N (34–43 HRC)
106 and over	37–43 HRC	106 and over	34–43 HRC

NA3	
Ring Thickness [Note (2)]	**Hardness**
0.010 in. thick	79–82 HR15N [Note (1)] (37–43 HRC)
0.015 in. and 0.020 in. thick	79–82 HR15N (37–43 HRC)
0.025 in. thick	56.5–62 HR30N (37–43 HRC)
0.035 in., 0.042 in., 0.050 in., and 0.062 in. thick	37–43 HRC

NOTES:
(1) These parts can only be checked by mounting for microhardness testing.
(2) See Table 8 for ring sizes.

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ASME B18.27.5

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EXTERNAL SELF-LOCKING RINGS TYPE NA14, EXTERNAL INTERLOCKING RINGS TYPE NA15, EXTERNAL BOWED LOCKING PRONGS RINGS TYPE NA16

1 INTRODUCTORY NOTES

1.1 Scope

This Standard provides complete general and dimensional data for three series of general purpose bowed tapered and reduced cross section retaining rings which may be used with the nominal size shafts and in grooves of the recommended dimensions listed. Also included are formulas and tolerances on which dimensional data are based. Three appendices include guidance for assembly and recommended standard drawing formats.

The inclusion of dimensional data in this Standard is not intended to imply that all of the products described are stock production sizes. Consumers should consult with suppliers concerning lists of stock production sizes.

1.2 ISO Standard

There are no existing ISO Standards for these products.

1.3 Ring Types

1.3.1 External Self-Locking Rings — Type NA14. Dimensions of retaining rings and grooves for various shaft sizes are given in Table 6. See Nonmandatory Appendix A for equivalent metric data.

1.3.2 External Interlocking Rings — Type NA15. Dimensions of retaining rings and grooves for various shaft sizes are given in Table 7. See Nonmandatory Appendix C for equivalent metric data.

1.3.3 External Bowed Locking Prong Rings — Type NA16. Dimensions of retaining rings and grooves for various shaft sizes are given in Table 8. See Nonmandatory Appendix E for equivalent metric data.

1.4 Designations

Retaining rings in this Standard shall be designated by the following data in the sequence shown: ASME document number; ring series type number; size; material; protective finish, if required; or by, optionally, ASME B18.24.3 PIN Code. See examples below:

ASME B18.27.5, NA14-18, Carbon spring steel, phosphate
R275NAA0018NN056NNAA1

ASME B18.27.5, NA14-25, Carbon spring steel, zinc plated
R275NAA0025NN056NNDE1

ASME B18.27.5, NA15-150, Corrosion-resistant steel
R275NAB0150NN519NNAB1

ASME B18.27.5, NA16-12, Beryllium copper
R275NAC0012NN643NNAA1

1.5 Applicability

The rings specified in this Standard are intended primarily for use with the shaft and groove sizes recommended; however, in certain cases these diameters may be altered somewhat to suit the requirements of a particular design. When such changes are made, care should be taken to not alter the shaft size to such an extent that the ring will take enough permanent set to allow a loose fit after the ring has been assembled into the groove. Neither should the groove diameter be altered to the extent to permit the ring to fit loosely.

For Type NA16 rings, the groove location parameters ($x_{Max.}$ and $x_{Min.}$) should not be altered to the extent the take-up is adversely affected.

1.6 Dimensions

All dimensions in this Standard are in inches unless otherwise stated.

1.7 Supplementary Information

Allowable loads and clearance dimensions for all three ring series are included in Mandatory Appendices I, II, and III. Revolutions Per Minute (RPM) limits and maximum radii and chamfers for ring Types NA14 and NA15 are included in Mandatory Appendices I and II.

Groove location parameters for ring Type NA16 are given in Mandatory Appendices III.

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1.8 Reference Standards

Unless otherwise specified, the referenced standard shall be the most recent issue at the time of order placement.

ASME B18.24.3, Part Identifying Number (PIN) Code System Standard for B18 Nonthreaded Products

Publisher: The American Society of Mechanical Engineers (ASME), Three Park Avenue, New York, NY 10016-5990; Order Department: 22 Law Drive, Box 2300, Fairfield, NJ 07007-2300

ASTM E 18, Standard Test Method for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials

ASTM E 92, Standard Test Method for Vickers Hardness of Metallic Materials

ASTM B 117, Standard Practice for Operating Salt Spray (Fog) Testing Apparatus

ASTM A 380, Standard Practice for Cleaning and Descaling Stainless Steel Parts, Equipment, and Systems

ASTM B 695, Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel

ASTM DS-56F/SAE HS-1086, Unified Numbering System (UNS) for Metals and Alloys

Publisher: The American Society for Testing and Materials (ASTM), 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959

2 GENERAL DATA

2.1 External Self-Locking Retaining Rings

Type NA14 external self-locking retaining rings are designed for use on ungrooved shafts, tubes, or bosses. These rings can be used in many assemblies which do not require any sizeable thrust load but serve merely as a locking and positioning device against small loads and vibrations. If abnormal loading conditions are present, the thrust capacity can be substantially increased by installing the ring in a shallow groove.

Retaining ring pliers or special tools are used for assembly. When installed, friction force caused by heavy spring pressure of ring on shaft makes the fastener secure against axial displacement in either direction.

2.2 External Interlocking Retaining Rings

Type NA15 external interlocking retaining rings are designed to withstand high rotational speeds and heavy thrust loads. The ring is produced in two identical halves. The ends interlock into a groove on a shaft and once assembled, the ring is dynametrically balanced.

Assembly of the rings can be accomplished by hand or with the use of simple fixtures.

2.3 External Bowed Locking Prongs Retaining Rings

Type NA16 external bowed locking prongs retaining rings are a variation of the NA9 bowed E-type rings, and also are installed radially, usually by means of an applicator or screw driver. They differ from the NA9 bowed E-rings in that in addition to the bowed design for eliminating "play" in an assembly, it also has two prongs which lock the fastener positively in its groove.

These rings are secure against relative rotation between the retained parts. They also will withstand moderate thrust and impact loads. Its bowed construction allows the ring to provide resilient end-play take up.

3 MATERIAL

3.1 Carbon Spring Steel

Retaining rings made from carbon spring steel shall conform to the chemical composition of UNS G10600 to UNS G10900 or equivalent and have the following physical properties.

3.1.1 Heat Treatment. The retaining rings shall be heat treated by austempering to the hardness values specified in Table 1.

3.1.2 Finishes. The following finishes are available.

3.1.2.1 Phosphate Coating. Finish shall consist of basic zinc phosphate treatment and subsequent supplementary treatment to enhance shelf life (example of supplementary treatment: *wax, light drying oil).*

3.1.2.2 Zinc Plating. Finish shall consist of mechanically applied zinc with a dichromate conversion treatment similar to ASTM B 695 Type II, Class 8. The resulting treatment shall be capable of withstanding 72 hours to white corrosion or red rust. Salt spray corrosion resistance test method shall be similar to ASTM B 117.

NOTE: Electroplating is not allowed for plating of retaining rings.

3.1.2.3 Oil Finish. To extend shelf life, rings shall be coated with a thin film of non-tacky water displacing rust preventative oil.

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TABLE 1 HARDNESS RANGES FOR TAPERED AND REDUCED CROSS SECTION RETAINING RINGS (CARBON SPRING STEEL)

NA14		NA15	
Ring Size	**Hardness**	**Ring Size**	**Hardness**
6 through 9	458–528 HV (83.5–86 HR15N) (46–51 HRC)	46 through 62	465–544 HV (65.5–70.5 HR30N) (46.5–52 HRC)
12 through 23	458–528 HV (65–69.5 HR30N) (46–51 HRC)	66 and over	471–544 HV (47–52 HRC)
25 and over	458–528 HV (46–51 HRC)	...	...

NA16	
Ring Size	**Hardness**
9 and 12 [Note (1)]	458–528 HV (83.5–86 HR15N) (46–51 HRC)
18 and 25	458–528 HV (83.5–86 HR15N) (46–51 HRC)
31 and 37	458–528 HV (65–69.5 HR30N) (46–51 HRC)

NOTE:
(1) These parts can only be checked by mounting for microhardness testing.

3.2 Corrosion-Resistant Steel

Retaining rings made from corrosion-resistant steel shall conform to the chemical composition of UNS S15700.

Optional Material: For rings with thickness of 0.062 or greater, retaining rings may be made from UNS S17700. The retaining rings shall have the following physical properties.

3.2.1 Heat Treatment. The retaining rings shall be heat treated to the hardness values as specified in Table 2.

3.2.2 Surface Treatment. Retaining rings shall be cleaned free of scale, grease, oil, and other foreign material in conformance to ASTM A 380.

3.3 Beryllium Copper

Retaining rings made from beryllium copper shall conform to the chemical composition of UNS C17200 and have the following physical properties.

3.3.1 Heat Treatment. The retaining rings shall be heat treated to the hardness values as specified in Table 3.

3.3.2 Surface Treatment. Retaining rings shall be cleaned to remove oxide formed as a result of the heat treating process. Since these rings have extremely high resistance to most types of atmospheric corrosion, further protective finishes are usually not required.

4 HARDNESS TESTING PROCEDURE

The surfaces of both sides of each sample retaining ring shall be prepared for hardness testing by removal of all plating and other surface conditions that may affect the hardness reading. Hardness testing procedure shall be in conformance to ASTM E 18 or ASTM E 92.

5 EXPANDABILITY AND CRACKING TESTS

All retaining rings shall be capable of undergoing the following procedures.

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TABLE 2 HARDNESS RANGES FOR TAPERED AND REDUCED CROSS SECTION RETAINING RINGS (CORROSION-RESISTANT STEEL)

NA14		NA15	
Ring Size	**Hardness**	**Ring Size**	**Hardness**
9	434–528 HV (82.5–86 HR15N) (44–51 HRC)	All	434–528 HV (44–51 HRC)
12 through 18	434–528 HV (63–69.5 HR30N) (44–51 HRC)	...	...
25 and over	434–528 HV (44–51 HRC)	...	...

NA16	
Ring Size	**Hardness**
9 and 12 [Note (1)]	434–528 HV (82.5–86 HR15N) (44–51 HRC)
18 through 31	434–528 HV (82.5–86 HR15N) (44–51 HRC)
37	434–528 HV (63–69.5 HR30N) (44–51 HRC)

NOTE:
(1) These parts can only be checked by mounting for microhardness testing.

5.1 NA14 External Self-Locking Retaining Rings

(a) The free diameter of the ring before expansion shall be within specified tolerances. See dimension *D* in Table 6.

(b) The ring shall be expanded over a shaft having the maximum diameter as shown in Table 6, dimension *S*.

(c) After removal from the shaft the ring shall not show any evidence of cracking.

5.2 NA15 External Interlocking Retaining Rings and NA16 External Bowed Locking Prongs Retaining Rings

(a) The rings when assembled shall grip the minimum groove diameter (see dimension *G* in Table 7 and Table 8) and shall have no less than 3 point contact.

(b) After removal the rings shall not show any evidence of cracking.

6 IRREGULARITY LIMITATIONS

6.1 Dish

Dish measurements of tapered and reduced section retaining rings as shown in Fig. 1 shall not exceed the limitations specified in Table 4 for the applicable ring series thickness.

6.2 Pitch

Pitch measurements of tapered and reduced section retaining rings as shown in Fig. 2 shall not exceed the limitations specified in Table 5 for the applicable ring series thickness.

7 WORKMANSHIP

Workmanship shall be in accordance with high grade commercial practice. Rings shall be free from rust, loose scale, hanging burrs, cracks, and any other defects that might affect their functioning.

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TABLE 3 HARDNESS RANGES FOR TAPERED AND REDUCED CROSS SECTION RETAINING RINGS (BERYLLIUM COPPER)

NA14		NA15	
Ring Size	**Hardness**	**Ring Size**	**Hardness**
9	336–423 HV (77–82 HR15N) (34–43 HRC)	46 through 62	363–423 HV (56.5–62 HR30N) (37–43 HRC)
12 through 18	336–423 HV (54–62 HR30N) (34–43 HRC)	66 and over	363–423 HV (37–43 HRC)
25 and over	363–423 HV (34–43 HRC)	...	...

NA16	
Ring Size	**Hardness**
9 and 12 [Note (1)]	336–423 HV (77–82 HR15N) (34–43 HRC)
18 through 37	336–423 HV (77–82 HR15N) (34–43 HRC)

NOTE:
(1) These parts can only be checked by mounting for microhardness testing.

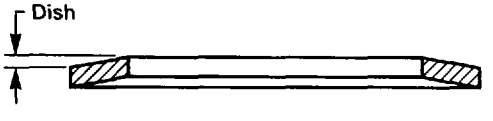


FIG. 1 DISH FOR TYPES NA14 AND NA15

TABLE 4 DISH LIMITATIONS

Types NA14 and NA15	
Ring Thickness [Note (1)]	**Max. Dish**
0.015	0.002
0.025–0.035	0.003
0.042–0.093	0.005
0.109	0.010

NOTE:
(1)(a) See Table 6 for ring sizes Type NA14.
(b) See Table 7 for ring sizes Type NA15.

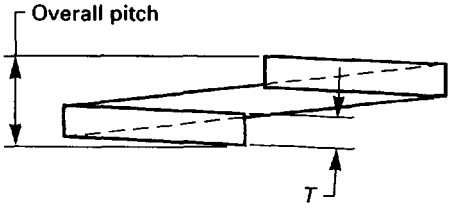


FIG. 2 PITCH FOR TYPES NA14 AND NA15

TABLE 5 PITCH LIMITATIONS

Types NA14 and NA15	
Ring Size, in.	**Overall Pitch, Max.**
All Sizes	1.5T

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8 ADDITIONAL DATA

8.1 Dimensional Data

Dimensional data and performance information on rings and grooves for tapered and reduced cross section retaining rings are shown in Tables 6, 7, and 8, and Mandatory Appendices I, II, and III.

8.2 Metric Values

For reference purposes only, metric values are shown in Nonmandatory Appendices A, B, C, D, E, and F.

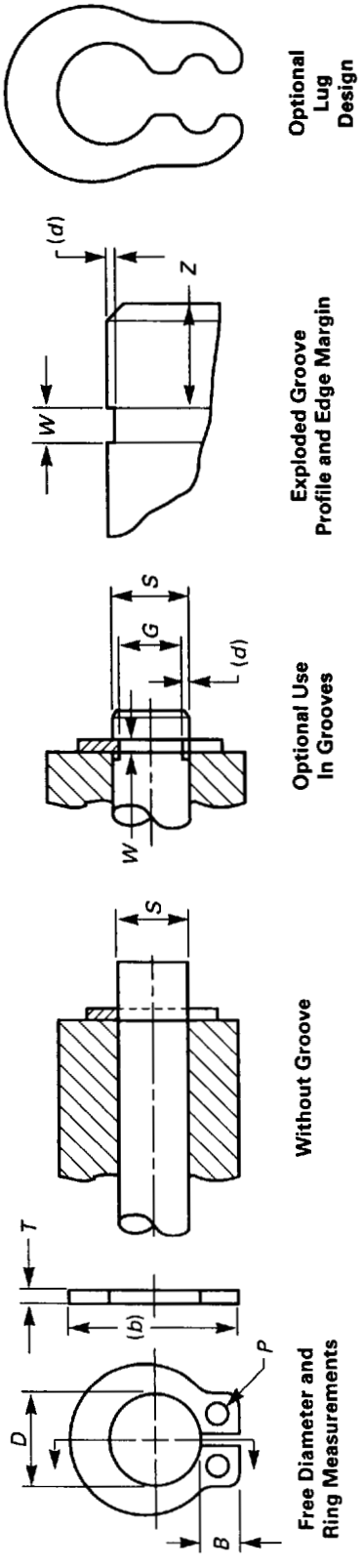
8.3 Additional Information

Consult with suppliers for additional information not included in this Standard.

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TABLE 6 ILLUSTRATION



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TABLE 6 NA14 EXTERNAL SELF-LOCKING RETAINING RINGS

Ring Series and Size No.	Shaft Diameter				Ring Size and Weight									Groove Size					Edge Margin
					Free Diameter		Thickness [Note (1)]		Hole Diameter		Lug Height (Max.)	Ring Height	Approx. Mass per 1000 Pcs.	Diameter		Width		Depth	
	S, Dec.																		
	From	To	S, Frac.	S, mm	D	Tol.	T	Tol.	P	Tol.	B	(b)	lb	G	Tol.	W	Tol.	(d)	Z
NA14-6	0.058	0.060	...	1.50	0.055	+0.002	0.015		0.035		0.071	0.145	0.030						
NA14-7	0.078	0.080	5/64	2.01	0.074	−0.003	0.025		0.034	±0.004	0.074	0.184	0.08						
NA14-9	0.092	0.096	3/32	2.39	0.089		0.025	±0.002	0.034		0.077	0.207	0.10						
NA14-12	0.123	0.127	1/8	3.18	0.120		0.025		0.042	+0.010	0.081	0.268	0.24	Not recommended for use with grooves					
NA14-15	0.154	0.158	5/32	3.96	0.150	+0.002	0.025		0.042	−0.002	0.081	0.307	0.30						
NA14-18	0.185	0.189	3/16	4.75	0.181	−0.004	0.035		0.051		0.100	0.364	0.55						
NA14-19	0.195	0.199	...	5.00	0.187	±0.003	0.032		0.051	±0.004	0.112	0.375	0.45						
NA14-23	0.234	0.238	15/64	5.99	0.224		0.035	±0.003	0.051		0.101	0.422	0.76	0.228	+0.0005	0.041	+0.003	0.004	0.030
NA14-25	0.248	0.252	1/4	6.35	0.238	+0.002-0.004	0.035		0.051	+0.010-0.002	0.100	0.437	0.74	0.240	−0.0015	0.041	−0.000	0.005	0.030
NA14-31	0.310	0.316	5/16	7.95	0.298		0.042		0.078		0.145	0.553	1.39	0.303		0.048		0.005	0.030
NA14-37	0.373	0.379	3/8	9.55	0.354	+0.003	0.042		0.078		0.145	0.620	1.72	0.361	+0.001	0.048		0.007	0.030
NA14-43	0.434	0.440	7/16	11.10	0.412	−0.005	0.050		0.078	+0.015	0.155	0.701	2.61	0.419	−0.002	0.056	+0.004	0.009	0.030
NA14-50	0.497	0.503	1/2	12.70	0.470	+0.004	0.050		0.078	−0.002	0.162	0.768	2.91	0.478		0.056	−0.000	0.011	0.040
NA14-62	0.622	0.628	5/8	15.88	0.593	−0.006	0.062	±0.004	0.078		0.184	0.948	5.70	0.599		0.069		0.013	0.045
NA14-75	0.745	0.755	3/4	19.05	0.706		0.062		0.120		0.237	1.115	6.88	0.718	+0.002-0.003	0.069		0.016	0.050

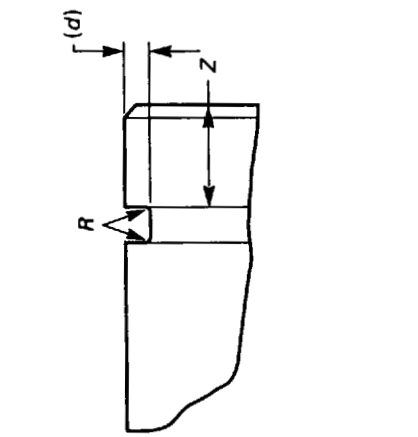
GENERAL NOTE: For reference, see Table 6 illustration on previous page.

NOTE:

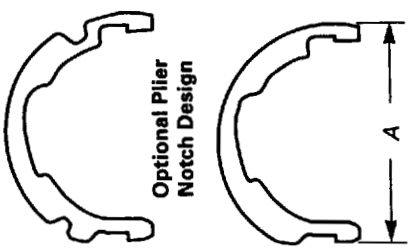
(1) For plated rings, add 0.002 in. to the listed maximum ring thickness, except that maximum ring thickness (when used in a groove) will be a minimum of 0.0002 in. less than the listed groove width (*W*) minimum.

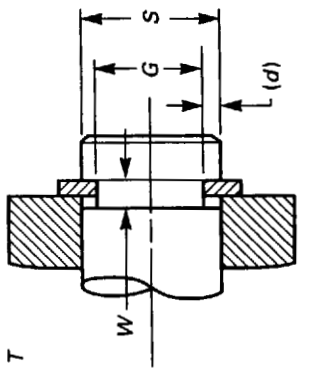
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TABLE 7 ILLUSTRATION

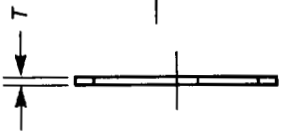


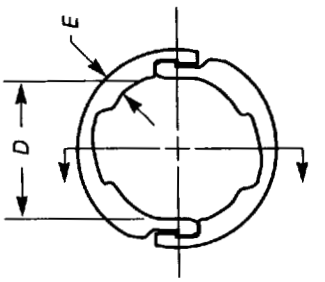
Exploded Groove Profile and Edge Margin (Z).
Maximum bottom radii (R), 0.005
For ring sizes –46 thru –98; 0.010
For ring sizes –112 thru –200; 0.015
For ring sizes –212 thru –337.





Shaft Diameter and
Groove Dimensions





Free Diameter and
Ring Measurements

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TABLE 7 NA15 EXTERNAL INTERLOCKING RETAINING RINGS

Ring Series and Size No.	Shaft Diameter			Ring Size and Weight									Groove Dimensions					
				Free Diameter [Note (1)]		Thickness [Note (2)]		Large Section		Width Across Lugs		Approx. Mass per 1000 Rings (2 Halves)	Diameter		Width		Depth	Edge Margin
	S, Dec.	*S*, Frac.	*S*, mm	*D*	Tol.	*T*	Tol.	*E*	Tol.	*A*	Tol.	lb.	*G*	Tol.	*W*	Tol.	(*d*)	*Z*
NA15-46	0.469	15/32	11.91	0.414		0.035		0.105		0.585	±0.003	1.36	0.419	±0.0015	0.039		0.025	0.075
NA15-50	0.500	1/2	12.70	0.459		0.035		0.105		0.625		1.50	0.464	0.004 (3)	0.039		0.018	0.054
NA15-59	0.594	19/32	15.09	0.538	±0.002	0.035		0.105	±0.005	0.710	±0.004	1.74	0.544		0.039	+0.003	0.025	0.075
NA15-62	0.625	5/8	15.88	0.569		0.035		0.105		0.740		1.82	0.575		0.039	−0.000	0.025	0.075
NA15-66	0.669	...	16.99	0.593		0.042		0.135		0.815		3.1	0.599		0.046		0.035	0.105
NA15-75	0.750	3/4	19.05	0.673	±0.003	0.042	±0.002	0.135		0.894	±0.005	3.5	0.680	±0.002	0.046		0.035	0.105
NA15-78	0.781	25/32	19.84	0.703		0.042		0.135		0.925		3.6	0.711	0.004 (3)	0.046		0.035	0.105
NA15-87	0.875	7/8	22.23	0.796		0.042		0.135		1.017		3.8	0.805		0.046		0.035	0.105
NA15-98	0.984	63/64	24.99	0.863		0.050		0.188		1.172		7.3	0.872	±0.003	0.056		0.056	0.168
NA15-98	1.000	1	25.40	0.863		0.050		0.188	±0.006	1.172	±0.006	7.3	0.872	0.004 (3)	0.056		0.064	0.192
NA15-112	1.125	1 1/8	28.58	1.002		0.050		0.188		1.311		7.9	1.013		0.056		0.056	0.168
NA15-118	1.188	1 3/16	30.18	1.064	±0.004	0.050		0.188		1.373		8.5	1.075	±0.003	0.056	+0.004	0.056	0.168
NA15-125	1.250	1 1/4	31.75	1.126		0.050		0.188		1.435		8.9	1.138	0.005 (3)	0.056	−0.000	0.056	0.168
NA15-137	1.375	1 3/8	34.93	1.250		0.050		0.188		1.559	±0.007	9.6	1.263		0.056		0.056	0.168
NA15-150	1.500	1 1/2	38.10	1.374		0.050		0.188		1.683		10.6	1.388		0.056		0.056	0.168
NA15-156	1.562	1 9/16	39.67	1.412		0.062		0.222		1.778		16.4	1.427		0.068		0.068	0.204
NA15-162	1.625	1 5/8	41.28	1.474		0.062		0.222		1.840		17.5	1.489		0.068		0.068	0.204
NA15-175	1.750	1 3/4	44.45	1.597	±0.005	0.062		0.222		1.963	±0.008	18.4	1.614	±0.005	0.068		0.068	0.204
NA15-175	1.772	...	45.01	1.597		0.062		0.222		1.963		18.4	1.614	0.005 (3)	0.068		0.078	0.234
NA15-187	1.875	1 7/8	47.63	1.721		0.062		0.222		2.090		20.8	1.739		0.068		0.068	0.204
NA15-196	1.969	1 31/32	50.01	1.779		0.078		0.262		2.209		31.0	1.797		0.086		0.086	0.258
NA15-200	2.000	2	50.80	1.809		0.078		0.262		2.242		31.6	1.828		0.086		0.086	0.258
NA15-212	2.125	2 1/8	53.98	1.933	±0.006	0.078	±0.003	0.262	±0.007	2.364		34.2	1.953	±0.005	0.086	+0.005	0.086	0.258
NA15-212	2.156	2 5/32	54.76	1.933		0.078		0.262		2.364		34.2	1.953	0.006 (3)	0.086	−0.000	0.101	0.303
NA15-225	2.250	2 1/4	57.15	2.057		0.078		0.262		2.488	±0.010	37.3	2.078		0.086		0.086	0.258
NA15-237	2.375	2 3/8	60.33	2.180		0.078		0.262		2.610		38.9	2.203		0.086		0.086	0.258
NA15-250	2.500	2 1/2	63.50	2.304		0.078		0.262		2.734		39.7	2.328		0.086		0.086	0.258
NA15-262	2.625	2 5/8	66.68	2.428		0.078		0.262		2.858		43.9	2.453		0.086		0.086	0.258
NA15-275	2.750	2 3/4	69.85	2.518		0.093		0.323		3.049		63.2	2.544		0.103		0.103	0.309
NA15-287	2.875	2 7/8	73.03	2.642	±0.008	0.093		0.323		3.172	±0.012	68.4	2.669	±0.006	0.103		0.103	0.309
NA15-300	3.000	3	76.20	2.754		0.093		0.329	±0.008	3.294		70.4	2.794	0.006 (3)	0.103		0.103	0.309
NA15-325	3.250	3 1/4	82.55	3.013		0.093		0.325		3.542	±0.015	77.6	3.044		0.103		0.103	0.309
NA15-337	3.375	3 3/8	85.73	3.114		0.109		0.395		3.761		94.0	3.145		0.120		0.115	0.345

GENERAL NOTE: For reference, see Table 7 illustration on previous page.

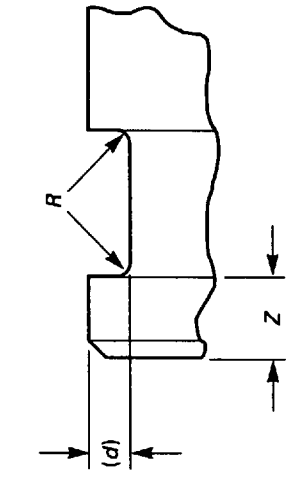
NOTES:

(1) The free diameter dimension is for reference only and should not be used as part of an inspection procedure. Only dimension *A* (width across lugs) should be used for this purpose.

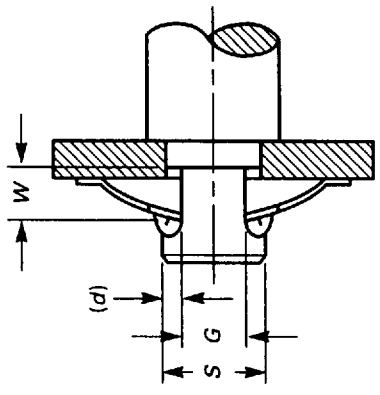
(2) For plated rings, add 0.002 in. to the listed maximum thickness, except that maximum ring thickness after plating will be a minimum of 0.0002 in. less than the listed groove (*W*) minimum.

(3) *F.I.M (Full Indicator Movement)*: maximum circular runout of groove diameter to shaft.

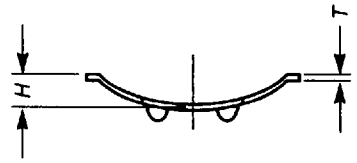
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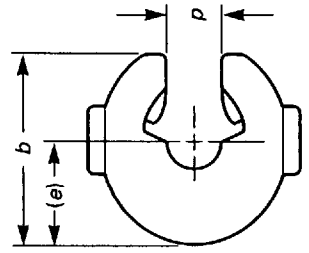


Exploded Groove Profile and Edge Margin (*Z*).
Maximum bottom radii (*R*), 0.005
for ring sizes –9 thru –25; 0.010
For ring sizes –31 thru –43



Shaft Diameter and
Groove Dimensions





Ring Measurements

TABLE 8 NA16 EXTERNAL BOWED LOCKING PRONGS RETAINING RINGS

Ring Series and Size No.	Ring Size and Weight													Groove Dimensions						Edge Margin
	Shaft Diameter			Length			Gap		Bow Height		Thickness [Note (1)]		Approx Mass per 1000 Pcs.	Diameter		Width		Depth	
	S, Dec.	Tol.	*S*, Frac.	*b*	Tol.	(*e*)	*p*	Tol.	*H*	Tol.	*T*	Tol.	lb.	*G*	Tol.	*W*	Tol.	(*d*)	*Z*
NA16-9	0.092	±0.002	3/32	0.307	±0.010	0.166	0.063	±0.004	0.050	±0.010	0.010	±0.001	0.23	0.061	±0.001	0.035	+0.005 −0.000	0.016	0.031
NA16-12	0.125		1/8	0.307		0.166	0.086		0.050		0.010		0.19	0.082	±0.0015	0.035		0.021	0.043
NA16-15	0.156		5/32	0.330		0.184	0.108		0.055		0.010		0.24	0.104		0.040		0.026	0.052
NA16-18	0.188		3/16	0.390		0.213	0.130		0.060		0.015		0.47	0.124	±0.002	0.045		0.032	0.064
NA16-25	0.250	±0.003	1/4	0.500		0.280	0.172	±0.005	0.070		0.015	±0.002	0.77	0.165		0.055		0.042	0.085
NA16-31	0.312		5/16	0.620		0.360	0.234		0.095		0.015		1.3	0.228	±0.003	0.080		0.042	0.084
NA16-37	0.375		3/8	0.740		0.427	0.280		0.130		0.020		2.2	0.270		0.095		0.052	0.105
NA16-43	0.438		7/16	0.820	±0.020	0.475	0.340	±0.010	0.130		0.020		2.6	0.327		0.105		0.055	0.111

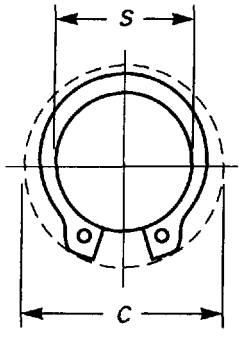
NOTE:
(1) For plated rings, add 0.002 in. to the listed maximum thickness.

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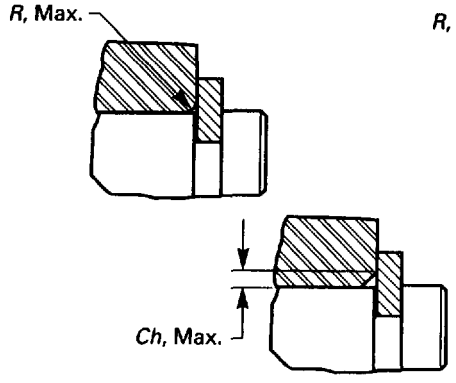
MANDATORY APPENDIX I
EXTERNAL SELF-LOCKING SERIES NA14

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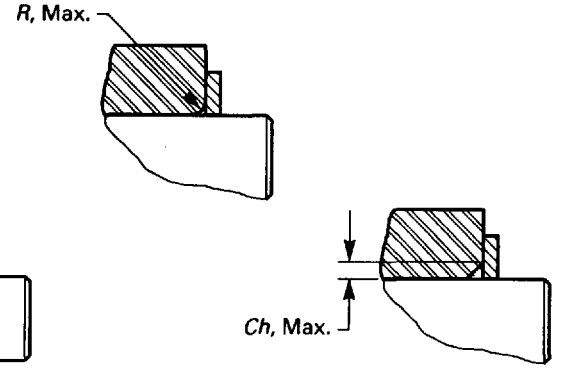
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Clearance Diameter Expanded Over Shaft



Maximum Corner Radius and Chamfer (With Groove)



Maximum Corner Radius and Chamfer (Without Groove)

TABLE I NA14 EXTERNAL SELF-LOCKING RETAINING RINGS

Ring Series and Size No.	Application Data					Limits Standard Material
	Clearance Diameter Released Over Shaft	Allowable Thrust Loads Square Corner Abutment		Allowable Corner Radii and Chamfers		
		UNS G10600–G10900 and UNS S15700 Stainless Steel Rings	All Standard Rings Used on Low Carbon Steel Shafts			
	C	*Pr* (lb) [Note (1)]	*Pg* (lb) [Note (2)]	*R*, Max.	*Ch*, Max.	RPM
NA14-6	0.21	5	Not	0.025	0.015	
NA14-7	0.24	8	recom-	0.036	0.022	
NA14-9	0.26	8	mended	0.042	0.025	
NA14-12	0.33	10	for use	0.054	0.032	OVER
NA14-15	0.36	12	with	0.059	0.035	80000
NA14-18	0.44	20	grooves	0.063	0.038	
NA14-19	0.43	30		0.064	0.039	
NA14-23	0.48	22	70	0.070	0.042	
NA14-25	0.49	23	90	0.072	0.043	77000
NA14-31	0.68	25	110	0.080	0.048	58000
NA14-37	0.74	31	180	0.086	0.051	51000
NA14-43	0.81	41	290	0.093	0.056	44000
NA14-50	0.90	46	390	0.100	0.060	40000
NA14-62	1.06	61	570	0.120	0.072	32000
NA14-75	1.32	66	850	0.125	0.075	25000

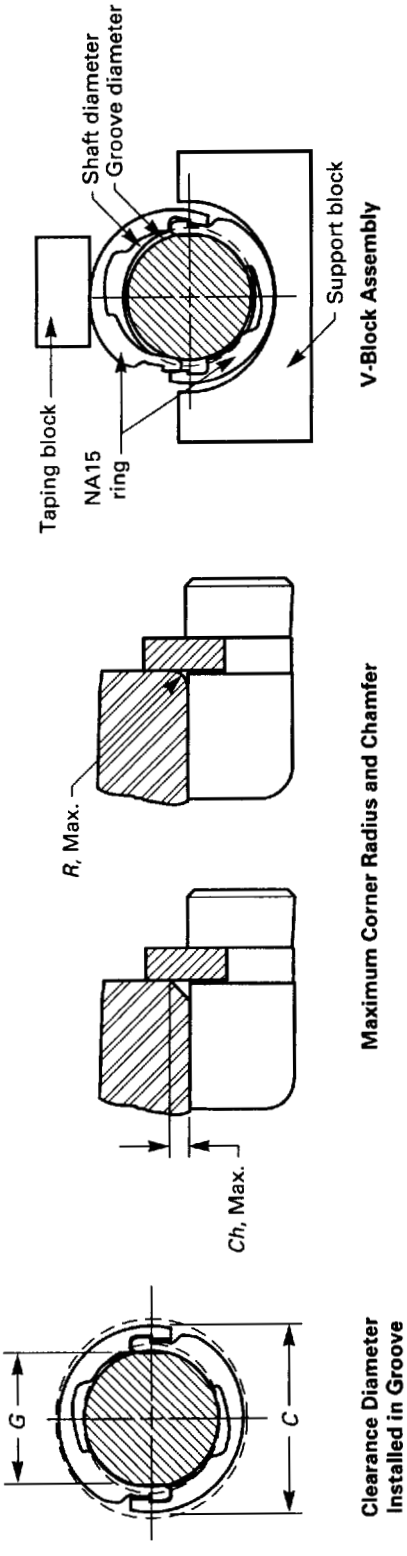
NOTES:
(1) Values listed above apply to rings installed on shafts made of soft low carbon steel.
(2) The allowable thrust load values for *Pg* include a safety factor of 2.

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MANDATORY APPENDIX II
EXTERNAL INTERLOCKING SERIES NA15

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TABLE II ILLUSTRATION



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TABLE II NA15 EXTERNAL INTERLOCKING RETAINING RINGS

Ring Series and Size No.	Application Data						
	Clearance Released in Groove	Allowable Thrust Loads [Note (1)] Square Corner Abutment		Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.	Calculated Allowable Assembly (Steel Rings)
		UNS G10600–G10900 and Stainless Steel Rings Used on Hardened Shafts (50 HRc Min)	All Standard Rings Used on Low Carbon Steel Shafts				
	C	*Pr* (lb) [Note (2)]	*Pg* (lb)	*R*, Max.	*Ch*, Max.	*P'r* (lb)	RPM
NA15-46	0.640	2030	620	0.052	0.040	610	50000
NA15-50	0.680	2132	480	0.052	0.040	610	50000
NA15-59	0.766	2538	790	0.052	0.040	610	46000
NA15-62	0.797	2690	830	0.052	0.040	610	45000
NA15-66	0.886	3400	1250	0.065	0.050	880	43000
NA15-75	0.967	3806	1400	0.065	0.050	880	40000
NA15-78	0.998	4009	1450	0.065	0.050	880	39000
NA15-87	1.092	4466	1600	0.065	0.050	880	35000
NA15-98	1.273	5938	2900	0.086	0.066	1250	31000
NA15-98	1.273	5938	3400	0.081	0.062	1250	30000
NA15-112	1.42	6801	3350	0.086	0.066	1250	28000
NA15-118	1.48	7207	3500	0.086	0.066	1250	27000
NA15-125	1.54	7562	3700	0.086	0.066	1250	26000
NA15-137	1.67	8323	4100	0.086	0.066	1250	24000
NA15-150	1.79	9084	4450	0.086	0.066	1250	22000
NA15-156	1.91	11926	5650	0.100	0.077	1900	21000
NA15-162	1.97	12434	5850	0.100	0.077	1900	20500
NA15-175	2.10	13398	6300	0.100	0.077	1900	19000
NA15-175	2.10	13398	7350	0.094	0.072	1900	19000
NA15-187	2.22	14312	6800	0.100	0.077	1900	17000
NA15-196	2.37	18524	9000	0.114	0.088	3050	15500
NA15-200	2.40	18778	9150	0.114	0.088	3050	15000
NA15-212	2.52	19996	9700	0.114	0.088	3050	14300
NA15-212	2.52	19996	11500	0.104	0.080	3050	14300
NA15-225	2.65	21112	10300	0.114	0.088	3050	13500
NA15-237	2.77	22330	10800	0.114	0.088	3050	12800
NA15-250	2.90	23548	11400	0.114	0.088	3050	12000
NA15-262	3.02	24665	12000	0.114	0.088	3050	11300
NA15-275	3.25	30653	15000	0.143	0.110	4300	10500
NA15-287	3.37	32074	15700	0.143	0.110	4300	9800
NA15-300	3.50	33495	16400	0.143	0.110	4300	9000
NA15-325	3.75	36286	17800	0.144	0.111	4300	7500
NA15-337	3.99	44153	20600	0.182	0.140	5950	6800

GENERAL NOTE: For reference, see Table II illustration on previous page.

NOTES:

(1) *Safety Factors Pr and Pg*: the allowable thrust load values listed include the following safety factors: *Pr*: 3 *Pg*: 2.

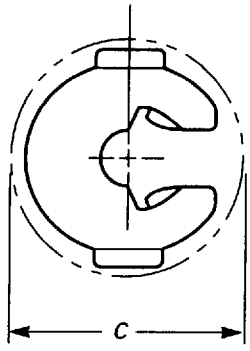
(2) The *Pr* values listed apply to rings made from UNS G10600–G10900 and UNS S15700 stainless steel. *Pr* values for rings made from beryllium copper can be calculated by multiplying listed values by 0.75.

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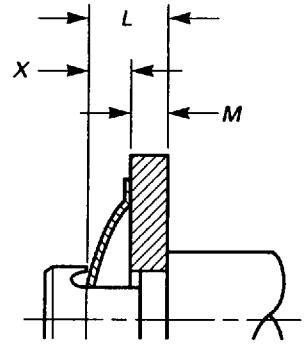
MANDATORY APPENDIX III
EXTERNAL BOWED LOCKING PRONGS SERIES NA16

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Clearance in Groove



L, Max. = *M*, Min. + *X*, Max.
L, Min. = *M*, Max. + *X*, Min.

TABLE III NA16 EXTERNAL BOWED LOCKING PRONGS RETAINING RINGS

Ring Series and Size No.	Application Data								
	Clearance Released in Groove	Allowable Thrust Loads [Note (1)] (Square Corner Abutment)		Distance Outer Groove Wall to Face of Retained Part		Resilient Take Up of Tolerances of *L* and *M*	Approx. Average Resilient Resistance Within *X*, Max. and *X*, Min.		Approx. Force Needed to Flatten Rings
		UNS G10600–G10900 and Stainless Steel Rings Used on Hardened Shafts (50 HRc, Min.)	All Standard Rings Used on Low Carbon Steel Shafts				As Installed	After Flattening	
	C	*Pr* (lb) [Note (2)]	*Pg* (lb)	*X*, Min.	*X*, Max.	*X*, Max. – *X*, Min.	lb	lb	lb
NA16-9	0.370	80	35	0.030	0.038	0.008	9	3.5	30
NA16-12	0.370	102	60	0.030	0.040	0.010	8	3.0	30
NA16-15	0.410	120	100	0.035	0.045	0.010	8	4.0	30
NA16-18	0.480	203	140	0.039	0.049	0.010	20	5.5	60
NA16-25	0.620	305	250	0.045	0.060	0.015	15	7.0	60
NA16-31	0.790	355	300	0.070	0.085	0.015	6	4.0	60
NA16-37	0.940	555	450	0.080	0.105	0.025	19	7.0	80
NA16-43	1.050	700	600	0.095	0.120	0.025	12	6.0	60

NOTES:
(1) *Safety Factors for Pr and Pg:* the allowable thrust load values listed include the following safety factors: *Pr*: 3 *Pg:* 3.
(2) The *Pr* values for rings made from beryllium copper can be calculated by multiplying listed values by 0.75.

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NONMANDATORY APPENDIX A
TYPE NA14 REFERENCE METRIC VALUES (DIMENSIONS)

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TABLE A NA14 REFERENCE METRIC VALUES (DIMENSIONS)

Ring Series and Size No.	Shaft Diameter	Ring Size and Weight								Groove Dimensions					Edge Margin
		Free Diameter		Thickness [Note (1)]		Hole Diameter		Lug Height (Max.)	Ring Height	Approx. Mass per 1000 Pcs.	Diameter		Width		Depth	
	S, mm	*D*	Tol.	*T*	Tol.	*P*	Tol.	*B*	(*b*)	kg	*G*	Tol.	*W*	Tol.	(*d*)	*Z*
NA14-6	1.50	1.40	+0.05	0.38		0.89		1.80	3.68	0.01						
NA14-7	2.01	1.88	−0.08	0.64		0.86	±0.10	1.88	4.67	0.04						
NA14-9	2.39	2.26		0.64	±0.05	0.86		1.95	5.26	0.05						
NA14-12	3.18	3.05		0.64		1.07	+0.25	2.06	6.81	0.11	Not recommended for use with grooves					
NA14-15	3.96	3.81	+0.05	0.64		1.07	−0.05	2.06	7.80	0.14						
NA14-18	4.75	4.60	−0.10	0.89		1.30		2.54	9.25	0.25						
NA14-19	5.00	4.75	±0.08	0.81		1.30	±0.10	2.84	9.53	0.20						
NA14-23	5.99	5.69		0.89	±0.08	1.30		2.57	10.72	0.35	5.79		1.04	+0.08	0.10	0.76
NA14-25	6.35	6.05	+0.05/−0.10	0.89		1.30	+0.25/−0.05	2.54	11.10	0.34	6.10	+0.013	1.04	0	0.13	0.76
NA14-31	7.95	7.57	+0.08	1.07		1.98		3.68	14.05	0.63	7.70	−0.04	1.22		0.13	0.76
NA14-37	9.55	8.99	−0.13	1.07		1.98		3.68	15.75	0.78	9.17		1.22		0.18	0.76
NA14-43	11.10	10.46		1.27		1.98	+0.38	3.94	17.81	1.18	10.64	+0.03	1.42	+0.10	0.23	0.76
NA14-50	12.70	11.94	+0.10	1.27		1.98	−0.05	4.11	19.51	1.32	12.14	−0.05	1.42	0	0.28	1.02
NA14-62	15.88	15.06	−0.15	1.57	±0.10	1.98		4.67	24.08	2.59	15.21		1.75		0.33	1.14
NA14-75	19.05	17.93		1.57		3.05		6.02	28.32	3.12	18.24	+0.05/−0.08	1.75		0.41	1.27

GENERAL NOTE: See Table 6 for illustrations.

NOTE:

(1) For plated rings, add 0.05 mm to the listed maximum ring thickness, except that maximum thickness after plating will be a minimum of 0.005 mm less than the listed groove width (*W*) minimum.

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NONMANDATORY APPENDIX B
TYPE NA14 REFERENCE METRIC VALUES
(SUPPLEMENTARY INFORMATION)

TABLE B NA14 REFERENCE METRIC VALUES (SUPPLEMENTARY INFORMATION)

Ring Series and Size No.	Application Data					
	Clearance Diameter Released Over Shaft	Allowable Thrust Loads Square Corner Abutment		Allowable Corner Radii and Chamfers		Limits Standard Material
		UNS G10600–G10900 and UNS S15700 Stainless Steel Rings	All Standard Rings Used on Low Carbon Steel Shafts			
	C	*Pr* (kN) [Note (1)]	*Pg* (kN) [Note (2)]	*R*, Max.	*Ch*, Max.	RPM
NA14-6	5.33	0.02	Not	0.64	0.38	
NA14-7	6.10	0.04	recom-	0.91	0.56	
NA14-9	6.60	0.04	mended	1.07	0.64	
NA14-12	8.38	0.04	for use	1.37	0.81	OVER
NA14-15	9.14	0.05	with	1.50	0.89	80000
NA14-18	11.18	0.09	grooves	1.60	0.97	
NA14-19	10.92	0.13		1.63	0.99	
NA14-23	12.19	0.10	0.31	1.78	1.07	
NA14-25	12.45	0.10	0.40	1.83	1.09	77000
NA14-31	17.27	0.11	0.49	2.03	1.22	58000
NA14-37	18.80	0.14	0.80	2.18	1.30	51000
NA14-43	20.57	0.18	1.29	2.36	1.42	44000
NA14-50	22.86	0.20	1.73	2.54	1.52	40000
NA14-62	26.92	0.27	2.54	3.05	1.83	32000
NA14-75	33.53	0.29	3.78	3.18	1.91	25000

GENERAL NOTE: See Mandatory Appendix I for illustrations.

NOTES:

(1) Values listed above apply to rings installed on shafts made of soft low carbon steel.

(2) The allowable thrust load values for *Pg* include a safety factor of 2.

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NONMANDATORY APPENDIX C
TYPE NA15 REFERENCE METRIC VALUES (DIMENSIONS)

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TABLE C NA15 REFERENCE METRIC VALUES (DIMENSIONS)

Ring Series and Size No.	Shaft Diameter	Ring Size And Weight									Groove Dimensions					
		Free Diameter [Note (1)]		Thickness [Note (2)]		Large Section		Width Across Lugs		Approx. Mass per 1000 Rings (2 Halves)	Diameter		Width		Depth	Edge Margin
	S, mm	*D*	Tol.	*T*	Tol.	*E*	Tol.	*A*	Tol.	kg	*G*	Tol.	*W*	Tol.	(*d*)	*Z*
NA15-46	11.91	10.52		0.89		2.67		14.86	±0.08	0.62	10.64		0.99		0.64	1.91
NA15-50	12.70	11.66	±0.05	0.89		2.67	±0.13	15.88		0.68	11.79	±0.04	0.99		0.46	1.37
NA15-59	15.09	13.67		0.89		2.67		18.03	±0.10	0.79	13.82	0.10 (3)	0.99		0.64	1.91
NA15-62	15.88	14.45		0.89		2.67		18.80		0.83	14.61		0.99	+0.08	0.64	1.91
NA15-66	16.99	15.06		1.07		3.43		20.70		1.41	15.21		1.17	0	0.89	2.67
NA15-75	19.05	17.09	±0.08	1.07		3.43		22.71	±0.13	1.59	17.27	±0.05	1.17		0.89	2.67
NA15-78	19.84	17.86		1.07	±0.05	3.43		23.50		1.63	18.06	0.10 (3)	1.17		0.89	2.67
NA15-87	22.23	20.22		1.07		3.43		25.83		1.73	20.45		1.17		0.89	2.67
NA15-98	24.99	21.92		1.27		4.78		29.77		3.31	22.15	±0.08	1.42		1.42	4.27
NA15-98	25.40	21.92		1.27		4.78	±0.15	29.77	±0.15	3.31	22.15	0.10 (3)	1.42		1.63	4.88
NA15-112	28.58	25.45		1.27		4.78		33.30		3.59	25.73		1.42		1.42	4.27
NA15-118	30.18	27.03	±0.10	1.27		4.78		34.87		3.86	27.31	±0.08	1.42		1.42	4.27
NA15-125	31.75	28.60		1.27		4.78		36.45		4.04	28.91	0.13 (3)	1.42		1.42	4.27
NA15-137	34.93	31.75		1.27		4.78		39.60	±0.18	4.36	32.08		1.42	+0.10	1.42	4.27
NA15-150	38.10	34.90		1.27		4.78		42.75		4.81	35.26		1.42	0	1.42	4.27
NA15-156	39.67	35.86		1.57		5.64		45.16		7.45	36.25		1.73		1.73	5.18
NA15-162	41.28	37.44		1.57		5.64		46.74		7.95	37.82		1.73		1.73	5.18
NA15-175	44.45	40.56	±0.13	1.57		5.64		49.86	±0.20	8.35	41.00	±0.13	1.73		1.73	5.18
NA15-175	45.01	40.56		1.57		5.64		49.86		8.35	41.00	0.13 (3)	1.73		1.98	5.94
NA15-187	47.63	43.71		1.57		5.64		53.09		9.44	44.17		1.73		1.73	5.18
NA15-196	50.01	45.19		1.98		6.65		56.11		14.07	45.64		2.18		2.18	6.55
NA15-200	50.80	45.95		1.98		6.65		56.95		14.35	46.43		2.18		2.18	6.55
NA15-212	53.98	49.10		1.98		6.65	±0.18	60.05		15.53	49.61		2.18	+0.13	2.18	6.55
NA15-212	54.76	49.10	±0.15	1.98	±0.08	6.65		60.05		15.53	49.61		2.18	0	2.57	7.70
NA15-225	57.15	52.25		1.98		6.65		63.20	±0.25	16.93	52.78	±0.13	2.18		2.18	6.55
NA15-237	60.33	55.37		1.98		6.65		66.29		17.66	55.96	0.15 (3)	2.18		2.18	6.55
NA15-250	63.50	58.52		1.98		6.65		69.44		18.02	59.13		2.18		2.18	6.55
NA15-262	66.68	61.67		1.98		6.65		72.59		19.93	62.31		2.18		2.18	6.55
NA15-275	69.85	63.96		2.36		8.20		77.44		28.69	64.62		2.62		2.62	7.85
NA15-287	73.03	67.11		2.36		8.20		80.57	±0.30	31.05	67.79	±0.15	2.62		2.62	7.85
NA15-300	76.20	69.95	±0.20	2.36		8.36	±0.20	83.67		31.96	70.97	0.15 (3)	2.62		2.62	7.85
NA15-325	82.55	76.53		2.36		8.26		89.97	±0.38	35.23	77.32		2.62		2.62	7.85
NA15-337	85.73	79.10		2.77		10.03		95.53		42.66	79.88		3.05		2.92	8.76

GENERAL NOTE: See Table 7 for illustrations.

NOTES:

(1) The free diameter dimension is for reference only and should not be used as part of an inspection procedure. Only dimension *A* (width across lugs) should be used for this purpose.

(2) For plated rings, add 0.05 mm to the listed maximum ring thickness, except that maximum ring thickness after plating will be a minimum of 0.005 mm less than the listed groove width (*W*) minimum.

(3) *F.I.M. (Full Indicator Movement):* maximum allowable run out of groove diameter to shaft.

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NONMANDATORY APPENDIX D
TYPE NA15 REFERENCE METRIC VALUES
(SUPPLEMENTARY INFORMATION)

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TABLE D NA15 REFERENCE METRIC VALUES (SUPPLEMENTARY INFORMATION)

Ring Series and Size No.	Clearance Released in Groove	Application Data					
		Allowable Thrust Loads [Note (1)] Square Corner Abutment		Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.	Calculated Allowable Assembly (Steel Rings)
		UNS G10600–G10900 and Stainless Steel Rings Used on Hardened Shafts (50 HRc, Min.)	All Standard Rings Used on Low Carbon Steel Shafts				
	C	*Pr* (kN) [Note (2)]	*Pg* (kN)	*R*, Max.	*Ch*, Max.	*P'r* (kN)	RPM
NA15-46	16.26	9.03	2.76	1.32	1.02	2.71	50000
NA15-50	17.27	9.48	2.14	1.32	1.02	2.71	50000
NA15-59	19.46	11.29	3.51	1.32	1.02	2.71	46000
NA15-62	20.24	11.97	3.69	1.32	1.02	2.71	45000
NA15-66	22.50	15.12	5.56	1.65	1.27	3.91	43000
NA15-75	24.56	16.93	6.23	1.65	1.27	3.91	40000
NA15-78	25.35	17.83	6.45	1.65	1.27	3.91	39000
NA15-87	27.74	19.86	7.12	1.65	1.27	3.91	35000
NA15-98	32.33	26.41	12.90	2.18	1.68	5.56	31000
NA15-98	32.33	26.41	15.12	2.06	1.57	5.56	30000
NA15-112	36.07	30.25	14.90	2.18	1.68	5.56	28000
NA15-118	37.59	32.06	15.57	2.18	1.68	5.56	27000
NA15-125	39.12	33.64	16.46	2.18	1.68	5.56	26000
NA15-137	42.42	37.02	18.24	2.18	1.68	5.56	24000
NA15-150	45.47	40.41	19.79	2.18	1.68	5.56	22000
NA15-156	48.51	53.05	25.13	2.54	1.96	8.45	21000
NA15-162	50.04	55.31	26.02	2.54	1.96	8.45	20500
NA15-175	53.34	59.59	28.02	2.54	1.96	8.45	19000
NA15-175	53.34	59.59	32.69	2.39	1.83	8.45	19000
NA15-187	56.39	63.66	30.25	2.54	1.96	8.45	17000
NA15-196	60.20	82.39	40.03	2.90	2.24	13.57	15500
NA15-200	60.96	83.52	40.70	2.90	2.24	13.57	15000
NA15-212	64.01	88.94	43.15	2.90	2.24	13.57	14300
NA15-212	64.01	88.94	51.15	2.64	2.03	13.57	14300
NA15-225	67.31	93.91	45.81	2.90	2.24	13.57	13500
NA15-237	70.36	99.32	48.04	2.90	2.24	13.57	12800
NA15-250	73.66	104.74	50.71	2.90	2.24	13.57	12000
NA15-262	76.71	109.71	53.38	2.90	2.24	13.57	11300
NA15-275	82.55	136.34	66.72	3.63	2.79	19.13	10500
NA15-287	85.60	142.67	69.83	3.63	2.79	19.13	9800
NA15-300	88.90	148.99	72.95	3.63	2.79	19.13	9000
NA15-325	95.25	161.40	79.17	3.66	2.82	19.13	7500
NA15-337	101.35	196.39	91.63	4.62	3.56	26.47	6800

GENERAL NOTE: See Mandatory Appendix II for illustrations.

NOTES:

(1) *Safety Factors Pr and Pg*: the allowable thrust load values listed include the following safety factors: *Pr*: 3 *Pg*: 2.

(2) *Pr* values listed apply to rings made from UNS G10600–G10900 and UNS S15700 stainless steel. *Pr* values for rings made from beryllium copper can be calculated by multiplying listed values by 0.75.

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NONMANDATORY APPENDIX E
TYPE NA16 REFERENCE METRIC VALUES (DIMENSIONS)

TABLE E NA16 REFERENCE METRIC VALUES (DIMENSIONS)

Ring Series and Size No.	Ring Size and Weight											Groove Dimensions					Edge Margin
	Shaft Diameter		Length			Gap		Bow Height		Thickness [Note (1)]		Approx. Mass per 1000 Pcs.	Diameter		Width		Depth	
	S, mm	Tol.	*b*	Tol.	(*e*)	*p*	Tol.	*H*	Tol.	*T*	Tol.	kg	*G*	Tol.	*W*	Tol.	(*d*)	*Z*
NA16-9	2.34	±0.05	7.80		4.22	1.60		1.27		0.25		0.10	1.55	±0.03	0.89		0.41	0.79
NA16-12	3.18		7.80		4.22	2.18	±0.10	1.27		0.25	±0.03	0.09	2.08	±0.04	0.89		0.53	1.09
NA16-15	3.96		8.38		4.67	2.74		1.40		0.25		0.11	2.64		1.02		0.66	1.32
NA16-18	4.78		9.91	±0.25	5.41	3.30		1.52	±0.25	0.38		0.21	3.15	±0.05	1.14	+0.13	0.81	1.63
NA16-25	6.35	±0.08	12.70		7.11	4.37	±0.13	1.78		0.38	±0.05	0.35	4.19		1.40	0	1.07	2.16
NA16-31	7.92		15.75		9.14	5.94		2.41		0.38		0.59	5.79		2.03		1.07	2.13
NA16-37	9.53		18.80		10.85	7.11		3.30		0.51		1.00	6.86	±0.08	2.41		1.32	2.67
NA16-43	11.13		20.83	±0.51	12.07	8.64	±0.25	3.30		0.51		1.18	8.31		2.67		1.40	2.82

GENERAL NOTE: See Table 8 for illustrations.

NOTE:

(1) For plated rings, add 0.05 mm to the listed maximum thickness.

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NONMANDATORY APPENDIX F
TYPE NA16 REFERENCE METRIC VALUES
(SUPPLEMENTARY INFORMATION)

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TABLE F NA16 REFERENCE METRIC VALUES (SUPPLEMENTARY INFORMATION)

Ring Series and Size No.	Application Data								
	Clearance Released in Groove	Allowable Thrust Loads [Note (1)] (Square Corner Abutment)		Distance Outer Groove Wall to Face of Retained Part		Resilient Take Up of Tolerances of *L* and *M*	Approx. Average Resilient Resistance Within *X*, Max. and *X*, Min.		Approx. Force Needed to Flatten Rings
		UNS G10600–G10900 and Stainless Steel Rings Used on Hardened Shafts (50 HRc Min.)	All Standard Rings Used on Low Carbon Steel Shafts				As Installed	After Flattening	
	C	*Pr* (kN) [Note (2)]	*Pg* (kN)	*X*, Min.	*X*, Max.	*X*, Max. – *X*, Min.	kN	kN	kN
NA16-9	9.40	0.36	0.16	0.76	0.97	0.20	0.04	0.02	0.13
NA16-12	9.40	0.45	0.27	0.76	1.02	0.25	0.04	0.01	0.13
NA16-15	10.41	0.54	0.44	0.89	1.14	0.25	0.04	0.02	0.13
NA16-18	12.19	0.90	0.62	0.99	1.24	0.25	0.09	0.02	0.27
NA16-25	15.75	1.36	1.11	1.14	1.52	0.38	0.07	0.03	0.27
NA16-31	20.07	1.58	1.33	1.78	2.16	0.38	0.03	0.02	0.27
NA16-37	23.88	2.47	2.00	2.03	2.67	0.64	0.08	0.03	0.36
NA16-43	26.67	3.11	2.67	2.41	3.05	0.64	0.05	0.03	0.27

GENERAL NOTE: See Mandatory Appendix III for illustration.

NOTES:

(1) *Safety Factors for Pr and Pg*: the allowable thrust load values listed include the following safety factors: *Pr*: 3 *Pg*: 3.

(2) *Pr* values listed apply to rings made from UNS G10600–G10900 and UNS S15700 stainless steel. *Pr* values for rings made from beryllium copper can be calculated by multiplying listed values by 0.75.

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AN AMERICAN NATIONAL STANDARD

ASME B18.27a-1999

ADDENDA

to

ASME B18.27-1998
TAPERED AND REDUCED CROSS SECTION RETAINING RINGS (INCH SERIES)

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
Three Park Avenue • New York, NY 10016

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ASME B18.27a-1999

Following approval by the ASME B18 Committee and ASME, and after public review, ASME B18.27a-1999 was approved by the American National Standards Institute on May 10, 1999.

Addenda to the 1998 edition of ASME B18.27 are issued in the form of replacement pages. Revisions, additions, and deletions are incorporated directly into the affected pages. It is advisable, however, that this page, the Addenda title and copyright pages, and all replaced pages be retained for reference.

SUMMARY OF CHANGES

This is the first Addenda to be published to ASME B18.27-1998.

Replace or insert the pages listed. Changes given below are identified on the pages by a margin note, **(a)**, placed next to the affected area. The pages not listed are the reverse sides of the listed pages and contain no changes.

Page	*Location*	*Change*
iii	Foreword	Updated to reflect Addenda
ix	Preface	Updated to reflect Addenda
xi	Contents	Updated to reflect Addenda
135–189	ASME B18.27.4	Added

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FOREWORD (a)

American National Standards Committee B27 for the standardization of plain and lock washers was organized in March 1926 as Sectional Committee B27, under the aegis of the American Standards Association (later the United States of America Standards Institute and, as of October 6, 1969, the American National Standards Institute, Inc.), with the Society of Automotive Engineers and The American Society of Mechanical Engineers as joint secretariats. In 1950, this Committee was designated as responsible for the standardization of washers and machine rings.

At a meeting of ANSI B27 Standards Committee held on February 4, 1971, it was recommended to the secretariats (ASME and SAE) that Subcommittees 1, 2, and 4 on Washers be merged into ANSI B18 Standards Committee and that Subcommittee 3 on Retaining Rings become a separate Standards Committee retaining the B27 designation. This change was subsequently approved by ANSI.

Formation of Subcommittee 1 on Tapered and Reduced Section Retaining Rings was authorized by Standards Committee B27 at its meeting on October 15, 1974. At this meeting, it was decided that no further effort should be expended on inch dimensional products and Subcommittee 1 was assigned the responsibility of preparing American metric standards for tapered and reduced section retaining rings.

Subcommittee 1 prepared a draft proposal, General Purpose Tapered and Reduced Cross Section Retaining Rings, which was balloted on June 16, 1975. At a subcommittee meeting held on February 17, 1976, results from the letter ballot were reviewed. The proposal was accepted by the Subcommittee and presented to the B27 Standards Committee at its May 7, 1976, meeting. At that meeting, a letter ballot of the entire committee was authorized. The Standard was duly approved by the Committee and its sponsors and submitted to the American National Standards Institute for designation as an American Standard. This designation was granted on October 20, 1977.

It was recommended that American National Standards Committee B27 be made part of ASME B18 Main Committee. As a result, Subcommittee 27 of ASME B18 has the responsibility of developing and maintaining standards for retaining rings.

A need evolved for commercial and military requirements to develop inch series standards for General Purpose Tapered and Reduced Cross Section Type Retaining Rings. It was agreed by the ASME B18 Main Committee to have Subcommittee 27 develop these required inch series standards. The first of the inch standards, B18.27.1, covering External Type NA1, Internal Type NA2, and E-Ring Type NA3 rings, was approved by ANSI on July 16, 1998.

The second of the inch standards, B18.27.2, covering Heavy Duty External Type NA4, Reinforced E-Rings NA5, and C-Rings Type NA6, was approved by ANSI on July 16, 1998.

The third of the inch standards, B18.27.3, covering Bowed External Rings NA7, Bowed Internal Rings NA8, and Bowed External E-Rings NA9, was approved by ANSI on July 16, 1998.

The fourth of the inch standards, B18.27.4, covering Inverted External Rings NA10, Inverted Internal Rings NA11, Beveled External Rings NA12, and Beveled Internal Rings NA13, was approved by ANSI on May 10, 1999.

The fifth and final of the inch standards, B18.27.5, will be added in the next Addenda, scheduled for publication in 2000.

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PREFACE (a)

ORGANIZATION OF THIS DOCUMENT

This Standard compiles the following standards:

Standard	*Title*
ASME B18.27.1	External Type NA1, Internal Type NA2, E-Ring Type NA3
ASME B18.27.2	Heavy Duty External Type NA4, Reinforced E-Rings NA5, C-Rings Type NA6
ASME B18.27.3	Bowed External Rings NA7, Bowed Internal Rings NA8, Bowed External E-Rings NA9
ASME B18.27.4	Inverted External NA10, Inverted Internal NA11, Beveled External NA12, Beveled Internal NA13
ASME B18.27.5	In preparation

ADDENDA SERVICE

This edition of ASME B18.27-1998 includes an automatic addenda subscription service up to the publication of the next edition. The addenda subscription service will include the additional B18.27 documents not already included in the initial publication and approved revisions to the existing parts.

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ASME B18.27.5 **In preparation**

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ASME B18.27.4 (a)

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INVERTED EXTERNAL TYPE NA10, INVERTED INTERNAL TYPE NA11, BEVELED EXTERNAL TYPE NA12, BEVELED INTERNAL TYPE NA13

1 INTRODUCTORY NOTES

1.1 Scope

This Standard provides complete general and dimensional data for two series of general purpose inverted tapered and reduced cross section retaining rings, and two series of general purpose beveled tapered and reduced cross section retaining rings, which may be used with the nominal size shafts and housings listed and in grooves of the recommended dimensions listed. Also included are formulas and tolerances on which dimensional data are based. Four appendices include guidance for assembly and recommended standard drawing formats.

The inclusion of dimensional data in this Standard is not intended to imply that all of the products described are stock production sizes. Consumers should consult with suppliers concerning lists of stock production sizes.

1.2 ISO Standard

There are no existing ISO Standards for these products.

1.3 Ring Types

1.3.1 Inverted External Rings — Type NA10. Dimensions of retaining rings and grooves for various shaft sizes are given in Table 6. See Nonmandatory Appendix A for equivalent metric data.

1.3.2 Inverted Internal Rings — Type NA11. Dimensions of retaining rings and grooves for various housing sizes are given in Table 7. See Nonmandatory Appendix C for equivalent metric data.

1.3.3 Beveled External Rings — Type NA12. Dimensions of retaining rings and grooves for various shaft sizes are given in Table 8. See Nonmandatory Appendix E for equivalent metric data.

1.3.4 Beveled Internal Rings — Type NA13. Dimensions of retaining rings and grooves for various housing sizes are given in Table 9. See Nonmandatory Appendix G for equivalent metric data.

1.4 Designations

Retaining rings in this Standard shall be designated by the following data in the sequence shown: ring series type number; size; material; protective finish, if required; or by, optionally, ASME B18.24.3 PIN Code. See examples below:

NA10-75, Carbon spring steel, phosphate
R274NAA0075NN056NNAA1

NA11-150, Corrosion-resistant steel
R274NAB0150NN519NNAB1

NA12-175, Carbon spring steel, zinc plating
R274NAC0175NN056NNDE1

NA13-200, Beryllium copper
R274NAD0200NN643NNAA1

1.5 Applicability

The rings specified in this Standard are intended primarily for use with the shaft, housing, and groove sizes recommended; however, in certain cases these diameters may be altered somewhat to suit the requirements of a particular design. When such changes are made, care should be taken to not alter the shaft or housing size to such an extent that the ring will take enough permanent set to allow a loose fit after the ring has been assembled into the groove. Neither should the groove diameter be altered to the extent to permit the ring to fit loosely.

1.6 Dimensions

All dimensions in this Standard are in inches unless otherwise stated.

1.7 Supplementary Information

Allowable loads, maximum radii and chamfers, clearance dimensions, and gaging diameters for all four ring series are included in Mandatory Appendices I, II, III, and IV. Revolutions Per Minute (RPM) limits for the inverted external rings are included in Mandatory Appendix I.

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Groove location parameters for the beveled external rings Type NA12 and for the beveled internal rings Type NA13 are given in Mandatory Appendices III and IV, respectively.

1.8 Reference Standards

Unless otherwise specified, the referenced standard shall be the most recent issue at the time of order placement.

ASTM E 18, Standard Test Method for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials

ASTM B 117, Standard Practice for Operating Salt Spray (Fog) Testing Apparatus

ASTM A 380, Standard Practice for Cleaning and Descaling Stainless Steel Parts, Equipment, and Systems

ASTM B 695, Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel

ASTM DS-56F/SAE HS-1086, Unified Numbering System (UNS) for Metals and Alloys

Publisher: The American Society for Testing and Materials (ASTM), 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959

2 GENERAL DATA

2.1 Inverted External and Inverted Internal Rings

Types NA10 and NA11 inverted rings differ from the basic external and internal rings (Types NA1 and NA2) in that their section height has been increased and the lugs inverted allowing them to abut the bottom of the groove. This provides the advantages of better clearance and a higher uniform protruding shoulder. However, the inverted external and internal rings design results in a somewhat lower thrust load capacity than the basic external and internal rings.

2.2 Beveled External and Beveled Internal Rings

Types NA12 and NA13 beveled rings design provide rigid end-play take-up in assemblies where components wear or manufacturing tolerances cause end-play between the retaining ring and part being retained.

Beveled rings differ from the basic external and internal rings (Types NA1 and NA2) in that the groove engaging edge is beveled to a 15 deg angle. Type NA12 external beveled rings have the bevel located around the inner circumference of the ring. Type NA13 internal beveled rings have the bevel around the outer circumference.

The rings are to be used in grooves having 15 deg bevels on the load bearing groove walls. See Mandatory Appendices III and IV for groove location parameters.

3 MATERIAL

3.1 Carbon Spring Steel

Retaining rings made from carbon spring steel shall conform to the chemical composition of UNS G10600 to UNS G10900 or equivalent and have the following physical properties.

3.1.1 Heat Treatment. The retaining rings shall be heat treated by austempering up to Size -345. For sizes from -350 to -1000, the rings shall be heat treated by either austempering or by quench and temper. All sizes are to be heat treated to the hardness shown in Table 1.

3.1.2 Finishes. The following finishes are available.

3.1.2.1 Phosphate Coating. Finish shall consist of basic zinc phosphate treatment and subsequent supplementary treatment to enhance shelf life (example of supplementary treatment: *wax, light drying oil).*

3.1.2.2 Zinc Plating. Finish shall consist of mechanically applied zinc with a dichromate conversion treatment similar to ASTM B 695 Type II, Class 8. The resulting treatment shall be capable of withstanding 72 hours to white corrosion or red rust. Salt spray corrosion resistance test method shall be similar to ASTM B 117.

NOTE: Electroplating is not allowed for plating of retaining rings.

3.1.2.3 Oil Finish. To extend shelf life, rings shall be coated with a thin film of non-tacky water displacing rust preventative oil.

3.2 Corrosion-Resistant Steel

Retaining rings made from corrosion-resistant steel shall conform to the chemical composition of UNS S15700.

Optional Material: For rings with thickness of 0.062 or greater, retaining rings may be made from UNS S17700. The retaining rings shall have the following physical properties.

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TABLE 1 HARDNESS RANGES FOR TAPERED AND REDUCED CROSS SECTION RETAINING RINGS (CARBON SPRING STEEL)

NA10		NA11	
Ring Size	**Hardness**	**Ring Size**	**Hardness**
50 thru 81	471–560 HV (66–71 HR30N) (47–53 HRC)	62 and 75	498–577 HV (67.5–72 HR30N) (49–54 HRC)
87 thru 102	471–560 HV (47–53 HRC)	81 thru 100	471–560 HV (66–71 HR30N) (47–53 HRC)
106 thru 343	471–544 HV (47–52 HRC)	106 thru 343	471–544 HV (47–52 HRC)
350 and over	446–513 HV (45–50 HRC)	350 and Over	446–513 HV (45–50 HRC)
NA12		**NA13**	
Ring Size	**Hardness**	**Ring Size**	**Hardness**
100 and 102	471–560 HV (47–53 HRC)	100 and 102	471–560 HV (66–71 HR30N) (47–53 HRC)
106 thru 343	471–544 HV (47–52 HRC)	106 thru 347	471–544 HV (47–52 HRC)
350 thru 700	434–528 HV (44–51 HRC)	350 thru 700	434–528 HV (44–51 HRC)
725 thru 1000	392–471 HV (40–47 HRC)	725 thru 1000	392–471 HV (40–47 HRC)

3.2.1 Heat Treatment. The retaining rings shall be heat treated to the hardness values as specified in Table 2.

3.2.2 Surface Treatment. Retaining rings shall be cleaned free of scale, grease, oil, and other foreign material in conformance to ASTM A 380.

3.3 Beryllium Copper

Retaining rings made from beryllium copper shall conform to the chemical composition of UNS C17200 and have the following physical properties.

3.3.1 Heat Treatment. The retaining rings shall be heat treated to the hardness values as specified in Table 3.

3.3.2 Surface Treatment. Retaining rings shall be cleaned to remove oxide formed as a result of the heat treating process. Since these rings have extremely high resistance to most types of atmospheric corrosion, further protective finishes are usually not required.

4 HARDNESS TESTING PROCEDURE

The surfaces of both sides of each sample retaining ring shall be prepared for hardness testing by removal of all plating and other surface conditions that may affect the hardness reading. Hardness testing procedure shall be in conformance to ASTM E 18.

5 PERMANENT SET LIMITS

The following procedures should be used for determining if the permanent set of the ring is within the allowable limits.

5.1 NA10 Inverted External Retaining Rings

Step 1. Expand the ring with pliers until it just fits

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TABLE 2 HARDNESS RANGES FOR TAPERED AND REDUCED CROSS SECTION RETAINING RINGS (CORROSION-RESISTANT STEEL)

NA10		NA11	
Ring Size	**Hardness**	**Ring Size**	**Hardness**
50 thru 81	434–528 HV (63–69.5 HR30N) (44–51 HRC)	62 thru 100	434–528 HV (63–69.5 HR30N) (44–51 HRC)
87 and over	434–528 HV (44–51 HRC)	106 and over	434–528 HV (44–51 HRC)
NA12		**NA13**	
Ring Size	**Hardness**	**Ring Size**	**Hardness**
All	434–528 HV (44–51 HRC)	100 and 102	434–528 HV (63–69.5 HR30N) (44–51 HRC)
...	...	106 and over	434–528 HV (44–51 HRC)

TABLE 3 HARDNESS RANGES FOR TAPERED AND REDUCED CROSS SECTION RETAINING RINGS (BERYLLIUM COPPER)

NA10		NA11	
Ring Size	**Hardness**	**Ring Size**	**Hardness**
50 thru 81	363–423 HV (56.5–62 HR30N) (37–43 HRC)	62 thru 100	363–423 HV (56.5–62 HR30N) (37–43 HRC)
87 and over	363–423 HV (37–43 HRC)	106 and over	363–423 HV (37–43 HRC)
NA12		**NA13**	
Ring Size	**Hardness**	**Ring Size**	**Hardness**
100 and 102	363–423 HV (56.5–62 HR30N) (37–43 HRC)	100 and 102	336–423 HV (54–62 HR30N) (34–43 HRC)
106 and over	363–423 HV (37–43 HRC)	106 and over	336–423 HV (34–43 HRC)

over a shaft 1% larger than the nominal shaft diameter. Repeat this procedure 4 more times with the same ring. The ring shall not crack during this procedure.

Step 2. Measure the ring diameter (D) in the three places shown in Fig. 1, and compute the average diameter.

Step 3. Measure the ring's maximum section (dimension E). Compare the average diameter (Step 2 above) minus twice dimension E to the minimum groove diameter from Table 6. If the average diameter minus 2E is less than the minimum groove diameter, then the ring is fully functional and will perform according to the specifications of this Standard.

[Average Diameter −2E < Minimum Groove Diameter]

5.2 NA11 Inverted Internal Retaining Rings

Step 1. Compress the ring with pliers until the lugs

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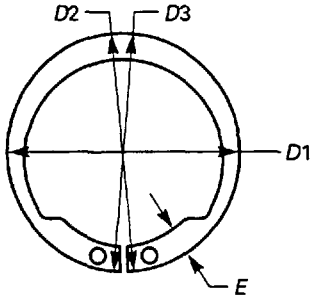


FIG. 1 PERMANENT SET MEASUREMENTS FOR TYPE NA10 RINGS

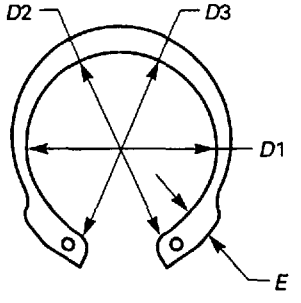


FIG. 2 PERMANENT SET MEASUREMENTS FOR TYPE NA11 RINGS

abut each other. Repeat this procedure 4 more times with the same ring.

Step 2. Measure the ring diameter (D) in the three places shown in Fig. 2, and compute the average diameter.

Step 3. Measure the ring's maximum section (dimension E). Compare the average diameter (Step 2 above) plus twice dimension E to the maximum groove diameter from Table 7. If the average diameter plus 2E is greater than the maximum groove diameter, then the ring is fully functional and will perform according to the specifications of this Standard.

[Average Diameter +2E > Maximum Groove Diameter]

5.3 NA12 Beveled External Retaining Rings

Step 1. Expand the ring with pliers until it just fits over a shaft 1% larger than the nominal shaft diameter. Repeat this procedure 4 more times with the same ring. The ring shall not crack during this procedure.

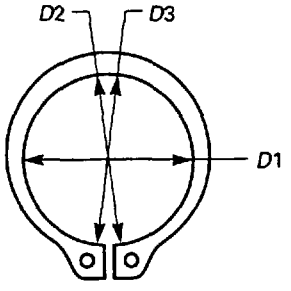


FIG. 3 PERMANENT SET MEASUREMENTS FOR TYPE NA12 RINGS

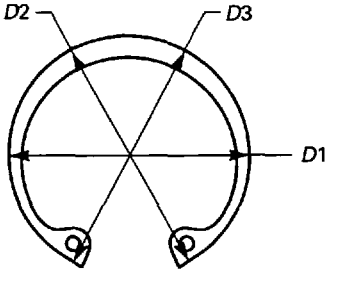


FIG. 4 PERMANENT SET MEASUREMENTS FOR TYPE NA13 RINGS

Step 2. Measure the ring diameter (D) in the three places shown in Fig. 3.

Step 3. Compute the average of the three diameters and compare it to the minimum groove diameter listed in the data chart for that ring. In all cases the average diameter after permanent set shall be less than the groove diameter to ensure that the ring will seat tightly.

5.4 NA13 Beveled Internal Retaining Rings

Step 1. Compress the ring with pliers until the lugs abut each other. Repeat this procedure 4 more times.

Step 2. Measure the ring diameter (D) in the three places shown in Fig. 4.

Step 3. Compute the average of the three diameters and compare it to the maximum groove diameter listed in the data chart for the ring. In all cases the average diameter after permanent set shall be greater than the groove diameter to ensure that the ring will seat tightly.

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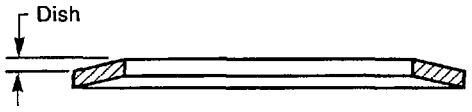


FIG. 5 DISH FOR TYPES NA10, NA11, NA12, AND NA13 RINGS

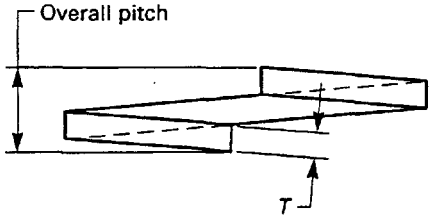


FIG. 6 PITCH FOR TYPES NA10, NA11, NA12, AND NA13 RINGS

6 IRREGULARITY LIMITATIONS

6.1 Dish

Dish measurements of tapered and reduced section retaining rings as shown in Fig. 5 shall not exceed the limitations specified in Table 4 for the applicable ring series thickness.

6.2 Pitch

Pitch measurements of tapered and reduced section retaining rings as shown in Fig. 6 shall not exceed the limitations specified in Table 5 for the applicable ring series thickness.

7 WORKMANSHIP

Workmanship shall be in accordance with high grade commercial practice. Rings shall be free from rust, loose scale, hanging burrs, cracks, and any other defects that might affect their functioning.

TABLE 4 DISH LIMITATIONS

Types NA10, NA11, NA12, and NA13	
Ring Thickness	**Max. Dish**
0.025–0.035	0.003
0.042–0.093	0.005
0.109–0.125	0.010
0.156–0.187	0.015

TABLE 5 PITCH LIMITATIONS

Types NA10, NA11, NA12, and NA13	
Ring Size, in.	**Overall Pitch, Max.**
All Sizes	3T

8 ADDITIONAL DATA

8.1 Dimensional Data

Dimensional data and performance information on rings and grooves for tapered and reduced cross section retaining rings are shown in Tables 6, 7, 8, and 9, and Mandatory Appendices I, II, III, and IV.

8.2 Metric Values

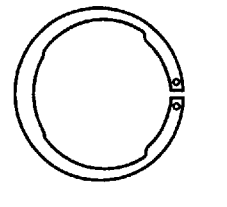
For reference purposes only, metric values are shown in Nonmandatory Appendices A, B, C, D, E, F, G, and H.

8.3 Additional Information

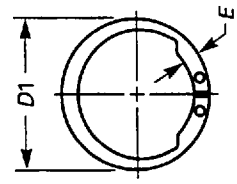
Consult with suppliers for additional information not included in this Standard.

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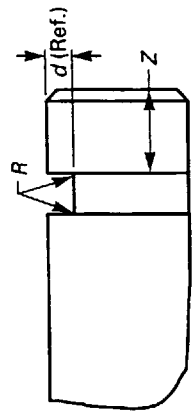
TABLE 6 ILLUSTRATION



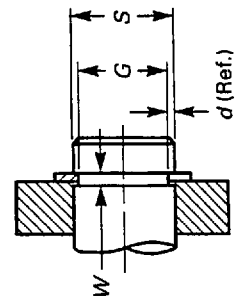
Alternate Design
(Manufacturer's Option)



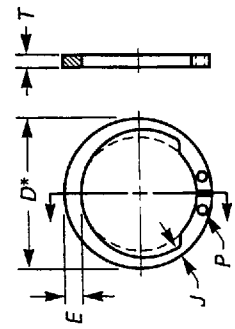
*Measuring Free Diameter (*D*)
D = *D1* – 2 (*E*)



Exploded Groove Profile & Edge Margin (*Z*) Maximum bottom radii (*R*), 0.005 for ring sizes –50 thru –100; 0.010 for ring sizes –106 thru –393



Shaft Diameter and Groove Dimensions



Free Diameter and Ring Measurements

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TABLE 6 NA10 INVERTED EXTERNAL RETAINING RINGS

Ring Series And Size No.	Shaft Diameter			Ring Size & Weight										Groove Dimensions					Edge Margin
				Free Diameter		Thickness [Note (1)]		Hole Diameter		Large Section (Including Lug)		Small Section		Approx. Weight Per 1000 pcs.	Diameter		Width		Depth	
	S, Dec.	*S*, Frac.	*S*, mm	*D*	Tol.	*T*	Tol.	*P*	Tol.	*E*	Tol.	*J*	Tol.	lbs.	*G*	Tol.	*W*	Tol.	(*d*)	*Z*
NA10-50	0.500	1/2	12.7	0.461		0.035		0.042		0.080		0.041		1.0	0.468	±0.002	0.039		0.016	0.048
NA10-56	0.562	9/16	14.3	0.521		0.035		0.042		0.088	±0.004	0.043	±0.004	1.4	0.530	0.004(2)	0.039		0.016	0.048
NA10-59	0.594	19/32	15.1	0.550		0.035		0.042		0.092		0.046		1.6	0.559		0.039		0.017	0.052
NA10-62	0.625	5/8	15.9	0.579		0.035		0.042	+0.010	0.096		0.048		1.6	0.588		0.039		0.018	0.055
NA10-68	0.688	11/16	17.5	0.635		0.042		0.042	−0.002	0.104		0.052		2.5	0.646		0.046		0.021	0.063
NA10-75	0.750	3/4	19.0	0.693	+0.005	0.042		0.042		0.112		0.056		2.8	0.704	±0.003	0.046	+0.003	0.023	0.069
NA10-78	0.781	25/32	19.8	0.722	−0.010	0.042		0.042		0.116		0.057		3.1	0.733	0.004(2)	0.046	−0.000	0.024	0.072
NA10-81	0.812	13/16	20.6	0.751		0.042		0.050		0.120	±0.005	0.060	±0.005	3.3	0.762		0.046		0.025	0.075
NA10-87	0.875	7/8	22.2	0.810		0.042		0.050		0.128		0.064		3.8	0.821		0.046		0.027	0.081
NA10-93	0.938	15/16	23.8	0.867		0.042		0.050		0.136		0.068		4.5	0.882		0.046		0.028	0.084
NA10-100	0.984	63/64	25.0	0.925		0.042	±0.002	0.050		0.144		0.072		4.8	0.926		0.046		0.029	0.087
NA10-100	1.000	1	25.4	0.925		0.042		0.050		0.144		0.072		4.8	0.940		0.046		0.030	0.090
NA10-106	1.062	1 1/16	27.0	0.982		0.050		0.078		0.147		0.073		6.2	0.998		0.056		0.032	0.096
NA10-112	1.125	1 1/8	28.6	1.041		0.050		0.078		0.150		0.075		6.7	1.059		0.056		0.033	0.099
NA10-118	1.188	1 3/16	30.2	1.098	+0.010	0.050		0.078		0.153		0.076		7.2	1.118		0.056		0.035	0.105
NA10-125	1.250	1 1/4	31.7	1.156	−0.015	0.050		0.078		0.157		0.079		7.6	1.176	±0.004	0.056		0.037	0.111
NA10-131	1.312	1 5/16	33.3	1.214		0.050		0.078	+0.015	0.161		0.080		8.2	1.232	0.005(2)	0.056		0.040	0.120
NA10-137	1.375	1 3/8	34.9	1.272		0.050		0.078	−0.002	0.165		0.082		8.4	1.291		0.056		0.042	0.126
NA10-143	1.438	1 7/16	36.5	1.333		0.050		0.078		0.169		0.085		9.1	1.350		0.056		0.044	0.132
NA10-150	1.500	1 1/2	38.1	1.387		0.050		0.078		0.173		0.086		9.8	1.406		0.056		0.047	0.141
NA10-156	1.562	1 9/16	39.7	1.446		0.062		0.078		0.178		0.089		12.9	1.468		0.068	+0.004	0.047	0.141
NA10-162	1.625	1 5/8	41.3	1.503		0.062		0.078		0.183		0.092		13.4	1.529		0.068	−0.000	0.048	0.144
NA10-177	1.750	1 3/4	44.4	1.637		0.062		0.078		0.196	±0.006	0.098	±0.006	16.1	1.650		0.068		0.050	0.150
NA10-177	1.772	...	45.0	1.637	+0.013	0.062		0.078		0.196		0.098		16.1	1.669	±0.005	0.068		0.051	0.153
NA10-181	1.812	1 13/16	46.0	1.675	−0.020	0.062		0.078		0.199		0.100		17.3	1.708	0.005(2)	0.068		0.052	0.156
NA10-196	1.969	1 31/32	50.0	1.819		0.062	±0.003	0.078		0.212		0.106		20.5	1.857		0.068		0.056	0.168
NA10-200	2.000	2	50.8	1.850		0.062		0.078		0.216		0.108		20.7	1.886		0.068		0.057	0.171
NA10-215	2.125	2 1/8	54.0	1.993		0.078		0.120		0.229		0.117		30.0	2.003	±0.006	0.086	+0.005	0.061	0.183
NA10-215	2.156	2 5/32	54.8	1.993	+0.015	0.078		0.120		0.229	±0.007	0.117	±0.007	30.0	2.032	0.006(2)	0.086	−0.000	0.062	0.186
NA10-250	2.500	2 1/2	63.5	2.313	−0.025	0.078		0.120		0.259		0.130		43.5	2.360		0.086		0.070	0.210
NA10-275	2.750	2 3/4	69.8	2.543		0.093		0.120		0.280		0.140		57.9	2.602		0.103		0.074	0.222
NA10-287	2.875	2 7/8	73.0	2.659		0.093		0.120		0.290		0.145		64.5	2.721		0.103		0.077	0.231
NA10-315	3.156	3 5/32	80.2	2.920	+0.020	0.093		0.120		0.316		0.159		77.0	2.986		0.103		0.085	0.255
NA10-325	3.250	3 1/4	82.5	3.006	−0.030	0.093		0.120		0.324	±0.008	0.162	±0.008	77.5	3.076		0.103		0.087	0.261
NA10-350	3.500	3 1/2	88.9	3.237		0.109		0.125		0.345		0.173		107.0	3.316		0.120		0.092	0.276
NA10-393	3.938	3 15/16	100.0	3.642		0.109		0.125		0.368		0.183		123.0	3.734		0.120		0.102	0.306

GENERAL NOTE: For reference, see Table 6 illustration on previous page.

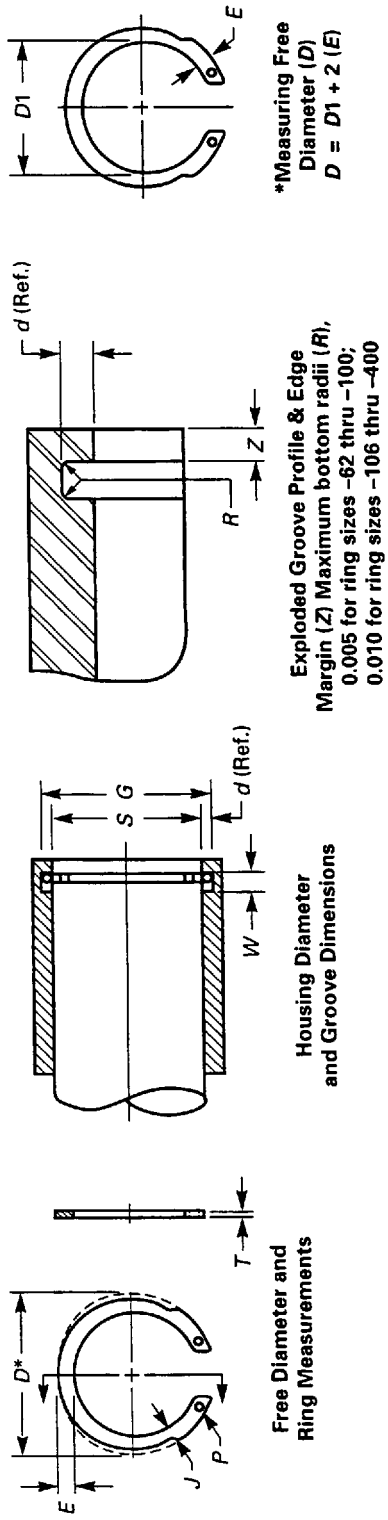
NOTES:

(1) For plated rings, add 0.002 in. to the listed maximum ring thickness, except that maximum ring thickness after plating will be a minimum of 0.0002 in. less than the listed groove width (*W*) minimum.

(2) *F.I.M. (Full Indicator Movement)*: maximum allowable run out of groove diameter to shaft.

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TABLE 7 NA11 INVERTED INTERNAL RETAINING RINGS

Ring Series And Size No.	Housing Diameter			Ring Size & Weight										Groove Dimensions					Edge Margin
				Free Diameter		Thickness [Note (1)]		Hole Diameter		Large Section (Including Lug)		Small Section		Approx. Weight Per 1000 pcs.	Diameter		Width		Depth	
	S, Dec.	*S*, Frac.	*S*, mm	*D*	Tol.	*T*	Tol.	*P*	Tol.	*E*	Tol.	*J*	Tol.	lbs.	*G*	Tol.	*W*	Tol.	(*d*)	*Z*
NA11-62	0.625	5/8	15.9	0.675		0.025		0.030		0.072	±0.004	0.036	±0.004	0.7	0.665	±0.002	0.029		0.020	0.060
NA11-75	0.750	3/4	19.0	0.808		0.035		0.042		0.085		0.042		1.3	0.796	0.004(2)	0.039		0.023	0.069
NA11-81	0.812	13/16	20.6	0.877	+0.010	0.042		0.042		0.092		0.044		2.0	0.862		0.046	+0.003	0.025	0.075
NA11-87	0.875	7/8	22.2	0.944	−0.005	0.042		0.042		0.099		0.047		2.2	0.931	±0.003	0.046	−0.000	0.028	0.084
NA11-93	0.938	15/16	23.8	1.015		0.042		0.042	+0.010	0.106	±0.005	0.051	±0.005	2.8	1.000	0.004(2)	0.046		0.031	0.093
NA11-100	1.000	1	25.4	1.081		0.042		0.042	−0.002	0.113		0.054		2.9	1.066		0.046		0.033	0.099
NA11-106	1.062	1 1/16	27.0	1.150		0.050		0.050		0.120		0.057		3.8	1.130		0.056		0.034	0.102
NA11-112	1.125	1 1/8	28.6	1.217		0.050		0.050		0.123		0.059		4.4	1.197		0.056		0.036	0.108
NA11-118	1.188	1 3/16	30.2	1.283	+0.015	0.050	±0.002	0.050		0.126		0.060		4.9	1.262		0.056		0.037	0.111
NA11-125	1.250	1 1/4	31.7	1.351	−0.010	0.050		0.050		0.129	±0.006	0.061	±0.006	5.0	1.330	±0.004	0.056		0.040	0.120
NA11-131	1.312	1 5/16	33.3	1.418		0.050		0.050		0.132		0.063		5.3	1.396	0.005(2)	0.056		0.042	0.126
NA11-137	1.375	1 3/8	34.9	1.486		0.050		0.050		0.135		0.065		5.9	1.461		0.056	+0.004	0.043	0.129
NA11-143	1.438	1 7/16	36.5	1.552		0.050		0.076		0.144		0.069		6.3	1.528		0.056	−0.000	0.045	0.135
NA11-150	1.500	1 1/2	38.1	1.622		0.050		0.076		0.148		0.070		6.8	1.594		0.056		0.047	0.141
NA11-156	1.562	1 9/16	39.7	1.688		0.062		0.076		0.158		0.074		8.9	1.658		0.068		0.048	0.144
NA11-162	1.625	1 5/8	41.3	1.756		0.062		0.076		0.162		0.077		10.4	1.725		0.068		0.050	0.150
NA11-168	1.688	1 11/16	42.9	1.823	+0.020	0.062		0.076		0.166		0.079		11.9	1.792	±0.005	0.068		0.052	0.156
NA11-175	1.750	1 3/4	44.4	1.891	−0.013	0.062		0.076		0.170		0.082		11.8	1.858	0.005(2)	0.068		0.054	0.162
NA11-187	1.875	1 7/8	47.6	2.025		0.062		0.076		0.188		0.090		14.8	1.989		0.068		0.057	0.171
NA11-200	2.000	2	50.8	2.160		0.062	±0.003	0.076	+0.015	0.208	±0.007	0.100	±0.007	17.4	2.122		0.068		0.061	0.183
NA11-206	2.062	2 1/16	52.4	2.224		0.078		0.094	−0.002	0.218		0.106		23.2	2.186		0.086		0.062	0.186
NA11-212	2.125	2 1/8	54.0	2.295		0.078		0.094		0.223		0.108		24.3	2.251	±0.006	0.086	+0.005	0.063	0.189
NA11-237	2.375	2 3/8	60.3	2.567	+0.025	0.078		0.094		0.243		0.115		28.6	2.517	0.006(2)	0.086	−0.000	0.071	0.213
NA11-243	2.438	2 7/16	61.9	2.634	−0.015	0.078		0.094		0.248		0.117		30.6	2.584		0.086		0.072	0.216
NA11-250	2.500	2 1/2	63.5	2.700		0.078		0.094		0.254		0.120		32.1	2.648		0.086		0.074	0.222
NA11-262	2.625	2 5/8	66.7	2.840		0.093		0.109		0.266		0.128		45.6	2.781		0.103		0.078	0.234
NA11-275	2.750	2 3/4	69.8	2.975		0.093		0.109		0.278		0.134		47.8	2.914		0.103		0.082	0.246
NA11-283	2.812	2 13/16	71.4	3.063		0.093		0.109		0.286		0.139		49.5	2.980		0.103		0.084	0.252
NA11-283	2.835	...	72.0	3.063		0.093		0.109		0.286		0.139		49.5	3.006		0.103		0.086	0.258
NA11-287	2.875	2 7/8	73.0	3.105	+0.030	0.093		0.109		0.290		0.139		50.1	3.051		0.103		0.088	0.264
NA11-300	3.000	3	76.2	3.245	−0.020	0.093		0.109		0.302		0.143		52.6	3.182		0.103		0.091	0.273
NA11-315	3.156	3 5/32	80.2	3.408		0.109		0.125		0.314		0.149		69.4	3.348		0.120		0.096	0.288
NA11-325	3.250	3 1/4	82.5	3.509		0.109		0.125		0.318		0.151		72.6	3.446		0.120		0.098	0.294
NA11-334	3.346	3 11/32	85.0	3.611		0.109		0.125		0.321	±0.008	0.155	±0.008	75.6	3.546		0.120		0.100	0.300
NA11-350	3.500	3 1/2	88.9	3.780		0.109		0.125		0.324		0.154		80.2	3.710		0.120		0.105	0.315
NA11-356	3.562	3 9/16	90.5	3.850		0.109		0.125		0.326		0.155		82.4	3.776		0.120		0.107	0.321
NA11-400	4.000	4	101.6	4.350		0.109		0.125		0.338		0.161		97.4	4.240		0.120		0.120	0.360

GENERAL NOTE: For reference, see Table 7 illustration on previous page.

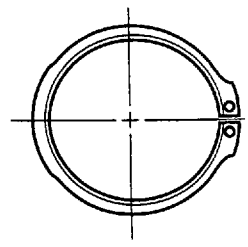
NOTES:

(1) For plated rings, add 0.002 in. to the listed maximum thickness except that maximum ring thickness after plating will be a minimum of 0.0002 in. less than the listed groove width (*W*) minimum.

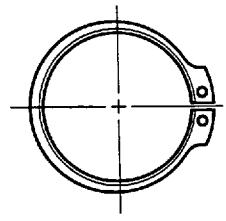
(2) *F.I.M. (Full Indicator Movement)*: maximum allowable run out of groove diameter to housing.

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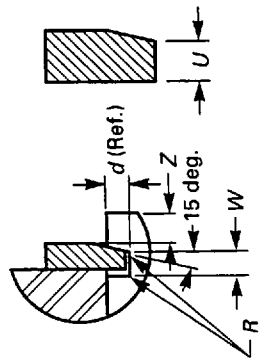
TABLE 8 ILLUSTRATION



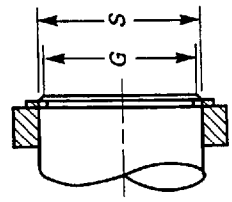
Alternate Lug Design (Manufacturer's Option for Larger Sizes)



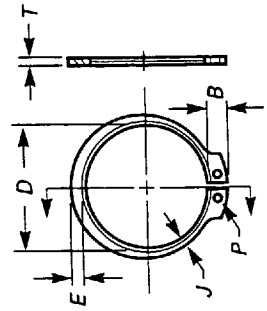
Asymmetrical Design (Manufacturer's Option)



Exploded Groove Profile & Edge Margin Maximum bottom radii (*R*), 0.005 for ring sizes –100 thru –200; 0.010 for ring sizes –206 thru –1000



Shaft Diameter and Groove Dimensions



Free Diameter and Ring Measurements

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TABLE 8 NA12 BEVELED EXTERNAL RETAINING RINGS

Ring Series and Size No.	Shaft Diameter			Ring Size & Weight														Groove Dimensions					Edge Margin
				Free Diameter		Thickness [Note (1)]		Thickness Beveled End [Note (1)]		Hole Diameter		Lug Height (Max.)	Large Section		Small Section		Approx. Weight per 1000 Pcs.	Diameter		Width		Depth	
	S, Dec.	*S*, Frac.	*S*, mm	*D*	Tol.	*T*	Tol.	*U*	Tol.	*P*	Tol.	*B*	*E*	Tol.	*J*	Tol.	lbs.	*G*	Tol.	*W*	Tol.	(*d*)	*Z*
NA12-100	1.000	1	25.4	0.925	+0.005	0.042		0.034		0.078		0.171	0.116	±0.005	0.065	±0.005	3.6	0.930	+0.000–0.003	0.037		0.035	0.052
NA12-102	1.023	...	26.0	0.946	–0.010	0.042		0.033		0.078		0.172	0.118		0.066		3.9	0.951	0.004(2)	0.036		0.036	0.054
NA12-106	1.062	1 1/16	27.0	0.982		0.050		0.041		0.078		0.185	0.122		0.069		4.8	0.992		0.044		0.035	0.052
NA12-112	1.125	1 1/8	28.6	1.041		0.050		0.041		0.078		0.186	0.128		0.071		5.1	1.051		0.044		0.037	0.055
NA12-118	1.188	1 3/16	30.2	1.098	+0.010	0.050	±0.002	0.041	±0.001	0.078		0.186	0.132		0.072		5.6	1.108	+0.000	0.044	+0.005	0.040	0.060
NA12-125	1.250	1 1/4	31.7	1.156	–0.015	0.050		0.040		0.078		0.187	0.140		0.076		5.9	1.166	–0.004	0.043	–0.000	0.042	0.063
NA12-131	1.312	1 5/16	33.3	1.214		0.050		0.039		0.078		0.187	0.146		0.0765		6.8	1.224	0.005(2)	0.042		0.044	0.066
NA12-137	1.375	1 3/8	34.9	1.272		0.050		0.039		0.078		0.188	0.152		0.082		7.2	1.282		0.042		0.046	0.069
NA12-143	1.438	1 7/16	36.5	1.333		0.050		0.039		0.078	+0.015	0.188	0.160	±0.006	0.086	±0.006	8.1	1.343		0.042		0.047	0.070
NA12-150	1.500	1 1/2	38.1	1.387		0.050		0.038		0.120	–0.002	0.218	0.168		0.091		9.0	1.397		0.041		0.051	0.076
NA12-156	1.562	1 9/16	39.7	1.446		0.062		0.049		0.125		0.259	0.172		0.093		12.4	1.459		0.053		0.051	0.076
NA12-162	1.625	1 5/8	41.3	1.503		0.062		0.049		0.125		0.239	0.180		0.097		13.2	1.516		0.053		0.054	0.081
NA12-168	1.688	1 11/16	42.9	1.560		0.062		0.048		0.125		0.239	0.184		0.099		14.8	1.573		0.052		0.057	0.085
NA12-175	1.750	1 3/4	44.4	1.618	+0.013	0.062	±0.003	0.048		0.125		0.241	0.188		0.101		15.3	1.631	+0.000	0.052		0.059	0.088
NA12-177	1.772	...	45.0	1.637	–0.020	0.062		0.048		0.125		0.241	0.190		0.102		15.4	1.650	–0.005	0.052		0.061	0.090
NA12-181	1.812	1 13/16	46.0	1.675		0.062		0.048		0.125		0.242	0.192		0.102		16.2	1.688	0.005(2)	0.052		0.062	0.093
NA12-187	1.875	1 7/8	47.6	1.735		0.062		0.048		0.125		0.243	0.196		0.104		17.3	1.748		0.052		0.063	0.094
NA12-196	1.969	1 31/32	50.0	1.819		0.062		0.047		0.125		0.266	0.200		0.106		18.0	1.832		0.051		0.068	0.102
NA12-200	2.000	2	50.8	1.850		0.062		0.047		0.125		0.266	0.204		0.108		19.0	1.863		0.051		0.068	0.102
NA12-206	2.062	2 1/16	52.4	1.906		0.078		0.062		0.125		0.271	0.208		0.111		25.0	1.921		0.067		0.070	0.105
NA12-212	2.125	2 1/8	54.0	1.964		0.078		0.062		0.125		0.285	0.212		0.113		26.1	1.979		0.067		0.073	0.109
NA12-215	2.156	2 5/32	54.8	1.993	+0.015	0.078		0.062	±0.0015	0.125		0.271	0.212		0.113		26.3	2.008	+0.000	0.067	+0.007	0.074	0.111
NA12-225	2.250	2 1/4	57.1	2.081	–0.025	0.078		0.061		0.125		0.272	0.220		0.116		27.7	2.096	–0.006	0.066	–0.000	0.077	0.115
NA12-231	2.312	2 5/16	58.7	2.139		0.078		0.060		0.125		0.272	0.222		0.118		28.0	2.154	0.006(2)	0.065		0.079	0.118
NA12-237	2.375	2 3/8	60.3	2.197		0.078		0.060		0.125		0.272	0.224		0.119		29.2	2.212		0.065		0.081	0.121
NA12-243	2.438	2 7/16	61.9	2.255		0.078		0.060		0.125		0.273	0.228		0.120		29.5	2.270		0.065		0.084	0.126
NA12-250	2.500	2 1/2	63.5	2.313		0.078		0.059		0.125		0.273	0.232	±0.007	0.122	±0.007	29.7	2.328		0.064		0.086	0.129
NA12-255	2.559	...	65.0	2.377	+0.020	0.078		0.059		0.125		0.273	0.238		0.125		33.9	2.397		0.064		0.081	0.121
NA12-262	2.625	2 5/8	66.7	2.428	–0.030	0.078		0.059		0.125		0.273	0.242		0.127		35.0	2.448		0.064		0.088	0.132
NA12-268	2.688	2 11/16	68.3	2.485		0.078		0.059		0.125		0.273	0.246		0.129		36.0	2.505		0.064		0.091	0.136
NA12-275	2.750	2 3/4	69.8	2.543		0.093		0.073		0.125		0.329	0.248		0.131		47.0	2.563		0.079		0.093	0.139
NA12-287	2.875	2 7/8	73.0	2.659		0.093		0.072		0.125		0.313	0.256		0.133		48.5	2.679		0.078		0.098	0.147
NA12-293	2.938	2 15/16	74.6	2.717		0.093		0.072	±0.002	0.125		0.313	0.260		0.136		50.0	2.737		0.078		0.100	0.150
NA12-300	3.000	3	76.2	2.775		0.093		0.071		0.125		0.269	0.264		0.138		52.0	2.795		0.077		0.102	0.153
NA12-306	3.062	3 1/16	77.8	2.832		0.093		0.071		0.125		0.257	0.252		0.131		47.0	2.852		0.077		0.105	0.157

(continued)

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TABLE 8 NA12 BEVELED EXTERNAL RETAINING RINGS (CONT'D)

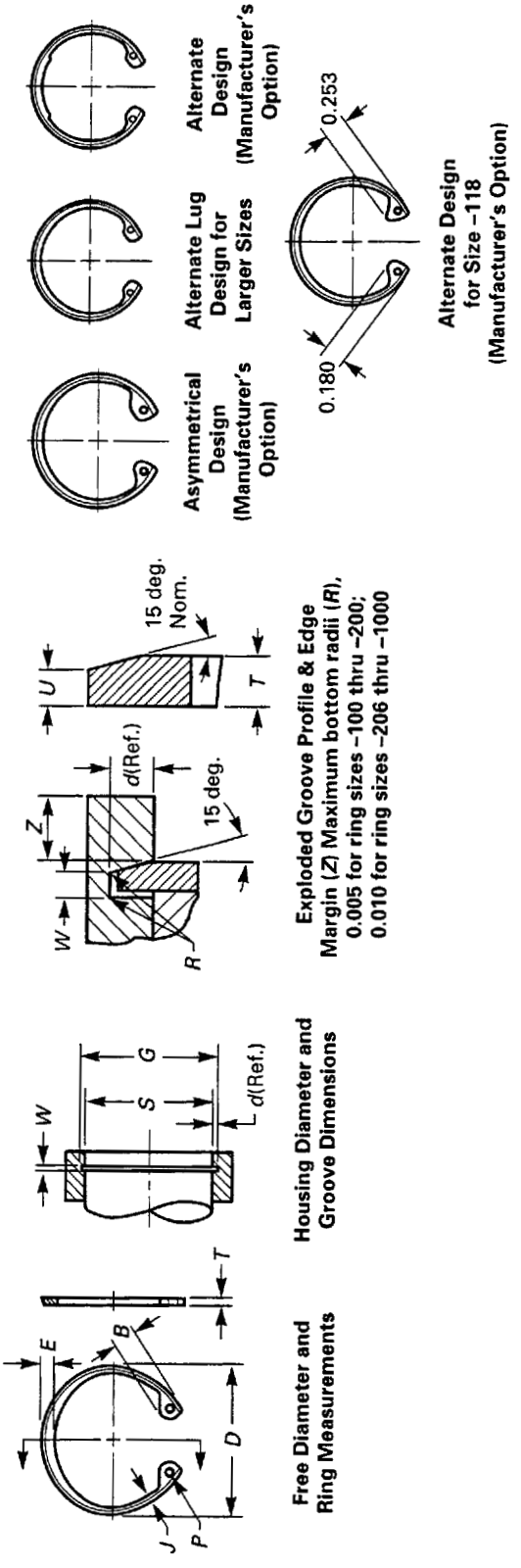
Ring Series and Size No.	Shaft Diameter			Ring Size & Weight														Groove Dimensions					Edge Margin
				Free Diameter		Thickness [Note (1)]		Thickness Beveled End [Note (1)]		Hole Diameter		Lug Height (Max.)	Large Section		Small Section		Approx. Weight per 1000 Pcs.	Diameter		Width		Depth	
	S, Dec.	*S*, Frac.	*S*, mm	*D*	Tol.	*T*	Tol.	*U*	Tol.	*P*	Tol.	*B*	*E*	Tol.	*J*	Tol.	lbs.	*G*	Tol.	*W*	Tol.	(*d*)	*Z*
NA12-312	3.125	3 1/8	79.4	2.892		0.093		0.070		0.125		0.313	0.272		0.141		58.0	2.912		0.076		0.106	0.159
NA12-315	3.156	3 5/32	80.2	2.920		0.093		0.070		0.125		0.313	0.274		0.143		59.0	2.940	+0.000	0.076	+0.007	0.108	0.162
NA12-325	3.250	3 1/4	82.5	3.006		0.093		0.070	±0.002	0.125		0.313	0.280		0.145		62.0	3.026	−0.006	0.076	−0.000	0.112	0.168
NA12-334	3.346	3 11/32	85.0	3.092	+0.020	0.093		0.069		0.125		0.313	0.286		0.147		64.0	3.112	0.006 (2)	0.075		0.117	0.175
NA12-343	3.438	3 7/16	87.3	3.179	−0.030	0.093		0.069		0.125	+0.015	0.313	0.292	±0.008	0.148	±0.008	66.0	3.199		0.075		0.119	0.178
NA12-350	3.500	3 1/2	88.9	3.237		0.109		0.084		0.125	−0.002	0.290	0.285		0.148		72.0	3.257		0.091		0.121	0.181
NA12-354	3.543	...	90.0	3.277		0.109		0.084		0.125		0.333	0.288		0.149		73.0	3.297		0.091		0.123	0.184
NA12-362	3.625	3 5/8	92.1	3.352		0.109		0.083		0.125		0.333	0.296		0.153		76.0	3.372		0.090		0.126	0.189
NA12-368	3.688	3 11/16	93.7	3.410		0.109	±0.003	0.083		0.125		0.335	0.302		0.156		80.0	3.430		0.090		0.129	0.193
NA12-375	3.750	3 3/4	95.2	3.468		0.109		0.082		0.125		0.337	0.310		0.160		83.0	3.488		0.089		0.131	0.196
NA12-387	3.875	3 7/8	98.4	3.584		0.109		0.082		0.125		0.335	0.318		0.163		88.0	3.604		0.089		0.135	0.202
NA12-393	3.938	3 15/16	100.0	3.642		0.109		0.081	±0.0025	0.125		0.347	0.318		0.163		95.0	3.662		0.088	+0.008	0.138	0.207
NA12-400	4.000	4	101.6	3.700		0.109		0.081		0.125		0.357	0.318		0.163		101.0	3.720		0.088	−0.000	0.140	0.210
NA12-425	4.250	4 1/4	108.0	3.989		0.109		0.087		0.125		0.403	0.318		0.176		112.0	4.009		0.094		0.120	0.180
NA12-437	4.375	4 3/8	111.1	4.106		0.109		0.087		0.125		0.403	0.318		0.181		115.0	4.126		0.094		0.124	0.186
NA12-450	4.500	4 1/2	114.3	4.223		0.109		0.087		0.125		0.412	0.405		0.185		132.0	4.243		0.094		0.128	0.192
NA12-475	4.750	4 3/4	120.6	4.458		0.109		0.085		0.125		0.437	0.303		0.136		113.0	4.478		0.092		0.136	0.204
NA12-500	5.000	5	127.0	4.692		0.109		0.084		0.156		0.458	0.360	±0.010	0.194	±0.010	149.0	4.712		0.091		0.144	0.216
NA12-525	5.250	5 1/4	133.3	4.927		0.125		0.098		0.156		0.480	0.372		0.211		190.0	4.947	+0.000	0.105		0.151	0.226
NA12-550	5.500	5 1/2	139.7	5.162	+0.020	0.125	±0.004	0.097		0.156		0.505	0.390		0.209		201.0	5.182	−0.007	0.104		0.159	0.238
NA12-575	5.750	5 3/4	146.0	5.396	−0.040	0.125		0.096		0.156		0.526	0.408		0.220		199.0	5.416	0.006 (2)	0.103		0.167	0.250
NA12-600	6.000	6	152.4	5.631		0.125		0.095		0.156		0.548	0.381		0.171		210.0	5.651		0.102		0.174	0.261
NA12-625	6.250	6 1/4	158.7	5.866		0.156		0.124		0.156	+0.020	0.573	0.396		0.176		282.0	5.886		0.132		0.182	0.273
NA12-650	6.500	6 1/2	165.1	6.100	+0.020	0.156		0.123		0.156	−0.005	0.598	0.438		0.236		330.0	6.120		0.131		0.190	0.285
NA12-675	6.750	6 3/4	171.4	6.335	−0.050	0.156		0.122	±0.003	0.187		0.620	0.456		0.246		356.0	6.355		0.130		0.197	0.295
NA12-700	7.000	7	177.8	6.570		0.156		0.121		0.187		0.542	0.474		0.256		388.0	6.590		0.129		0.205	0.307
NA12-750	7.500	7 1/2	190.5	7.039		0.187		0.149		0.187		0.688	0.507	±0.015	0.277	±0.015	534.0	7.059		0.158		0.220	0.330
NA12-800	8.000	8	203.2	7.508		0.187	±0.005	0.148		0.187		0.747	0.540		0.294		628.0	7.528	+0.000	0.157	+0.010	0.236	0.354
NA12-850	8.500	8 1/2	215.9	7.977	+0.020	0.187		0.145		0.187		0.747	0.573		0.314		700.0	7.997	−0.008	0.154	−0.000	0.251	0.376
NA12-900	9.000	9	228.6	8.445	−0.060	0.187		0.144		0.187		0.747	0.609		0.333		757.0	8.465	0.006 (2)	0.153		0.267	0.400
NA12-950	9.500	9 1/2	241.3	8.915		0.187		0.141		0.187		0.747	0.642		0.350		820.0	8.935		0.150		0.282	0.423
NA12-1000	10.000	10	254.0	9.385		0.187		0.139		0.187		0.747	0.675		0.367		964.0	9.405		0.148		0.297	0.445

GENERAL NOTE: For reference, see Table 8 illustration on page 147.

NOTES:
(1) For plated rings, add 0.002 in. to the listed maximum thickness (*T*) and beveled end thickness (*U*) values.
(2) *F.I.M. (Full Indicator Movement)*: maximum allowable run out of groove diameter to shaft.

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TABLE 9 ILLUSTRATION



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TABLE 9 NA13 BEVELED INTERNAL RETAINING RINGS

Ring Series and Size No.	Housing Diameter			Ring Size & Weight														Groove Dimensions					Edge Margin
				Free Diameter		Thickness [Note (1)]		Thickness Beveled End [Note (1)]		Hole Diameter		Lug Height (Max.)	Large Section		Small Section		Approx. Weight per 1000 Pcs.	Diameter		Width		Depth	
	S, Dec.	S, Frac.	S, mm	D	Tol.	T	Tol.	U	Tol.	P	Tol.	B	E	Tol.	J	Tol.	lbs.	G	Tol.	W	Tol.	(d)	Z
NA13-100	1.000	1	25.4	1.111	+0.015	0.042		0.033		0.062	+0.010	0.160	0.104	±0.005	0.052	±0.005	2.7	1.076	+0.003	0.036		0.038	0.057
NA13-102	1.023	...	26.0	1.136	−0.010	0.042		0.033		0.062	−0.002	0.160	0.106		0.054		2.8	1.101	−0.000	0.036		0.039	0.058
NA13-106	1.062	1 1/16	27.0	1.180		0.050		0.041		0.078		0.185	0.110		0.055		3.7	1.138	0.004(2)	0.044		0.038	0.057
NA13-112	1.125	1 1/8	28.6	1.249		0.050		0.040		0.078		0.185	0.116		0.057		4.0	1.205		0.043		0.040	0.060
NA13-118	1.181	...	30.0	1.319		0.050		0.040		0.078		0.185	0.120		0.058		4.3	1.265		0.043		0.042	0.063
NA13-125	1.188	1 3/16	30.2	1.319		0.050		0.040		0.078		0.185	0.120		0.058		4.3	1.272		0.043		0.042	0.063
NA13-125	1.250	1 1/4	31.7	1.388	+0.025	0.050	±0.002	0.039		0.078		0.185	0.124	±0.006	0.062	±0.006	4.8	1.342		0.042		0.046	0.069
NA13-125	1.259	...	32.0	1.388	−0.020	0.050		0.039		0.078		0.185	0.124		0.062		4.8	1.351		0.042		0.046	0.069
NA13-131	1.312	1 5/16	33.3	1.456		0.050		0.039		0.078		0.185	0.130		0.062		5.0	1.408		0.042		0.048	0.072
NA13-137	1.375	1 3/8	34.9	1.526		0.050		0.038		0.078		0.185	0.130		0.063		5.1	1.475		0.041		0.050	0.075
NA13-137	1.378	...	35.0	1.526		0.050		0.038	±0.001	0.078		0.185	0.130		0.063		5.1	1.478	+0.004	0.041	+0.005	0.050	0.075
NA13-143	1.438	1 7/16	36.5	1.596		0.050		0.037		0.078		0.185	0.133		0.065		5.8	1.572	−0.000	0.040	−0.000	0.052	0.078
NA13-145	1.456	...	37.0	1.616		0.050		0.037		0.078		0.185	0.133		0.065		6.4	1.562	0.005(2)	0.040		0.053	0.078
NA13-150	1.500	1 1/2	38.1	1.660		0.050		0.037		0.078		0.185	0.133		0.066		6.5	1.604		0.040		0.052	0.078
NA13-156	1.562	1 9/16	39.7	1.734		0.062		0.048		0.078		0.207	0.157		0.078		8.9	1.674		0.052		0.056	0.084
NA13-156	1.575	...	40.0	1.734		0.062		0.048		0.078		0.207	0.157		0.078		8.9	1.687		0.052		0.056	0.084
NA13-162	1.625	1 5/8	41.3	1.804		0.062		0.047		0.078		0.235	0.164		0.082		10.0	1.743		0.051		0.059	0.088
NA13-165	1.653	...	42.0	1.835		0.062		0.047		0.078		0.235	0.167		0.083		10.4	1.773		0.051		0.060	0.090
NA13-168	1.688	1 11/16	42.9	1.874	+0.035	0.062		0.046		0.078	+0.015	0.235	0.170		0.085		10.8	1.810	+0.005	0.050		0.061	0.091
NA13-175	1.750	1 3/4	44.4	1.942	−0.025	0.062		0.046		0.078	−0.002	0.239	0.171		0.083		10.3	1.878	−0.000	0.050		0.064	0.096
NA13-181	1.812	1 13/16	46.0	2.012		0.062		0.046		0.093		0.239	0.170	±0.007	0.084	±0.007	11.5	1.944	0.005(2)	0.050		0.066	0.099
NA13-185	1.850	...	47.0	2.054		0.062		0.046		0.093		0.239	0.170		0.085		12.8	1.984		0.050		0.067	0.100
NA13-187	1.875	1 7/8	47.6	2.054		0.062		0.046		0.093		0.239	0.170		0.085		12.8	2.011		0.050		0.068	0.102
NA13-193	1.938	1 15/16	49.2	2.141		0.062		0.045		0.093		0.235	0.170		0.085		13.3	2.082		0.049		0.072	0.108
NA13-200	2.000	2	50.8	2.210		0.062		0.044		0.093		0.245	0.170		0.085		14.0	2.144		0.048		0.072	0.108
NA13-206	2.047	...	52.0	2.280		0.078		0.060		0.093		0.255	0.186		0.091		18.0	2.195		0.065		0.074	0.111
NA13-206	2.062	2 1/16	52.4	2.280		0.078		0.060		0.093		0.255	0.186		0.091		18.0	2.210		0.065		0.074	0.111
NA13-212	2.125	2 1/8	54.0	2.350		0.078		0.060		0.093		0.265	0.195		0.096		19.4	2.279		0.065		0.077	0.115
NA13-218	2.165	...	55.0	2.415		0.078		0.059		0.093		0.265	0.199		0.098		19.6	2.327		0.064		0.077	0.115
NA13-218	2.188	2 3/16	55.6	2.415	+0.040	0.078	±0.003	0.059	±0.0015	0.093		0.265	0.199		0.098		19.6	2.350	+0.006	0.064		0.081	0.121
NA13-225	2.250	2 1/4	57.1	2.490	−0.030	0.078		0.059		0.093		0.285	0.203		0.099		21.8	2.420	−0.000	0.064		0.081	0.121
NA13-231	2.312	2 5/16	58.7	2.535		0.078		0.058		0.093		0.275	0.209		0.102		22.6	2.484	0.006(2)	0.063	+0.007	0.085	0.127
NA13-237	2.375	2 3/8	60.3	2.630		0.078		0.058		0.093		0.285	0.207		0.102		23.2	2.552		0.063	−0.000	0.086	0.129
NA13-244	2.440	2 7/16	62.0	2.702		0.078		0.057		0.110		0.285	0.209		0.103		25.4	2.618		0.062		0.089	0.133
NA13-250	2.500	2 1/2	63.5	2.775		0.078		0.057		0.110		0.285	0.210		0.103		25.5	2.684		0.062		0.089	0.133
NA13-250	2.531	2 17/32	64.3	2.775		0.078		0.057		0.110		0.285	0.210		0.103		25.5	2.717		0.062		0.092	0.138
NA13-256	2.562	2 9/16	65.1	2.844		0.093		0.072		0.110		0.305	0.222		0.109		34.0	2.750		0.078		0.093	0.139
NA13-262	2.625	2 5/8	66.7	2.910		0.093		0.071		0.110		0.295	0.226		0.111		34.0	2.750		0.078		0.094	0.141
NA13-268	2.677	...	68.0	2.980		0.093		0.071		0.110		0.305	0.230		0.113		34.5	2.820		0.077		0.097	0.145
NA13-268	2.688	2 11/16	68.3	2.980		0.093		0.071		0.110		0.305	0.230		0.113		35.0	2.876		0.077		0.099	0.148
NA13-275	2.750	2 3/4	69.8	3.050		0.093		0.070	±0.002	0.110		0.305	0.234		0.115		35.0	2.887		0.077		0.099	0.148
NA13-281	2.812	2 13/16	71.4	3.121		0.093		0.070		0.110		0.305	0.230		0.115		35.5	2.955		0.076		0.102	0.153
NA13-281	2.835	...	72.0	3.121		0.093		0.070		0.110		0.305	0.230		0.115		36.0	3.020		0.076		0.104	0.156
NA13-287	2.875	2 7/8	73.0	3.191		0.093		0.070		0.110		0.315	0.240		0.120		36.0	3.043		0.076		0.104	0.156
NA13-300	2.953	...	75.0	3.325		0.093		0.068		0.110		0.305	0.250		0.122		41.0	3.085		0.076		0.105	0.157
NA13-300	3.000	3	76.2	3.325		0.093		0.068		0.110		0.305	0.250		0.122		42.5	3.178		0.074		0.112	0.168
NA13-306	3.062	3 1/16	77.8	3.418	±0.055	0.109		0.082	±0.0025	0.125		0.318	0.254	±0.008	0.126	±0.008	42.5	3.225		0.074		0.112	0.168
NA13-312	3.125	3 1/8	79.4	3.488		0.109		0.082		0.125		0.318	0.259		0.129		53.0	3.290		0.089	±0.008	0.114	0.171
																	56.0	3.355		0.089	−0.000	0.115	0.172

(continued)

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TABLE 9 NA13 BEVELED INTERNAL RETAINING RINGS (CONT'D)

Ring Series and Size No.	Housing Diameter			Ring Size & Weight													Groove Dimensions					Edge Margin
				Free Diameter		Thickness [Note (1)]		Thickness Beveled End [Note (1)]		Hole Diameter		Lug Height (Max.)	Large Section		Small Section		Approx. Weight per 1000 Pcs.	Diameter		Width		Depth	
	S, Dec.	*S*, Frac.	*S*, mm	*D*	Tol.	*T*	Tol.	*U*	Tol.	*P*	Tol.	*B*	*E*	Tol.	*J*	Tol.	lbs.	*G*	Tol.	*W*	Tol.	(*d*)	*Z*
NA13-315	3.149	...	80.0	3.523		0.109		0.082		0.125		0.318	0.262		0.129		57.0	3.381		0.089		0.116	0.174
NA13-315	3.156	3 5/32	80.2	3.523	±0.055	0.109	±0.003	0.082	±0.0025	0.125		0.318	0.262		0.129		57.0	3.388		0.089	+0.008	0.116	0.174
NA13-325	3.250	3 1/4	82.5	3.623		0.109		0.082		0.125		0.350	0.269		0.135		60.0	3.489		0.089	−0.000	0.119	0.178
NA13-334	3.346	3 11/32	85.0	3.734		0.109		0.082		0.125		0.350	0.276		0.140		65.0	3.591		0.089		0.122	0.183
NA13-347	3.469	3 15/32	88.1	3.857		0.109		0.082		0.125		0.350	0.286		0.144		69.0	3.726	+0.006	0.089		0.128	0.192
NA13-350	3.500	3 1/2	88.9	3.890		0.109		0.082		0.125		0.350	0.289		0.142		71.0	3.760	−0.000	0.089		0.130	0.195
NA13-354	3.543	...	90.0	3.936		0.109		0.082		0.125	+0.015	0.350	0.292		0.142		72.0	3.806	0.006(2)	0.089		0.132	0.198
NA13-354	3.562	3 9/16	90.5	3.936		0.109		0.082		0.125	−0.002	0.350	0.292		0.142		72.0	3.830		0.089		0.134	0.201
NA13-362	3.625	3 5/8	92.1	4.024		0.109		0.082		0.125		0.350	0.299		0.150		73.0	3.900		0.089		0.137	0.205
NA13-375	3.740	...	95.0	4.157		0.109		0.082		0.125		0.350	0.309		0.155		78.0	4.030		0.089		0.145	0.217
NA13-375	3.750	3 3/4	95.2	4.157		0.109		0.082		0.125		0.350	0.309	±0.008	0.155	±0.008	78.0	4.040		0.089		0.145	0.217
NA13-387	3.875	3 7/8	98.4	4.291		0.109		0.082		0.125		0.378	0.319		0.160		87.0	4.171		0.089		0.148	0.222
NA13-393	3.938	3 15/16	100.0	4.358		0.109		0.082		0.125		0.378	0.324		0.161		88.0	4.236		0.089		0.149	0.223
NA13-400	4.000	4	101.6	4.424		0.109		0.082		0.125		0.378	0.330		0.166		93.0	4.302		0.089		0.151	0.226
NA13-412	4.125	4 1/8	104.8	4.558		0.109		0.082		0.125		0.378.	0.330		0.171		97.0	4.433		0.089		0.154	0.231
NA13-425	4.250	4 1/4	108.0	4.691		0.109		0.082		0.125		0.378.	0.335		0.180		101.0	4.562		0.089		0.156	0.234
NA13-433	4.331	...	110.0	4.756		0.109		0.082		0.156		0.413	0.343		0.180		105.0	4.647		0.089		0.158	0.237
NA13-450	4.500	4 1/2	114.3	4.940		0.109		0.082		0.156		0.413	0.351		0.181		111.0	4.824		0.089		0.162	0.243
NA13-462	4.625	4 5/8	117.5	5.076		0.109		0.082		0.156		0.413	0.360		0.183		117.0	4.955		0.089		0.165	0.247
NA13-475	4.724	...	120.0	5.213		0.109		0.082		0.156		0.413	0.370		0.183		124.0	5.060		0.089		0.168	0.252
NA13-475	4.750	4 3/4	120.6	5.213		0.109		0.082		0.156		0.413	0.370		0.183		124.0	5.086		0.089		0.168	0.252
NA13-500	5.000	5	127.0	5.485		0.109		0.082		0.156		0.413	0.390		0.186		136.0	5.346		0.089		0.173	0.259
NA13-525	5.250	5 1/4	133.3	5.770	±0.065	0.125		0.095		0.156	+0.020	0.465	0.408		0.198		174.0	5.612	+0.007	0.102	+0.010	0.181	0.271
NA13-537	5.375	5 3/8	136.5	5.910		0.125	±0.004	0.095		0.156	−0.005	0.465	0.408	±0.009	0.198	±0.009	179.0	5.739	−0.000	0.102	−0.000	0.182	0.273
NA13-550	5.500	5 1/2	139.7	6.066		0.125		0.095	±0.003	0.156		0.465	0.408		0.198		183.0	5.864	0.006(2)	0.102		0.182	0.273
NA13-575	5.750	5 3/4	146.0	6.336		0.125		0.095		0.156		0.465	0.408		0.198		192.0	6.120		0.102		0.185	0.277
NA13-600	6.000	6	152.4	6.620		0.125		0.095		0.156		0.465	0.408		0.196		201.0	6.374		0.102		0.187	0.280
NA13-625	6.250	6 1/4	158.7	6.895		0.156		0.121		0.187		0.465	0.423		0.211		266.0	6.642		0.129		0.196	0.294
NA13-650	6.500	6 1/2	165.1	7.170		0.156		0.121		0.187		0.495	0.438		0.219		281.0	6.908		0.129		0.204	0.306
NA13-662	6.625	6 5/8	168.3	7.308	±0.080	0.156		0.121		0.187		0.495	0.447		0.221		305.0	7.042		0.129		0.208	0.312
NA13-675	6.750	6 3/4	171.4	7.445		0.156		0.120		0.187		0.540	0.456		0.224		325.0	7.174		0.128		0.212	0.318
NA13-700	7.000	7	177.8	7.720		0.156		0.120		0.187		0.540	0.474		0.232		344.0	7.441		0.128		0.220	0.330
NA13-725	7.250	7 1/4	184.1	7.995		0.187		0.150		0.187		0.570	0.489		0.238		428.0	7.708	+0.008	0.159		0.229	0.343
NA13-750	7.500	7 1/2	190.5	8.270		0.187		0.150		0.187		0.570	0.507		0.247		485.0	7.974	−0.000	0.159		0.237	0.355
NA13-775	7.750	7 3/4	196.8	8.545		0.187		0.150		0.187		0.570	0.523		0.255		520.0	8.240	0.006(2)	0.159		0.245	0.367
NA13-800	8.000	8	203.2	8.820		0.187		0.146		0.187		0.610	0.540		0.262		555.0	8.507		0.155		0.253	0.379
NA13-825	8.250	8 1/4	209.5	9.095		0.187		0.146		0.187		0.610	0.558		0.270	±0.010	603.0	8.773		0.155		0.261	0.391
NA13-850	8.500	8 1/2	215.9	9.285	±0.090	0.187	±0.005	0.142		0.187		0.670	0.573	±0.010	0.277		634.0	9.040		0.151		0.270	0.405
NA13-875	8.750	8 3/4	222.2	9.558		0.187		0.142		0.187		0.670	0.591		0.286		653.0	9.307		0.151		0.278	0.417
NA13-900	9.000	9	228.6	9.830		0.187		0.142		0.187		0.670	0.609		0.294		732.0	9.573		0.151		0.286	0.429
NA13-925	9.250	9 1/4	235.0	10.102		0.187		0.142		0.187		0.670	0.625		0.299		767.0	9.838		0.151		0.294	0.441
NA13-950	9.500	9 1/2	241.3	10.375		0.187		0.138		0.187		0.745	0.642		0.304		803.0	10.106		0.147		0.303	0.454
NA13-975	9.750	9 3/4	247.7	10.648		0.187		0.138		0.187		0.745	0.658		0.309		833.0	10.372		0.147		0.311	0.466
NA13-1000	10.000	10	254.0	10.920		0.187		0.138		0.187		0.745	0.675		0.315		863.0	10.639		0.147		0.319	0.478

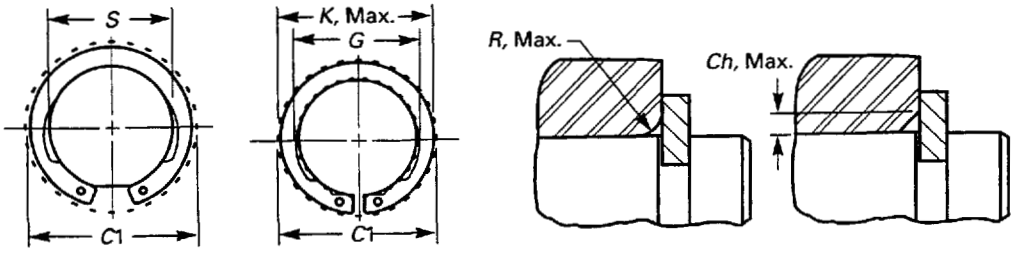
GENERAL NOTE: For reference, see Table 9 illustration on page 150.

NOTES:
(1) For plated rings, add 0.002 in. to the listed maximum thickness (*T*) and beveled end thickness (*U*) values.
(2) *F.I.M. (Full Indicator Movement)*: maximum allowable run out of groove diameter to housing.

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MANDATORY APPENDIX I
INVERTED EXTERNAL SERIES NA10

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Clearance Diameter Expanded Over Shaft

Clearance Diameter and Gaging Diameter Released in Groove

Maximum Corner Radius and Chamfer

TABLE I ILLUSTRATION

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TABLE I NA10 INVERTED EXTERNAL RETAINING RINGS

Ring Series and Size No.	Application Data								
	Clearance Diameter		Gaging Diameter	Allowable Thrust Load [Note (1)] Square Corner Abutment		Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.	Limits Standard Material
	Expanded Over Shaft	Released in Groove	For Checking Ring Seated in Groove	UNS G10600–G10900 & Stainless Steel Rings Used on Hardened Shafts (50 HRc, Min.)	All Standard Rings Used on Low Carbon Steel Shafts				
	*C*1	*C*2	*K*, Max.	*Pr* (lb) [Note (2)]	*Pg* (lb)	*R*, Max.	*Ch*, Max.	*P'r* (lb)	RPM
NA10-50	0.67	0.645	0.64	1117	280	0.051	0.032	680	40000
NA10-56	0.75	0.72	0.715	1269	320	0.057	0.036	680	35000
NA10-59	0.79	0.76	0.75	1320	370	0.059	0.037	680	32000
NA10-62	0.83	0.80	0.79	1421	400	0.062	0.039	680	30000
NA10-68	0.91	0.87	0.87	2335	500	0.066	0.042	1000	28000
NA10-75	0.99	0.95	0.945	2538	600	0.071	0.045	1000	26500
NA10-78	1.04	1.00	0.98	2639	650	0.073	0.046	1000	25500
NA10-81	1.08	1.03	1.02	2690	700	0.076	0.048	1000	24500
NA10-87	1.15	1.10	1.095	2893	850	0.080	0.051	1000	23000
NA10-93	1.23	1.18	1.17	3147	900	0.086	0.054	1000	21500
NA10-100	1.30	1.25	1.24	3350	1000	0.091	0.057	1000	20000
NA10-100	1.31	1.26	1.25	3350	1050	0.091	0.057	1000	20000
NA10-106	1.38	1.32	1.31	4212	1200	0.092	0.058	1460	19000
NA10-112	1.45	1.39	1.38	4466	1300	0.093	0.059	1460	18800
NA10-118	1.52	1.46	1.45	4720	1450	0.094	0.059	1460	18000
NA10-125	1.59	1.52	1.52	4974	1600	0.096	0.060	1460	17000
NA10-131	1.66	1.58	1.58	5227	1850	0.097	0.061	1460	16500
NA10-137	1.73	1.65	1.65	5481	2050	0.098	0.061	1460	16000
NA10-143	1.80	1.72	1.715	5735	2200	0.100	0.063	1460	15000
NA10-150	1.87	1.78	1.775	5938	2500	0.100	0.063	1460	14800
NA10-156	1.95	1.86	1.85	7714	2600	0.104	0.066	2250	14000
NA10-162	2.02	1.93	1.92	8019	2750	0.108	0.067	2250	13200
NA10-177	2.18	2.08	2.07	8628	3100	0.116	0.073	2250	11700
NA10-177	2.20	2.10	2.09	8628	3200	0.116	0.073	2250	11700
NA10-181	2.24	2.14	2.13	8983	3300	0.117	0.074	2250	11500
NA10-196	2.43	2.32	2.31	9693	3900	0.124	0.078	2250	10500
NA10-200	2.47	2.36	2.35	9896	4000	0.127	0.080	2250	10000
NA10-215	2.62	2.50	2.49	13195	4550	0.133	0.084	3750	9400
NA10-215	2.65	2.53	2.52	13195	4700	0.133	0.084	3750	9400
NA10-250	3.05	2.92	2.91	15530	6200	0.151	0.095	3750	8400
NA10-275	3.34	3.20	3.19	20402	7200	0.165	0.103	5500	7600
NA10-287	3.49	3.34	3.33	21315	7800	0.170	0.107	5500	7300
NA10-315	3.82	3.66	3.65	23447	9400	0.185	0.116	5500	6500
NA10-325	3.93	3.76	3.75	24056	10000	0.190	0.118	5500	6400
NA10-350	4.22	4.04	4.03	30349	11500	0.202	0.127	7850	5900
NA10-393	4.71	4.51	4.50	34206	14000	0.212	0.133	7850	5200

GENERAL NOTE: For reference, see Table I illustration on previous page.

NOTES:

(1) *Safety Factors Pr and Pg:* the allowable thrust load values listed include the following safety factors: *Pr*: 4 *Pg*: 2

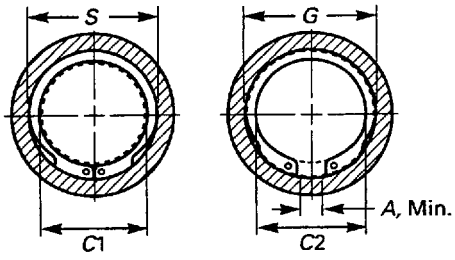
(2) The *Pr* values listed apply to rings made from G10600–G10900 and UNS S15700 stainless steel. *Pr* values for rings made from beryllium copper can be calculated by multiplying listed values by 0.75.

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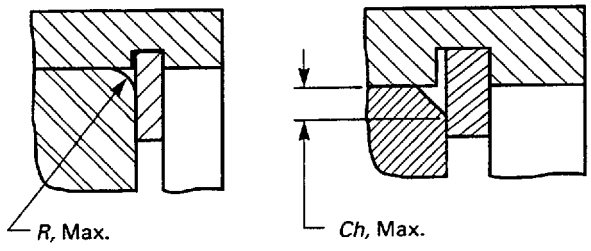
MANDATORY APPENDIX II
INVERTED INTERNAL SERIES NA11

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Clearance Diameter Compressed in Housing **Clearance Diameter and Gap Width Released in Groove**



Allowable Corner Radius and Chamfer

TABLE II ILLUSTRATION

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TABLE II NA11 INVERTED INTERNAL RETAINING RINGS

Ring Series and Size No.	Application Data							
	Clearance Diameter		Gap Width in Groove	Allowable Thrust Load [Note (1)] Square Corner Abutment		Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.
	Compressed in Housing	Released in Groove		UNS G10600–G10900 and Stainless Steel Rings Used in Hardened Bores (50 HRc, Min.)	All Standard Rings Used in Low Carbon Steel Bores			
	*C*1	*C*2	*A*, Min.	*Pr* (lb) [Note (2)]	*Pg* (lb)	*R*, Max.	*Ch*, Max.	*P'r* (lb)
NA11-62	0.47	0.51	0.16	1015	450	0.042	0.028	400
NA11-75	0.56	0.605	0.165	1675	600	0.050	0.031	850
NA11-81	0.62	0.665	0.18	2639	700	0.054	0.034	1250
NA11-87	0.65	0.705	0.19	2893	850	0.057	0.036	1250
NA11-93	0.70	0.755	0.22	3147	1000	0.060	0.038	1250
NA11-100	0.75	0.81	0.235	3350	1150	0.064	0.040	1250
NA11-106	0.80	0.87	0.22	4212	1250	0.069	0.043	1800
NA11-112	0.86	0.93	0.245	4466	1400	0.070	0.044	1800
NA11-118	0.91	0.98	0.26	4720	1600	0.071	0.045	1800
NA11-125	0.97	1.05	0.28	4974	1750	0.071	0.045	1800
NA11-131	1.02	1.10	0.29	5227	1950	0.072	0.045	1800
NA11-137	1.08	1.16	0.33	5481	2100	0.074	0.046	1800
NA11-143	1.13	1.22	0.35	5735	2300	0.079	0.050	1800
NA11-150	1.18	1.27	0.33	5938	2500	0.081	0.051	1800
NA11-156	1.21	1.30	0.36	7714	2650	0.088	0.055	2900
NA11-162	1.27	1.37	0.385	8019	2850	0.090	0.056	2900
NA11-168	1.32	1.42	0.405	8374	3100	0.091	0.057	2900
NA11-175	1.38	1.49	0.42	8678	3300	0.093	0.058	2900
NA11-187	1.47	1.58	0.44	9287	3750	0.105	0.066	2900
NA11-200	1.55	1.67	0.48	9896	4300	0.118	0.074	2900
NA11-206	1.59	1.71	0.485	12840	4500	0.125	0.078	4600
NA11-212	1.65	1.77	0.49	13246	4700	0.128	0.080	4600
NA11-237	1.86	2.00	0.55	14718	5900	0.138	0.086	4600
NA11-243	1.91	2.05	0.57	15124	6200	0.141	0.088	4600
NA11-250	1.96	2.10	0.59	15530	6500	0.144	0.090	4600
NA11-262	2.06	2.21	0.60	19488	7200	0.150	0.094	6700
NA11-275	2.16	2.32	0.63	20300	7900	0.157	0.098	6700
NA11-283	2.21	2.37	0.61	20808	8300	0.162	0.102	6700
NA11-283	2.23	2.39	0.67	20808	8550	0.162	0.102	6700
NA11-287	2.26	2.43	0.67	21315	8900	0.162	0.101	6700
NA11-300	2.36	2.53	0.705	22229	9600	0.169	0.106	6700
NA11-315	2.50	2.69	0.76	27405	10600	0.174	0.109	9000
NA11-325	2.58	2.77	0.77	28217	11200	0.176	0.110	9000
NA11-334	2.67	2.87	0.81	29029	11700	0.177	0.111	9000
NA11-350	2.82	3.03	0.84	30349	12900	0.175	0.110	9000
NA11-356	2.88	3.09	0.86	30958	13400	0.175	0.110	9000
NA11-400	3.29	3.53	0.93	34713	16900	0.174	0.108	9000

GENERAL NOTE: For reference, see Table II illustration on previous page.

NOTES:

(1) *Safety factors for Pr and Pg:* the allowable thrust load values listed include the following safety factors: Pr: 4; *Pg*: 2.

(2) The *Pr* values listed apply to rings made from UNS G10600–G10900 and UNS S15700 stainless steel. *Pr* values for rings made from beryllium copper can be calculated by multiplying listed values by 0.75.

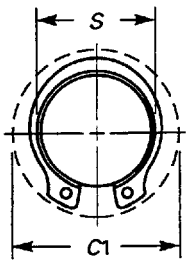
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MANDATORY APPENDIX III
BEVELED EXTERNAL SERIES NA12

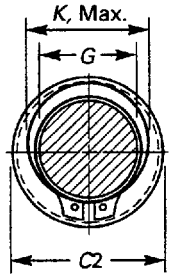
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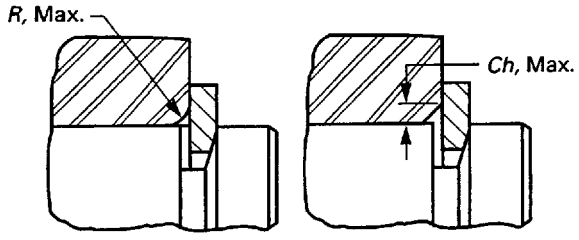
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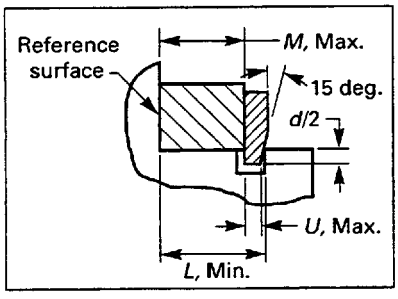
Clearance Diameter Expanded Over Shaft



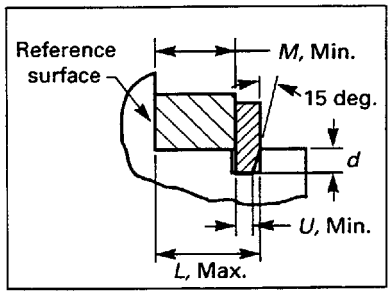
Clearance Diameter and Gaging Diameter Released in Groove



Maximum Corner Radius and Chamfer



Minimum Insertion of a Beveled Retaining Ring



Maximum Insertion of a Beveled Retaining Ring

Computing Groove Location

The following equations determine the distance from the defined shoulder (plane of reference) to the top of the far groove wall:

L, Min. $\geq$ M, Max. + U, Max. + $d/2$ tan 15 deg. (Corresponding to minimum groove engagement:)

L, Max. $\leq$ M, Min. + U, Min. + d tan 15 deg. (Corresponding to maximum groove engagement:)

TABLE III ILLUSTRATION

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TABLE III NA12 BEVELED EXTERNAL RETAINING RINGS

Ring Series and Size No.	Application Data								
	Clearance Diameter		Gaging Diameter Ring Installed in Groove	Allowable Thrust Load [Note (1)] Square Corner Abutment		Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.	End Play Take Up
	Expanded Over Shaft	Released in Groove		UNS G10600–G10900 and Stainless Steel Rings Used on Hardened Shafts (50 HRc, Min.)	All Standard Rings Used on Low Carbon Steel Shafts				
	*C*1	*C*2	*K*, Max.	*Pr* (lb) [Note (2)]	*Pg* (lb)	*R*, Max.	*Ch*, Max.	*P'r* (lb)	in.
NA12-100	1.41	1.38	1.144	5024	1200	0.057	0.034	1340	0.005
NA12-102	1.43	1.40	1.170	5126	1300	0.058	0.035	1340	0.005
NA12-106	1.50	1.47	1.217	6293	1300	0.060	0.036	1950	0.005
NA12-112	1.55	1.52	1.286	6699	1450	0.063	0.038	1950	0.005
NA12-118	1.61	1.57	1.351	7105	1650	0.064	0.0385	1950	0.005
NA12-125	1.69	1.65	1.424	7460	1850	0.068	0.041	1950	0.0055
NA12-131	1.75	1.71	1.490	7866	2000	0.068	0.041	1950	0.006
NA12-137	1.80	1.76	1.562	8222	2250	0.072	0.043	1950	0.006
NA12-143	1.87	1.83	1.636	8628	2450	0.076	0.045	1950	0.006
NA12-150	1.99	1.95	1.706	8932	2700	0.079	0.047	1950	0.007
NA12-156	2.10	2.05	1.778	11571	2900	0.082	0.049	3000	0.007
NA12-162	2.17	2.13	1.849	12028	3100	0.087	0.052	3000	0.0075
NA12-168	2.24	2.20	1.912	12535	3400	0.090	0.054	3000	0.0075
NA12-175	2.31	2.26	1.981	12992	3650	0.091	0.054	3000	0.008
NA12-177	2.33	2.28	2.004	13144	3750	0.092	0.055	3000	0.008
NA12-181	2.38	2.33	2.047	13449	3950	0.092	0.055	3000	0.008
NA12-187	2.44	2.39	2.114	13906	4200	0.094	0.056	3000	0.0085
NA12-196	2.54	2.48	2.209	14565	4700	0.094	0.056	3000	0.009
NA12-200	2.55	2.49	2.246	14819	4800	0.096	0.057	3000	0.009
NA12-206	2.68	2.62	2.315	19234	5100	0.098	0.059	5000	0.0095
NA12-212	2.75	2.68	2.386	19793	5450	0.098	0.059	5000	0.010
NA12-215	2.78	2.71	2.410	20097	5600	0.097	0.058	5000	0.010
NA12-225	2.87	2.80	2.513	21011	6100	0.100	0.060	5000	0.010
NA12-231	2.94	2.87	2.577	21518	6300	0.100	0.060	5000	0.0105
NA12-237	3.01	2.94	2.640	22127	6800	0.100	0.060	5000	0.011
NA12-243	3.07	3.00	2.706	22736	7100	0.102	0.061	5000	0.011
NA12-250	3.12	3.04	2.772	23345	7500	0.104	0.062	5000	0.0115
NA12-255	3.18	3.10	2.845	23853	7300	0.108	0.065	5000	0.011
NA12-262	3.25	3.17	2.910	24462	8200	0.1095	0.066	5000	0.0115
NA12-268	3.32	3.24	2.975	25071	8600	0.1115	0.067	5000	0.012
NA12-275	3.45	3.37	3.041	30552	9000	0.112	0.067	7350	0.012
NA12-287	3.57	3.48	3.172	31973	9900	0.115	0.069	7350	0.013
NA12-293	3.64	3.55	3.239	32683	10300	0.116	0.070	7350	0.0135
NA12-300	3.69	3.59	3.306	33394	10700	0.117	0.070	7350	0.0135
NA12-306	3.74	3.64	3.347	34003	11200	0.107	0.064	7350	0.014

(continued)

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TABLE III NA12 BEVELED EXTERNAL RETAINING RINGS (CONT'D)

Ring Series and Size No.	Application Data								
	Clearance Diameter		Gaging Diameter Ring Installed in Groove	Allowable Thrust Load [Note (1)] Square Corner Abutment		Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.	End Play Take Up
	Expanded Over Shaft	Released in Groove		UNS G10600–G10900 and Stainless Steel Rings Used on Hardened Shafts (50 HRc, Min.)	All Standard Rings Used on Low Carbon Steel Shafts				
	C1	*C2*	*K*, Max.	*Pr* (lb) [Note (2)]	*Pg* (lb)	*R*, Max.	*Ch*, Max.	*P'r* (lb)	in.
NA12-312	3.82	3.73	3.439	34815	11700	0.120	0.072	7350	0.014
NA12-315	3.85	3.75	3.469	35119	11900	0.1205	0.072	7350	0.0145
NA12-325	3.95	3.85	3.571	36134	12700	0.123	0.074	7350	0.015
NA12-334	4.04	3.94	3.669	37251	13600	0.126	0.076	7350	0.0155
NA12-343	4.14	4.03	3.767	38266	14300	0.129	0.077	7350	0.016
NA12-350	4.25	4.14	3.821	45574	14800	0.122	0.073	10500	0.016
NA12-354	4.29	4.18	3.866	46183	15200	0.123	0.074	10500	0.0165
NA12-362	4.37	4.25	3.956	47299	16300	0.127	0.076	10500	0.017
NA12-368	4.43	4.31	4.026	48010	16500	0.1295	0.078	10500	0.017
NA12-375	4.50	4.38	4.098	48822	17200	0.133	0.080	10500	0.0175
NA12-387	4.60	4.47	4.229	50446	18300	0.137	0.082	10500	0.018
NA12-393	4.70	4.57	4.290	51359	19000	0.137	0.082	10500	0.0185
NA12-400	4.78	4.65	4.350	52171	19600	0.135	0.081	10500	0.019
NA12-425	5.09	4.98	4.620	55419	18000	0.146	0.088	10500	0.016
NA12-437	5.22	5.10	4.740	57043	19000	0.146	0.088	10500	0.017
NA12-450	5.37	5.25	4.920	58667	20200	0.102	0.061	10500	0.017
NA12-475	5.67	5.54	5.060	61915	22700	0.115	0.069	10500	0.018
NA12-500	5.96	5.83	5.410	65163	25400	0.165	0.099	10500	0.019
NA12-525	6.27	6.12	5.670	78460	28000	0.169	0.101	13500	0.020
NA12-550	6.57	6.42	5.940	82215	30800	0.175	0.105	13500	0.021
NA12-575	6.86	6.70	6.210	85971	33800	0.184	0.110	13500	0.022
NA12-600	7.16	6.99	6.380	89625	37000	0.143	0.086	13500	0.023
NA12-625	7.46	7.29	6.650	116522	40000	0.148	0.089	21000	0.024
NA12-650	7.87	7.69	6.980	121191	43500	0.191	0.114	21000	0.025
NA12-675	8.06	7.87	7.260	125860	47000	0.200	0.120	21000	0.026
NA12-700	8.36	8.16	7.520	130529	50500	0.208	0.125	21000	0.027
NA12-750	8.96	8.75	8.060	167678	58000	0.220	0.132	30000	0.029
NA12-800	9.56	9.33	8.590	178843	66500	0.235	0.141	30000	0.032
NA12-850	10.16	9.91	9.130	190008	75000	0.250	0.150	30000	0.034
NA12-900	10.75	10.49	9.670	201173	86000	0.267	0.160	30000	0.036
NA12-950	11.34	11.06	10.200	212338	94500	0.281	0.168	30000	0.038
NA12-1000	11.94	11.65	10.730	223503	105000	0.294	0.176	30000	0.040

GENERAL NOTE:
(a) For reference, see Table III illustration on page 162.
(b) See Table 8 for dimensions *U* and *d*.

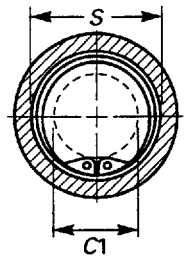
NOTES:
(1) *Safety Factors Pr and Pg:* the allowable thrust load values listed include the following safety factors: *Pr*: 4; *Pg*: 2.
(2) The *Pr* values listed apply to rings made from UNS G10600–G10900 and UNS S15700 stainless steel. *Pr* values for rings made from beryllium copper can be calculated by multiplying listed values by 0.75.

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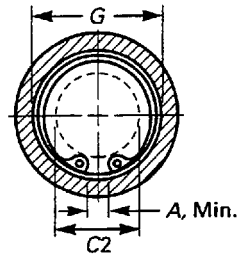
MANDATORY APPENDIX IV
BEVELED INTERNAL SERIES NA13

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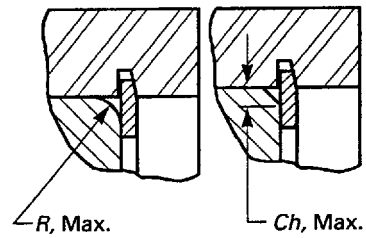
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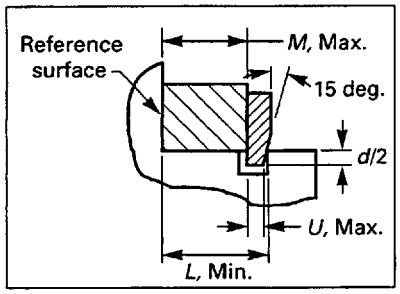
Clearance Diameter Compressed in Housing



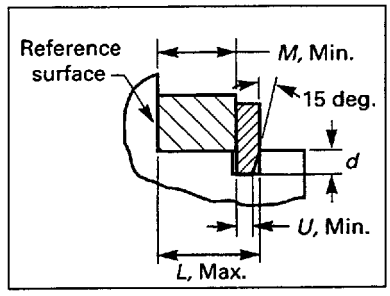
Clearance Diameter and Gap Width Released in Groove



Allowable Corner Radius and Chamfer



Minimum Insertion of a Beveled Retaining Ring



Maximum Insertion of a Beveled Retaining Ring

Computing Groove Location

The following equations determine the distance from the defined shoulder (plane of reference) to the top of the far groove wall:

L, Min. $\geq$ M, Max. + U, Max. + $d/2$ tan 15 deg. (Corresponding to minimum groove engagement:)

L, Max. $\leq$ M, Min. + U, Min. + d tan 15 deg. (Corresponding to maximum groove engagement:)

TABLE IV ILLUSTRATION

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TABLE IV NA13 BEVELED INTERNAL RETAINING RINGS

Ring Series and Size No.	Application Data								
	Clearance Diameter		Gap Width Ring in Groove	Allowable Thrust Load [Note (1)] Square Corner Abutment		Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.	End Play Take Up
	Compressed in Housing	Released in Groove		UNS G10600–G10900 and Stainless Steel Rings Used in Hardened Bores (50 HRc, Min.)	All Standard Rings Used in Low Carbon Steel Bores				
	C1	*C2*	*A*, Min.	*Pr* (lb) [Note (2)]	*Pg* (lb)	*R*, Max.	*Ch*, Max.	*P'r* (lb)	in.
NA13-100	0.665	0.70	0.145	6039	1600	0.042	0.034	1650	0.005
NA13-102	0.69	0.725	0.150	6141	1700	0.042	0.034	1650	0.005
NA13-106	0.685	0.72	0.143	7562	1700	0.044	0.035	2400	0.005
NA13-112	0.745	0.78	0.157	8019	1900	0.047	0.036	2400	0.005
NA13-118	0.79	0.83	0.150	8526	2100	0.047	0.036	2400	0.0055
NA13-118	0.80	0.835	0.169	8526	2100	0.047	0.036	2400	0.0055
NA13-125	0.875	0.92	0.184	8932	2400	0.048	0.038	2400	0.006
NA13-125	0.885	0.93	0.209	8932	2400	0.048	0.038	2400	0.006
NA13-131	0.93	0.97	0.198	9440	2650	0.048	0.038	2400	0.006
NA13-137	0.99	1.03	0.211	9846	2900	0.048	0.038	2400	0.0065
NA13-137	0.99	1.03	0.219	9846	2900	0.048	0.038	2400	0.0065
NA13-143	1.06	1.11	0.221	10353	3100	0.048	0.038	2400	0.007
NA13-145	1.08	1.13	0.226	10455	3250	0.048	0.038	2400	0.007
NA13-150	1.12	1.17	0.238	10708	3300	0.048	0.038	2400	0.007
NA13-156	1.14	1.15	0.238	13906	3600	0.064	0.050	3900	0.0075
NA13-156	1.15	1.16	0.275	13906	3600	0.064	0.050	3900	0.0075
NA13-162	1.15	1.22	0.242	14413	4000	0.064	0.050	3900	0.008
NA13-165	1.17	1.22	0.248	14718	4200	0.064	0.050	3900	0.008
NA13-168	1.21	1.29	0.255	15022	4300	0.064	0.050	3900	0.008
NA13-175	1.26	1.31	0.267	15580	4700	0.064	0.050	3900	0.0085
NA13-181	1.32	1.38	0.277	16139	5050	0.064	0.050	3900	0.009
NA13-185	1.36	1.42	0.284	16443	5200	0.064	0.050	3900	0.009
NA13-187	1.39	1.44	0.310	16697	5400	0.064	0.050	3900	0.009
NA13-193	1.45	1.51	0.328	17255	5900	0.064	0.050	3900	0.0095
NA13-200	1.50	1.57	0.332	17763	6100	0.064	0.050	3900	0.0095
NA13-206	1.52	1.59	0.311	23091	6500	0.076	0.061	6200	0.0095
NA13-206	1.54	1.61	0.349	23091	6500	0.078	0.062	6200	0.0095
NA13-212	1.58	1.65	0.345	23751	7000	0.078	0.062	6200	0.010
NA13-218	1.61	1.69	0.323	24462	7450	0.078	0.062	6200	0.010
NA13-218	1.64	1.72	0.373	24462	7450	0.078	0.062	6200	0.010
NA13-225	1.69	1.77	0.368	25223	8050	0.078	0.062	6200	0.0105
NA13-231	1.75	1.82	0.362	25832	8400	0.078	0.062	6200	0.011
NA13-237	1.81	1.89	0.374	26542	8900	0.078	0.062	6200	0.0115
NA13-244	1.86	1.94	0.386	27304	9100	0.078	0.062	6200	0.012
NA13-250	1.91	2.00	0.398	28014	9600	0.078	0.062	6200	0.012
NA13-250	1.94	2.03	0.460	28014	9600	0.078	0.062	6200	0.0125
NA13-256	1.95	2.04	0.400	34206	10200	0.088	0.070	9000	0.0125
NA13-262	2.02	2.11	0.418	35068	10800	0.088	0.070	9000	0.013
NA13-268	2.05	2.15	0.393	35931	11300	0.090	0.072	9000	0.013
NA13-268	2.06	2.16	0.423	35931	11300	0.090	0.072	9000	0.013
NA13-275	2.12	2.21	0.442	36642	11800	0.092	0.074	9000	0.014
NA13-281	2.18	2.27	0.459	37504	12200	0.088	0.070	9000	0.014
NA13-281	2.21	2.31	0.512	37504	12200	0.088	0.070	9000	0.014
NA13-287	2.22	2.32	0.451	38367	12600	0.092	0.074	9000	0.014
NA13-300	2.30	2.41	0.449	40093	14200	0.092	0.074	9000	0.015
NA13-300	2.35	2.46	0.568	40093	14200	0.092	0.074	9000	0.015
NA13-306	2.41	2.51	0.473	47807	14800	0.097	0.078	12000	0.015
NA13-312	2.47	2.58	0.469	48822	15200	0.099	0.079	12000	0.0155
NA13-315	2.49	2.60	0.462	49329	15500	0.100	0.080	12000	0.0155

(continued)

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TABLE IV NA13 BEVELED INTERNAL RETAINING RINGS (CONT'D)

Ring Series and Size No.	Application Data								
	Clearance Diameter		Gap Width Ring in Groove	Allowable Thrust Load [Note (1)] Square Corner Abutment		Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.	End Play Take Up
	Compressed in Housing	Released in Groove		UNS G10600–G10900 and Stainless Steel Rings Used in Hardened Bores (50 HRc, Min.)	All Standard Rings Used in Low Carbon Steel Bores				
	C1	*C2*	*A*, Min.	*Pr* (lb) [Note (2)]	*Pg* (lb)	*R*, Max.	*Ch*, Max.	*P'r* (lb)	in.
NA13-315	2.50	2.61	0.481	49329	15500	0.100	0.080	12000	0.0155
NA13-325	2.54	2.65	0.509	50750	16400	0.104	0.083	12000	0.016
NA13-334	2.63	2.74	0.514	52374	17300	0.108	0.086	12000	0.0165
NA13-347	2.76	2.88	0.571	54201	18800	0.108	0.086	12000	0.017
NA13-350	2.79	2.91	0.574	54709	19300	0.110	0.088	12000	0.017
NA13-354	2.83	2.95	0.586	55419	19800	0.110	0.088	12000	0.0175
NA13-354	2.85	2.97	0.643	55419	19800	0.110	0.088	12000	0.018
NA13-362	2.91	3.03	0.639	56739	21100	0.116	0.093	12000	0.018
NA13-375	3.02	3.15	0.647	58566	23100	0.120	0.096	12000	0.0195
NA13-375	3.03	3.17	0.674	58566	23100	0.120	0.096	12000	0.0195
NA13-387	3.11	3.25	0.680	60494	24300	0.123	0.098	12000	0.020
NA13-393	3.17	3.31	0.687	61611	24900	0.124	0.099	12000	0.020
NA13-400	3.23	3.37	0.694	62626	25600	0.128	0.102	12000	0.020
NA13-412	3.36	3.51	0.718	64554	26900	0.130	0.104	12000	0.021
NA13-425	3.48	3.63	0.743	66483	28100	0.138	0.110	12000	0.021
NA13-433	3.50	3.65	0.803	67599	29000	0.142	0.114	12000	0.021
NA13-450	3.66	3.81	0.787	70340	30900	0.146	0.117	12000	0.022
NA13-462	3.79	3.95	0.822	72370	32400	0.151	0.121	12000	0.022
NA13-475	3.88	4.04	0.773	74298	33800	0.154	0.123	12000	0.023
NA13-475	3.90	4.06	0.843	74298	33800	0.154	0.123	12000	0.023
NA13-500	4.08	4.25	0.753	78155	38700	0.158	0.126	12000	0.023
NA13-525	4.31	4.48	0.886	94091	40300	0.168	0.134	15000	0.024
NA13-537	4.41	4.58	0.893	96324	41500	0.168	0.134	15000	0.024
NA13-550	4.53	4.70	0.879	98658	42500	0.168	0.134	15000	0.024
NA13-575	4.78	4.96	0.905	103124	45100	0.168	0.134	15000	0.025
NA13-600	5.03	5.21	0.929	107489	47600	0.168	0.134	15000	0.025
NA13-625	5.24	5.43	0.956	139766	52000	0.177	0.142	23000	0.026
NA13-650	5.49	5.68	1.040	145450	56200	0.181	0.145	23000	0.027
NA13-662	5.60	5.80	1.063	148190	58400	0.183	0.146	23000	0.028
NA13-675	5.65	5.85	0.985	151032	60700	0.188	0.150	23000	0.028
NA13-700	5.88	6.09	1.037	156615	65300	0.196	0.157	23000	0.029
NA13-725	6.08	6.30	1.085	194373	70400	0.202	0.162	34000	0.031
NA13-750	6.33	6.56	1.138	201173	75400	0.208	0.166	34000	0.032
NA13-775	6.58	6.82	1.178	207872	80500	0.214	0.171	34000	0.033
NA13-800	6.75	6.99	1.238	214571	85800	0.220	0.176	34000	0.034
NA13-825	7.00	7.25	1.269	221270	91300	0.229	0.183	34000	0.035
NA13-850	7.13	7.39	1.444	227969	97300	0.235	0.188	34000	0.036
NA13-875	7.38	7.65	1.481	233856	103200	0.241	0.193	34000	0.037
NA13-900	7.63	7.91	1.539	241367	109200	0.249	0.199	34000	0.038
NA13-925	7.88	8.16	1.559	248066	115300	0.253	0.202	34000	0.039
NA13-950	7.98	8.27	1.596	254765	122100	0.258	0.206	34000	0.041
NA13-975	8.23	8.52	1.680	261464	128600	0.263	0.210	34000	0.042
NA13-1000	8.48	8.78	1.687	268163	135300	0.270	0.216	34000	0.043

GENERAL NOTES:
(a) For reference, see Table IV illustration on page 166.
(b) See Table 9 for dimensions *U* and *D*.

NOTES:
(1) *Safety Factors Pr and Pg*: the allowable thrust load values listed include the following safety factors: *Pr*: 4; *Pg*: 2.
(2) The *Pr* values listed apply to rings made from UNS G10600–G10900 and UNS S15700 stainless steel. *Pr* values for rings made from beryllium copper can be calculated by multiplying listed values by 0.75

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NONMANDATORY APPENDIX A
TYPE NA10 REFERENCE METRIC VALUES (DIMENSIONS)

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TABLE A NA10 REFERENCE METRIC VALUES (DIMENSIONS)

Ring Series and Size No.	Shaft Diameter	Ring Size & Weight											Groove Dimensions					
		Free Diameter		Thickness [Note (1)]		Hole Diameter		Large Section (Including Lug)		Small Section		Approx. Weight per 1000 pcs.	Diameter		Width		Depth	Edge Margin
	S, mm	*D*	Tol.	*T*	Tol.	*P*	Tol.	*E*	Tol.	*J*	Tol.	kg	*G*	Tol.	*W*	Tol.	(*d*)	*Z*
NA10-50	12.7	11.71		0.89		1.07		2.03		1.04		0.45	11.89	±0.05	0.99		0.41	1.22
NA10-56	14.3	13.23		0.89		1.07		2.24	±0.10	1.09	±0.10	0.64	13.46	0.10(2)	0.99		0.41	1.22
NA10-59	15.1	13.97		0.89		1.07		2.34		1.17		0.73	14.20		0.99		0.43	1.32
NA10-62	15.9	14.71		0.89		1.07	+0.25	2.44		1.22		0.73	14.94		0.99		0.46	1.40
NA10-68	17.5	16.13		1.07		1.07	−0.05	2.64		1.32		1.14	16.41		1.17		0.53	1.60
NA10-75	19.0	17.60	+0.13	1.07		1.07		2.84		1.42		1.27	17.88	±0.08	1.17	+0.08	0.58	1.75
NA10-78	19.8	18.34	−0.25	1.07		1.07		2.95		1.45		1.41	18.62	0.10(2)	1.17	0	0.61	1.83
NA10-81	20.6	19.08		1.07		1.27		3.05	±0.13	1.52	±0.13	1.50	19.35		1.17		0.64	1.91
NA10-87	22.2	20.57		1.07		1.27		3.25		1.63		1.73	20.85		1.17		0.69	2.06
NA10-93	23.8	22.02		1.07		1.27		3.45		1.73		2.04	22.40		1.17		0.71	2.13
NA10-100	25.0	23.50		1.07	±0.05	1.27		3.66		1.83		2.18	23.52		1.17		0.74	2.21
NA10-100	25.4	23.50		1.07		1.27		3.66		1.83		2.18	23.88		1.17		0.76	2.29
NA10-106	27.0	24.94		1.27		1.98		3.73		1.85		2.81	25.35		1.42		0.81	2.44
NA10-112	28.6	26.44		1.27		1.98		3.81		1.91		3.04	26.90		1.42		0.84	2.51
NA10-118	30.2	27.89	+0.25	1.27		1.98		3.89		1.93		3.27	28.40		1.42		0.89	2.67
NA10-125	31.7	29.36	−0.38	1.27		1.98		3.99		2.01		3.45	29.87	±0.10	1.42		0.94	2.82
NA10-131	33.3	30.84		1.27		1.98	+0.38	4.09		2.03		3.72	31.29	0.13(2)	1.42		1.02	3.05
NA10-137	34.9	32.31		1.27		1.98	−0.05	4.19		2.08		3.81	32.79		1.42		1.07	3.20
NA10-143	36.5	33.86		1.27		1.98		4.29		2.16		4.13	34.29		1.42		1.12	3.35
NA10-150	38.1	35.23		1.27		1.98		4.39		2.18		4.45	35.71		1.42		1.19	3.58
NA10-156	39.7	36.73		1.57		1.98		4.52		2.26		5.86	37.29		1.73	+0.10	1.19	3.58
NA10-162	41.3	38.18		1.57		1.98		4.65		2.34		6.08	38.84		1.73	0	1.22	3.66
NA10-177	44.4	41.58		1.57		1.98		4.98	±0.15	2.49	±0.15	7.31	41.91		1.73		1.27	3.81
NA10-177	45.0	41.58	+0.33	1.57		1.98		4.98		2.49		7.31	42.39	±0.13	1.73		1.30	3.89
NA10-181	46.0	42.55	−0.51	1.57		1.98		5.05		2.54		7.85	43.38	0.13(2)	1.73		1.32	3.96
NA10-196	50.0	46.20		1.57	±0.08	1.98		5.38		2.69		9.31	47.17		1.73		1.42	4.27
NA10-200	50.8	46.99		1.57		1.98		5.49		2.74		9.40	47.90		1.73		1.45	4.34
NA10-215	54.0	50.62		1.98		3.05		5.82		2.97		13.62	50.88		2.18		1.55	4.65
NA10-215	54.8	50.62	+0.38	1.98		3.05		5.82	±0.18	2.97	±0.18	13.62	51.61		2.18		1.57	4.72
NA10-250	63.5	58.75	−0.63	1.98		3.05		6.58		3.30		19.75	59.94		2.18		1.78	5.33
NA10-275	69.8	64.59		2.36		3.05		7.11		3.56		26.29	66.09	±0.15	2.62	+0.13	1.88	5.64
NA10-287	73.0	67.54		2.36		3.05		7.37		3.68		29.28	69.11	0.15(2)	2.62	0	1.96	5.87
NA10-315	80.2	74.17	+0.51	2.36		3.05		8.03		4.04		34.96	75.84		2.62		2.16	6.48
NA10-325	82.5	76.35	−0.76	2.36		3.05		8.23	±0.20	4.11	±0.20	35.19	78.13		2.62		2.21	6.63
NA10-350	88.9	82.22		2.77		3.18		8.76		4.39		48.58	84.23		3.05		2.34	7.01
NA10-393	100.0	92.51		2.77		3.18		9.35		4.65		55.84	94.84		3.05		2.59	7.77

GENERAL NOTE: See Table 6 for illustrations.

NOTES:

(1) For plated rings, add 0.05 mm to the listed maxium ring thickness except that maximum thickness after plating will be a minimum of 0.005 mm less than the listed groove width (*W*) minimum.

(2) *F.I.M. (Full Indicator Movement)*: maximum allowable run out of groove diameter to shaft.

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NONMANDATORY APPENDIX B
TYPE NA10 REFERENCE METRIC VALUES
(SUPPLEMENTARY INFORMATION)

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TABLE B NA10 REFERENCE METRIC VALUES (SUPPLEMENTARY INFORMATION)

Ring Series and Size No.	Application Data								
	Clearance Diameter		Gaging Diameter	Allowable Thrust Load [Note (1)] Square Corner Abutment		Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.	Limits Standard Material
	Expanded Over Shaft	Released in Groove	For Checking Ring Seated in Groove	UNS G10600–G10900 and Stainless Steel Rings Used on Hardened Shafts (50 HRc, Min.)	All Standard Rings Used on Low Carbon Steel Shafts				
	*C*1	*C*2	*K*, Max.	*Pr* (kN) [Note (2)]	*Pg* (kN)	*R*, Max.	*Ch*, Max.	*P'r* (kN)	RPM
NA10-50	17.02	16.38	16.26	4.97	1.25	1.30	0.81	3.02	40000
NA10-56	19.05	18.29	18.16	5.64	1.42	1.45	0.91	3.02	35000
NA10-59	20.07	19.30	19.05	5.87	1.65	1.50	0.94	3.02	32000
NA10-62	21.08	20.32	20.07	6.32	1.78	1.57	0.99	3.02	30000
NA10-68	23.11	22.10	22.10	10.39	2.22	1.68	1.07	4.45	28000
NA10-75	25.15	24.13	24.00	11.29	2.67	1.80	1.14	4.45	26500
NA10-78	26.42	25.40	24.89	11.74	2.89	1.85	1.17	4.45	25500
NA10-81	27.43	26.16	25.91	11.97	3.11	1.93	1.22	4.45	24500
NA10-87	29.21	27.94	27.81	12.87	3.78	2.03	1.30	4.45	23000
NA10-93	31.24	29.97	29.72	14.00	4.00	2.18	1.37	4.45	21500
NA10-100	33.02	31.75	31.50	14.90	4.45	2.31	1.45	4.45	20000
NA10-100	33.27	32.00	31.75	14.90	4.67	2.31	1.45	4.45	20000
NA10-106	35.05	33.53	33.27	18.73	5.34	2.34	1.47	6.49	19000
NA10-112	36.83	35.31	35.05	19.86	5.78	2.36	1.50	6.49	18800
NA10-118	38.61	37.08	36.83	20.99	6.45	2.39	1.50	6.49	18000
NA10-125	40.39	38.61	38.61	22.12	7.12	2.44	1.52	6.49	17000
NA10-131	42.16	40.13	40.13	23.25	8.23	2.46	1.55	6.49	16500
NA10-137	43.94	41.91	41.91	24.38	9.12	2.49	1.55	6.49	16000
NA10-143	45.72	43.69	43.56	25.51	9.79	2.54	1.60	6.49	15000
NA10-150	47.50	45.21	45.09	26.41	11.12	2.54	1.60	6.49	14800
NA10-156	49.53	47.24	46.99	34.31	11.56	2.64	1.68	10.01	14000
NA10-162	51.31	49.02	48.77	35.67	12.23	2.74	1.70	10.01	13200
NA10-177	55.37	52.83	52.58	38.38	13.79	2.95	1.85	10.01	11700
NA10-177	55.88	53.34	53.09	38.38	14.23	2.95	1.85	10.01	11700
NA10-181	56.90	54.36	54.10	39.96	14.68	2.97	1.88	10.01	11500
NA10-196	61.72	58.93	58.67	43.11	17.35	3.15	1.98	10.01	10500
NA10-200	62.74	59.94	59.69	44.02	17.79	3.23	2.03	10.01	10000
NA10-215	66.55	63.50	63.25	58.69	20.24	3.38	2.13	16.68	9400
NA10-215	67.31	64.26	64.01	58.69	20.91	3.38	2.13	16.68	9400
NA10-250	77.47	74.17	73.91	69.08	27.58	3.84	2.41	16.68	8400
NA10-275	84.84	81.28	81.03	90.75	32.03	4.19	2.62	24.46	7600
NA10-287	88.65	84.84	84.58	94.81	34.69	4.32	2.72	24.46	7300
NA10-315	97.03	92.96	92.71	104.29	41.81	4.70	2.95	24.46	6500
NA10-325	99.82	95.50	95.25	107.00	44.48	4.83	3.00	24.46	6400
NA10-350	107.19	102.62	102.36	134.99	51.15	5.13	3.23	34.92	5900
NA10-393	119.63	114.55	114.30	152.15	62.27	5.38	3.38	34.92	5200

GENERAL NOTE: See Mandatory Appendix I for illustrations.

NOTES:

(1) *Safety Factors Pr and Pg*: the allowable thrust load values listed include the following safety factors: *Pr*: 4 *Pg*: 2.

(2) *Pr* values listed apply to rings made from UNS G10600–G10900 and UNS S15700 stainless steel. *Pr* values for rings made from beryllium copper can be calculated by multiplying listed values by 0.75.

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NONMANDATORY APPENDIX C
TYPE NA11 REFERENCE METRIC VALUES (DIMENSIONS)

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TABLE C NA11 REFERENCE METRIC VALUES (DIMENSIONS)

Ring Series and Size No.	Housing Diameter	Ring Size & Weight										Diameter		Width		Depth	Edge Margin
		Free Diameter		Thickness [Note (1)]		Hole Diameter		Large Section (Including Lug)		Small Section		Approx. Weight per 1000 Pieces					
	S, mm	*D*	Tol.	*T*	Tol.	*P*	Tol.	*E*	Tol.	*J*	Tol.	kg	*G*	Tol.	*W*	Tol.	(*d*)	*Z*
NA11-62	15.9	17.15		0.64		0.76		1.83	±0.10	0.91	±0.10	0.32	16.89	±0.05	0.74		0.51	1.52
NA11-75	19.0	20.52		0.89		1.07		2.16		1.07		0.59	20.22	0.10(2)	0.99		0.58	1.75
NA11-81	20.6	22.28	+0.25	1.07		1.07		2.34		1.12		0.91	21.89		1.17	+0.08	0.64	1.91
NA11-87	22.2	23.98	−0.13	1.07		1.07		2.51		1.19		1.00	23.65	±0.08	1.17	0	0.71	2.13
NA11-93	23.8	25.78		1.07		1.07	+0.25	2.69	±0.13	1.30	±0.13	1.27	25.40	0.10(2)	1.17		0.79	2.36
NA11-100	25.4	27.46		1.07		1.07	−0.05	2.87		1.37		1.32	27.08		1.17		0.84	2.51
NA11-106	27.0	29.21		1.27		1.27		3.05		1.45		1.73	28.70		1.42		0.86	2.59
NA11-112	28.6	30.91		1.27		1.27		3.12		1.50		2.00	30.40		1.42		0.91	2.74
NA11-118	30.2	32.59	+0.38	1.27	±0.05	1.27		3.20		1.52		2.22	32.05		1.42		0.94	2.82
NA11-125	31.7	34.32	−0.25	1.27		1.27		3.28	±0.15	1.55	±0.15	2.27	33.78	±0.10	1.42		1.02	3.05
NA11-131	33.3	36.02		1.27		1.27		3.35		1.60		2.41	35.46	0.13(2)	1.42		1.07	3.20
NA11-137	34.9	37.74		1.27		1.27		3.43		1.65		2.68	37.11		1.42	+0.10	1.09	3.28
NA11-143	36.5	39.42		1.27		1.93		3.66		1.75		2.86	38.81		1.42	0	1.14	3.43
NA11-150	38.1	41.20		1.27		1.93		3.76		1.78		3.09	40.49		1.42		1.19	3.58
NA11-156	39.7	42.88		1.57		1.93		4.01		1.88		4.04	42.11		1.73		1.22	3.66
NA11-162	41.3	44.60		1.57		1.93		4.11		1.96		4.72	43.82		1.73		1.27	3.81
NA11-168	42.9	46.30	+0.51	1.57		1.93		4.22		2.01		5.40	45.52	±0.13	1.73		1.32	3.96
NA11-175	44.4	48.03	−0.33	1.57		1.93		4.32		2.08		5.36	47.19	0.13(2)	1.73		1.37	4.11
NA11-187	47.6	51.44		1.57		1.93		4.78		2.29		6.72	50.52		1.73		1.45	4.34
NA11-200	50.8	54.86		1.57	±0.08	1.93	+0.38	5.28	±0.18	2.54	±0.18	7.90	53.90		1.73		1.55	4.65
NA11-206	52.4	56.49		1.98		2.39	+0.05	5.54		2.69		10.53	55.52		2.18		1.57	4.72
NA11-212	54.0	58.29		1.98		2.39		5.66		2.74		11.03	57.18	±0.15	2.18	+0.13	1.60	4.80
NA11-237	60.3	65.20	+0.64	1.98		2.39		6.17		2.92		12.98	63.93	0.15(2)	2.18	0	1.80	5.41
NA11-243	61.9	66.90	−0.38	1.98		2.39		6.30		2.97		13.89	65.63		2.18		1.83	5.49
NA11-250	63.5	68.58		1.98		2.39		6.45		3.05		14.57	67.26		2.18		1.88	5.64
NA11-262	66.7	72.14		2.36		2.77		6.76		3.25		20.70	70.64		2.62		1.98	5.94
NA11-275	69.8	75.57		2.36		2.77		7.06		3.40		21.70	74.02		2.62		2.08	6.25
NA11-283	71.4	77.80		2.36		2.77		7.26		3.53		22.47	75.69		2.62		2.13	6.40
NA11-283	72.0	77.80		2.36		2.77		7.26		3.53		22.47	76.35		2.62		2.18	6.55
NA11-287	73.0	78.87	+0.76	2.36		2.77		7.37		3.53		22.75	77.50		2.62		2.24	6.71
NA11-300	76.2	82.42	−0.51	2.36		2.77		7.67		3.63		23.88	80.82		2.62		2.31	6.93
NA11-315	80.2	86.56		2.77		3.18		7.98		3.78		31.51	85.04		3.05		2.44	7.32
NA11-325	82.5	89.13		2.77		3.18		8.08		3.84		32.96	87.53		3.05		2.49	7.47
NA11-334	85.0	91.72		2.77		3.18		8.15	±0.20	3.94	±0.20	34.32	90.07		3.05		2.54	7.62
NA11-350	88.9	96.01		2.77		3.18		8.23		3.91		36.41	94.23		3.05		2.67	8.00
NA11-356	90.5	97.79		2.77		3.18		8.28		3.94		37.41	95.91		3.05		2.72	8.15
NA11-400	101.6	110.49		2.77		3.18		8.59		4.09		44.22	107.70		3.05		3.05	9.14

GENERAL NOTE: See Table 7 for illustrations.

NOTES:

(1) For plated rings, add 0.05 mm to the listed maximum thickness except that the maximum thickness after plating will be a minimum of 0.005 mm less than the listed groove width (*W*) minimum.

(2) *F.I.M. (Full Indicator Movement)*: maximum allowable run out of groove diameter to housing.

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NONMANDATORY APPENDIX D
TYPE NA11 REFERENCE METRIC VALUES
(SUPPLEMENTARY INFORMATION)

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TABLE D NA11 REFERENCE METRIC VALUES (SUPPLEMENTARY INFORMATION)

Ring Series and Size No.	Application Data							
	Clearance Diameter		Gap Width Ring in Groove	Allowable Thrust Load [Note (1)] Square Corner Abutment		Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.
	Compressed in Housing	Released in Groove		UNS G10600–G10900 and Stainless Steel Rings Used in Hardened Bores (50 HRc, Min.)	All Standard Rings Used in Low Carbon Steel Bores			
	C1	*C2*	*A*, Min.	*Pr* (kN) [Note (2)]	*Pg* (kN)	*R*, Max.	*Ch*, Max.	*P'r* (kN)
NA11-62	11.94	12.95	4.06	4.51	2.00	1.07	0.71	1.78
NA11-75	14.22	15.37	4.19	7.45	2.67	1.27	0.79	3.78
NA11-81	15.75	16.89	4.57	11.74	3.11	1.37	0.86	5.56
NA11-87	16.51	17.91	4.83	12.87	3.78	1.45	0.91	5.56
NA11-93	17.78	19.18	5.59	14.00	4.45	1.52	0.97	5.56
NA11-100	19.05	20.57	5.97	14.90	5.12	1.63	1.02	5.56
NA11-106	20.32	22.10	5.59	18.73	5.56	1.75	1.09	8.01
NA11-112	21.84	23.62	6.22	19.86	6.23	1.78	1.12	8.01
NA11-118	23.11	24.89	6.60	20.99	7.12	1.80	1.14	8.01
NA11-125	24.64	26.67	7.11	22.12	7.78	1.80	1.14	8.01
NA11-131	25.91	27.94	7.37	23.25	8.67	1.83	1.14	8.01
NA11-137	27.43	29.46	8.38	24.38	9.34	1.88	1.17	8.01
NA11-143	28.70	30.99	8.89	25.51	10.23	2.01	1.27	8.01
NA11-150	29.97	32.26	8.38	26.41	11.12	2.06	1.30	8.01
NA11-156	30.73	33.02	9.14	34.31	11.79	2.24	1.40	12.90
NA11-162	32.26	34.80	9.78	35.67	12.68	2.29	1.42	12.90
NA11-168	33.53	36.07	10.29	37.25	13.79	2.31	1.45	12.90
NA11-175	35.05	37.85	10.67	38.60	14.68	2.36	1.47	12.90
NA11-187	37.34	40.13	11.18	41.31	16.68	2.67	1.68	12.90
NA11-200	39.37	42.42	12.19	44.02	19.13	3.00	1.88	12.90
NA11-206	40.39	43.43	12.32	57.11	20.02	3.18	1.98	20.46
NA11-212	41.91	44.96	12.45	58.92	20.91	3.25	2.03	20.46
NA11-237	47.24	50.80	13.97	65.47	26.24	3.51	2.18	20.46
NA11-243	48.51	52.07	14.48	67.27	27.58	3.58	2.24	20.46
NA11-250	49.78	53.34	14.99	69.08	28.91	3.66	2.29	20.46
NA11-262	52.32	56.13	15.24	86.68	32.03	3.81	2.39	29.80
NA11-275	54.86	58.93	16.00	90.29	35.14	3.99	2.49	29.80
NA11-283	56.13	60.20	15.49	92.55	36.92	4.11	2.59	29.80
NA11-283	56.64	60.71	17.02	92.55	38.03	4.11	2.59	29.80
NA11-287	57.40	61.72	17.02	94.81	39.59	4.11	2.57	29.80
NA11-300	59.94	64.26	17.91	98.87	42.70	4.29	2.69	29.80
NA11-315	63.50	68.33	19.30	121.90	47.15	4.42	2.77	40.03
NA11-325	65.53	70.36	19.56	125.51	49.82	4.47	2.79	40.03
NA11-334	67.82	72.90	20.57	129.12	52.04	4.50	2.82	40.03
NA11-350	71.63	76.96	21.34	134.99	57.38	4.45	2.79	40.03
NA11-356	73.15	78.49	21.84	137.70	59.60	4.45	2.79	40.03
NA11-400	83.57	89.66	23.62	154.40	75.17	4.42	2.74	40.03

GENERAL NOTE: See Mandatory Appendix II for illustrations.

NOTES:

(1) *Safety Factors for Pr and Pg*: The allowable thrust load values include the following safety factors: *Pr*: 4 *Pg*: 2.

(2) *Pr* values listed apply to rings made from UNS G10600–G10900 and UNS S15700 stainless steel. *Pr* values for rings made from beryllium copper can be calculated by multiplying listed values by 0.75.

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NONMANDATORY APPENDIX E
TYPE NA12 REFERENCE METRIC VALUES (DIMENSIONS)

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TABLE E NA12 REFERENCE METRIC VALUES (DIMENSIONS)

Ring Series and Size No.	Shaft Diameter	Ring Size and Weight														Groove Dimensions					
		Free Diameter		Thickness [Note (1)]		Thickness Beveled End [Note (1)]		Hole Diameter		Lug Height (Max.)	Large Section		Small Section		Approx. Weight per 1000 Pcs.	Diameter		Width		Depth	Edge Margin
	S, mm	*D*	Tol.	*T*	Tol.	*U*	Tol.	*P*	Tol.	*B*	*E*	Tol.	*J*	Tol.	kg	*G*	Tol.	*W*	Tol.	(*d*)	*Z*
NA12-100	25.4	23.50	+0.13	1.07		0.86		1.98		4.34	2.95	±0.13	1.65	±0.13	1.63	23.62	+0.00/-0.08	0.94		0.89	1.32
NA12-102	26.0	24.03	−0.25	1.07		0.84		1.98		4.37	3.00		1.68		1.77	24.16	0.10(2)	0.91		0.91	1.37
NA12-106	27.0	24.94		1.27		1.04		1.98		4.70	3.10		1.75		2.18	25.20		1.12		0.89	1.32
NA12-112	28.6	26.44		1.27		1.04		1.98		4.72	3.25		1.80		2.32	26.70		1.12		0.94	1.40
NA12-118	30.2	27.89	+0.25	1.27	±0.05	1.04	±0.03	1.98		4.72	3.35		1.83		2.54	28.14	+0.00	1.12	+0.13	1.02	1.52
NA12-125	31.7	29.36	−0.38	1.27		1.02		1.98		4.75	3.56		1.93		2.68	29.62	−0.10	1.09	0	1.07	1.60
NA12-131	33.3	30.84		1.27		0.99		1.98		4.75	3.71		1.94		3.09	31.09	0.13(2)	1.07		1.12	1.68
NA12-137	34.9	32.31		1.27		0.99		1.98		4.78	3.86		2.08		3.27	32.56		1.07		1.17	1.75
NA12-143	36.5	33.86		1.27		0.99		1.98	+0.38	4.78	4.06	±0.15	2.18	±0.15	3.68	34.11		1.07		1.19	1.78
NA12-150	38.1	35.23		1.27		0.97		3.05	−0.05	5.54	4.27		2.31		4.09	35.48		1.04		1.30	1.93
NA12-156	39.7	36.73		1.57		1.24		3.18		6.58	4.37		2.36		5.63	37.06		1.35		1.30	1.93
NA12-162	41.3	38.18		1.57		1.24		3.18		6.07	4.57		2.46		5.99	38.51		1.35		1.37	2.06
NA12-168	42.9	39.62		1.57		1.22		3.18		6.07	4.67		2.51		6.72	39.95		1.32		1.45	2.16
NA12-175	44.4	41.10	+0.33	1.57	±0.08	1.22		3.18		6.12	4.78		2.57		6.95	41.43	+0.00	1.32		1.50	2.24
NA12-177	45.0	41.58	−0.51	1.57		1.22		3.18		6.12	4.83		2.59		6.99	41.91	−0.13	1.32		1.55	2.29
NA12-181	46.0	42.55		1.57		1.22		3.18		6.15	4.88		2.59		7.35	42.88	0.13(2)	1.32		1.57	2.36
NA12-187	47.6	44.07		1.57		1.22		3.18		6.17	4.98		2.64		7.85	44.40		1.32		1.60	2.39
NA12-196	50.0	46.20		1.57		1.19		3.18		6.76	5.08		2.69		8.17	46.53		1.30		1.73	2.59
NA12-200	50.8	46.99		1.57		1.19		3.18		6.76	5.18		2.74		8.63	47.32		1.30		1.73	2.59
NA12-206	52.4	48.41		1.98		1.57		3.18		6.88	5.28		2.82		11.35	48.79		1.70		1.78	2.67
NA12-212	54.0	49.89		1.98		1.57		3.18		7.24	5.38		2.87		11.85	50.27		1.70		1.85	2.77
NA12-215	54.8	50.62	+0.38	1.98		1.57		3.18		6.88	5.38		2.87		11.94	51.00	+0.00	1.70	+0.18	1.88	2.82
NA12-225	57.1	52.86	−0.64	1.98		1.55		3.18		6.91	5.59		2.95		12.58	53.24	−0.15	1.68	0	1.96	2.92
NA12-231	58.7	54.33		1.98		1.52	±0.04	3.18		6.91	5.64		3.00		12.71	54.71	0.15(2)	1.65		2.01	3.00
NA12-237	60.3	55.80		1.98		1.52		3.18		6.91	5.69		3.02		13.26	56.18		1.65		2.06	3.07
NA12-243	61.9	57.28		1.98		1.52		3.18		6.93	5.79		3.05		13.39	57.66		1.65		2.13	3.20
NA12-250	63.5	58.75		1.98		1.50		3.18		6.93	5.89	±0.18	3.10	±0.18	13.48	59.13		1.63		2.18	3.28
NA12-255	65.0	60.38		1.98		1.50		3.18		6.93	6.05		3.18		15.39	60.88		1.63		2.06	3.07
NA12-262	66.7	61.67		1.98		1.50		3.18		6.93	6.15		3.23		15.89	62.18		1.63		2.24	3.35
NA12-268	68.3	63.12		1.98		1.50		3.18		6.93	6.25		3.28		16.34	63.63		1.63		2.31	3.45
NA12-275	69.8	64.59	+0.51	2.36		1.85		3.18		8.36	6.30		3.33		21.34	65.10		2.01		2.36	3.53
NA12-287	73.0	67.54	−0.76	2.36		1.83		3.18		7.95	6.50		3.38		22.02	68.05		1.98		2.49	3.73
NA12-293	74.6	69.01		2.36		1.83	±0.05	3.18		7.95	6.60		3.45		22.70	69.52		1.98		2.54	3.81
NA12-300	76.2	70.49		2.36		1.80		3.18		6.83	6.71		3.51		23.61	70.99		1.96		2.59	3.89
NA12-306	77.8	71.93		2.36		1.80		3.18		6.53	6.40		3.33		21.34	72.44		1.96		2.67	3.99

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TABLE E NA12 REFERENCE METRIC VALUES (DIMENSIONS) (CONT'D)

Ring Series and Size No.	Shaft Diameter	Ring Size and Weight													Groove Dimensions					
		Free Diameter		Thickness [Note (1)]		Thickness Beveled End [Note (1)]		Hole Diameter		Lug Height (Max.)	Large Section		Small Section		Approx. Weight per 1000 Pcs.	Diameter		Width		Depth	Edge Margin
	S, mm	*D*	Tol.	*T*	Tol.	*U*	Tol.	*P*	Tol.	*B*	*E*	Tol.	*J*	Tol.	kg	*G*	Tol.	*W*	Tol.	(*d*)	*Z*
NA12-312	79.4	73.46		2.36		1.78		3.18		7.95	6.91		3.58		26.33	73.96		1.93		2.69	4.04
NA12-315	80.2	74.17		2.36		1.78		3.18		7.95	6.96		3.63		26.79	74.68	+0.00	1.93	+0.18	2.74	4.11
NA12-325	82.5	76.35		2.36		1.78	±0.05	3.18		7.95	7.11		3.68		28.15	76.86	−0.15	1.93	0	2.84	4.27
NA12-334	85.0	78.54	+0.51	2.36		1.75		3.18		7.95	7.26		3.73		29.06	79.04	0.15(2)	1.91		2.97	4.45
NA12-343	87.3	80.75	−0.76	2.36		1.75		3.18	+0.38	7.95	7.42	±0.20	3.76	±0.20	29.96	81.25		1.91		3.02	4.52
NA12-350	88.9	82.22		2.77		2.13		3.18	−0.05	7.37	7.24		3.76		32.69	82.73		2.31		3.07	4.60
NA12-354	90.0	83.24		2.77		2.13		3.18		8.46	7.32		3.78		33.14	83.74		2.31		3.12	4.67
NA12-362	92.1	85.14		2.77		2.11		3.18		8.46	7.52		3.89		34.50	85.65		2.29		3.20	4.80
NA12-368	93.7	86.61		2.77		2.11		3.18		8.51	7.67		3.96		36.32	87.12		2.29		3.28	4.90
NA12-375	95.2	88.09		2.77		2.08		3.18		8.56	7.87		4.06		37.68	88.60		2.26		3.33	4.98
NA12-387	98.4	91.03		2.77		2.08		3.18		8.51	8.08		4.14		39.95	91.54		2.26		3.43	5.13
NA12-393	100.0	92.51		2.77	±0.08	2.06	±0.06	3.18		8.81	8.08		4.14		43.13	93.01		2.24	+0.20	3.51	5.26
NA12-400	101.6	93.98		2.77		2.06		3.18		9.07	8.08		4.14		45.85	94.49		2.24	0	3.56	5.33
NA12-425	108.0	101.32		2.77		2.21		3.18		10.24	8.08		4.47		50.85	101.83		2.39		3.05	4.57
NA12-437	111.1	104.29		2.77		2.21		3.18		10.24	8.08		4.60		52.21	104.80		2.39		3.15	4.72
NA12-450	114.3	107.26		2.77		2.21		3.18		10.46	10.29		4.70		59.93	107.77		2.39		3.25	4.88
NA12-475	120.6	113.23		2.77		2.16		3.18		11.10	7.70		3.45		51.30	113.74		2.34		3.45	5.18
NA12-500	127.0	119.18		2.77		2.13		3.96		11.63	9.14	±0.25	4.93	±0.25	67.65	119.68		2.31		3.66	5.49
NA12-525	133.3	125.15		3.18		2.49		3.96		12.19	9.45		5.36		86.26	125.65	+0.00	2.67		3.84	5.74
NA12-550	139.7	131.11	+0.51	3.18	±0.10	2.46		3.96		12.83	9.91		5.31		91.25	131.62	−0.18	2.64		4.04	6.05
NA12-575	146.0	137.06	−1.02	3.18		2.44		3.96		13.36	10.36		5.59		90.35	137.57	0.15(2)	2.62		4.24	6.35
NA12-600	152.4	143.03		3.18		2.41		3.96		13.92	9.68		4.34		95.34	143.54		2.59		4.42	6.63
NA12-625	158.7	149.00		3.96		3.15		3.96	+0.51	14.55	10.06		4.47		128.03	149.50		3.35		4.62	6.93
NA12-650	165.1	154.94	+0.51	3.96		3.12		3.96	−0.13	15.19	11.13		5.99		149.82	155.45		3.33		4.83	7.24
NA12-675	171.4	160.91	−1.27	3.96		3.10	±0.08	4.75		15.75	11.58		6.25		161.62	161.42		3.30	+0.25	5.00	7.49
NA12-700	177.8	166.88		3.96		3.07		4.75		13.77	12.04		6.50		176.15	167.39		3.28	0	5.21	7.80
NA12-750	190.5	178.79		4.75		3.78		4.75		17.48	12.88	±0.38	7.04	±0.38	242.44	179.30		4.01		5.59	8.38
NA12-800	203.2	190.70		4.75	±0.13	3.76		4.75		18.97	13.72		7.47		285.11	191.21	+0.00	3.99		5.99	8.99
NA12-850	215.9	202.62	+0.51	4.75		3.68		4.75		18.97	14.55		7.98		317.80	203.12	−0.20	3.91		6.38	9.55
NA12-900	228.6	214.50	−1.52	4.75		3.66		4.75		18.97	15.47		8.46		343.68	215.01	0.15(2)	3.89		6.78	10.16
NA12-950	241.3	226.44		4.75		3.58		4.75		18.97	16.31		8.89		372.28	226.95		3.81		7.16	10.74
NA12-1000	254.0	238.38		4.75		3.53		4.75		18.97	17.15		9.32		437.66	238.89		3.76		7.54	11.30

GENERAL NOTE: See Table 8 for illustrations.

NOTES:
(1) For plated rings, add 0.05 mm to the listed maximum thickness (*T*) and beveled end thickness (*U*) values.
(2) *F.I.M. (Full Indicator Movement)*: maximum allowable run out of groove to shaft.

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NONMANDATORY APPENDIX F
TYPE NA12 REFERENCE METRIC VALUES
(SUPPLEMENTARY INFORMATION)

TABLE F NA12 REFERENCE METRIC VALUES (SUPPLEMENTARY INFORMATION)

Ring Series and Size No.	Application Data								
	Clearance Diameter		Gaging Diameter Ring Installed in Groove	Allowable Thrust Load [Note (1)] Square Corner Abutment		Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.	End Play Take Up
	Expanded Over Shaft	Released in Groove		UNS G10600–G10900 and Stainless Steel Rings Used on Hardened Shafts (50 HRc, Min.)	All Standard Rings Used on Low Carbon Steel Shafts				
	C1	*C2*	*K*, Max.	*Pr* (kN) [Note (2)]	*Pg* (kN)	*R*, Max.	*Ch*, Max.	*P'r* (kN)	mm
NA12-100	35.81	35.05	29.06	22.35	5.34	1.45	0.86	5.96	0.13
NA12-102	36.32	35.56	29.72	22.80	5.78	1.47	0.89	5.96	0.13
NA12-106	38.10	37.34	30.91	27.99	5.78	1.52	0.91	8.67	0.13
NA12-112	39.37	38.61	32.66	29.80	6.45	1.60	0.97	8.67	0.13
NA12-118	40.89	39.88	34.32	31.60	7.34	1.63	0.98	8.67	0.13
NA12-125	42.93	41.91	36.17	33.18	8.23	1.73	1.04	8.67	0.14
NA12-131	44.45	43.43	37.85	34.99	8.90	1.73	1.04	8.67	0.15
NA12-137	45.72	44.70	39.67	36.57	10.01	1.83	1.09	8.67	0.15
NA12-143	47.50	46.48	41.55	38.38	10.90	1.93	1.14	8.67	0.15
NA12-150	50.55	49.53	43.33	39.73	12.01	2.01	1.19	8.67	0.18
NA12-156	53.34	52.07	45.16	51.47	12.90	2.08	1.24	13.34	0.18
NA12-162	55.12	54.10	46.96	53.50	13.79	2.21	1.32	13.34	0.19
NA12-168	56.90	55.88	48.56	55.76	15.12	2.29	1.37	13.34	0.19
NA12-175	58.67	57.40	50.32	57.79	16.24	2.31	1.37	13.34	0.20
NA12-177	59.18	57.91	50.90	58.46	16.68	2.34	1.40	13.34	0.20
NA12-181	60.45	59.18	51.99	59.82	17.57	2.34	1.40	13.34	0.20
NA12-187	61.98	60.71	53.70	61.85	18.68	2.39	1.42	13.34	0.22
NA12-196	64.52	62.99	56.11	64.79	20.91	2.39	1.42	13.34	0.23
NA12-200	64.77	63.25	57.05	65.91	21.35	2.44	1.45	13.34	0.23
NA12-206	68.07	66.55	58.80	85.55	22.68	2.49	1.50	22.24	0.24
NA12-212	69.85	68.07	60.60	88.04	24.24	2.49	1.50	22.24	0.25
NA12-215	70.61	68.83	61.21	89.39	24.91	2.46	1.47	22.24	0.25
NA12-225	72.90	71.12	63.83	93.46	27.13	2.54	1.52	22.24	0.25
NA12-231	74.68	72.90	65.46	95.71	28.02	2.54	1.52	22.24	0.27
NA12-237	76.45	74.68	67.06	98.42	30.25	2.54	1.52	22.24	0.28
NA12-243	77.98	76.20	68.73	101.13	31.58	2.59	1.55	22.24	0.28
NA12-250	79.25	77.22	70.41	103.84	33.36	2.64	1.57	22.24	0.29
NA12-255	80.77	78.74	72.26	106.10	32.47	2.74	1.65	22.24	0.28
NA12-262	82.55	80.52	73.91	108.81	36.47	2.78	1.68	22.24	0.29
NA12-268	84.33	82.30	75.57	111.52	38.25	2.83	1.70	22.24	0.30
NA12-275	87.63	85.60	77.24	135.90	40.03	2.84	1.70	32.69	0.30
NA12-287	90.68	88.39	80.57	142.22	44.04	2.92	1.75	32.69	0.33
NA12-293	92.46	90.17	82.27	145.37	45.81	2.95	1.78	32.69	0.34
NA12-300	93.73	91.19	83.97	148.54	47.59	2.97	1.78	32.69	0.34
NA12-306	95.00	92.46	85.01	151.25	49.82	2.72	1.63	32.69	0.36

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TABLE F NA12 REFERENCE METRIC VALUES (CONT'D) (SUPPLEMENTARY INFORMATION)

Ring Series and Size No.	Application Data								
	Clearance Diameter		Gaging Diameter Ring Installed in Groove	Allowable Thrust Load [Note (1)] Square Corner Abutment		Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.	End Play Take Up
	Expanded Over Shaft	Released in Groove		UNS G10600–G10900 and Stainless Steel Rings Used on Hardened Shafts (50 HRc, Min.)	All Standard Rings Used on Low Carbon Steel Shafts				
	*C*1	*C*2	*K*, Max.	*Pr* (kN) [Note (2)]	*Pg* (kN)	*R*, Max.	*Ch*, Max.	*P'r* (kN)	mm
NA12-312	97.03	94.74	87.35	154.86	52.04	3.05	1.83	32.69	0.36
NA12-315	97.79	95.25	88.11	156.21	52.93	3.06	1.83	32.69	0.37
NA12-325	100.33	97.79	90.70	160.72	56.49	3.12	1.88	32.69	0.38
NA12-334	102.62	100.08	93.19	165.69	60.49	3.20	1.93	32.69	0.39
NA12-343	105.16	102.36	95.68	170.21	63.61	3.28	1.96	32.69	0.41
NA12-350	107.95	105.16	97.05	202.71	65.83	3.10	1.85	46.70	0.41
NA12-354	108.97	106.17	98.20	205.42	67.61	3.12	1.88	46.70	0.42
NA12-362	111.00	107.95	100.48	210.39	72.50	3.23	1.93	46.70	0.43
NA12-368	112.52	109.47	102.26	213.55	73.39	3.29	1.98	46.70	0.43
NA12-375	114.30	111.25	104.09	217.60	76.51	3.38	2.03	46.70	0.44
NA12-387	116.84	113.54	107.42	224.38	81.40	3.48	2.08	46.70	0.46
NA12-393	119.38	116.08	108.97	228.44	84.51	3.48	2.08	46.70	0.47
NA12-400	121.41	118.11	110.49	232.06	87.18	3.43	2.06	46.70	0.48
NA12-425	129.29	126.49	117.35	246.50	80.06	3.71	2.24	46.70	0.41
NA12-437	132.59	129.54	120.40	253.73	84.51	3.71	2.24	46.70	0.43
NA12-450	136.40	133.35	124.97	260.95	89.85	2.59	1.55	46.70	0.43
NA12-475	144.02	140.72	128.52	275.40	100.97	2.92	1.75	46.70	0.46
NA12-500	151.38	148.08	137.41	289.85	112.98	4.19	2.51	46.70	0.48
NA12-525	159.26	155.45	144.02	348.99	124.54	4.29	2.57	60.05	0.51
NA12-550	166.88	163.07	150.88	356.69	137.00	4.45	2.67	60.05	0.53
NA12-575	174.24	170.18	157.73	382.40	150.34	4.67	2.79	60.05	0.56
NA12-600	181.86	177.55	162.05	398.65	164.58	3.63	2.18	60.05	0.58
NA12-625	189.48	185.17	168.91	518.29	177.92	3.76	2.26	93.4	0.61
NA12-650	199.90	195.33	177.29	539.06	193.49	4.85	2.90	93.4	0.64
NA12-675	204.72	199.90	184.40	559.83	209.06	5.08	3.05	93.4	0.66
NA12-700	212.34	207.26	191.01	580.59	224.62	5.28	3.18	93.4	0.69
NA12-750	227.58	222.25	204.72	745.83	257.98	5.59	3.35	133.4	0.74
NA12-800	242.82	236.98	218.19	795.49	295.79	5.97	3.58	133.4	0.81
NA12-850	258.06	251.71	231.90	845.16	333.60	6.35	3.81	133.4	0.86
NA12-900	273.05	266.45	245.62	894.82	382.53	6.78	4.06	133.4	0.91
NA12-950	288.04	280.92	259.08	944.48	420.34	7.14	4.27	133.4	0.97
NA12-1000	303.28	295.91	272.54	994.14	467.04	7.47	4.47	133.4	1.02

GENERAL NOTE: See Mandatory Appendix III for illustrations.

NOTES:

(1) *Safety Factors Pr and Pg*: The allowable thrust load values listed include the following safety factors: *Pr*: 4 *Pg*: 2.

(2) *Pr* values listed apply to rings made from UNS G10600–G10900 and UNS S15700 stainless steel. *Pr* values for rings made from beryllium copper can be calculated by multiplying listed values by 0.75.

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NONMANDATORY APPENDIX G
TYPE NA13 REFERENCE METRIC VALUES (DIMENSIONS)

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TABLE G NA13 REFERENCE METRIC VALUES (DIMENSIONS)

Ring Series and Size No.	Housing Diameter	Ring Size and Weight														Groove Dimensions					
		Free Diameter		Thickness [Note (1)]		Thickness Beveled End [Note (1)]		Hole Diameter		Lug Height (Max.)	Large Section		Small Section		Approx. Weight per 1000 Pcs.	Diameter		Width		Depth	Edge Margin
	S, mm	*D*	Tol.	*T*	Tol.	*U*	Tol.	*P*	Tol.	*B*	*E*	Tol.	*J*	Tol.	kg	*G*	Tol.	*W*	Tol.	(*d*)	*Z*
NA13-100	25.4	28.22	+0.38	1.07		0.84		1.57	+0.25	4.06	2.64	±0.13	1.32	±0.13	1.23	27.33	+0.08	0.91		0.97	1.45
NA13-102	26.0	28.85	−0.25	1.07		0.84		1.57	−0.05	4.06	2.69		1.37		1.27	27.97	0	0.91		0.99	1.47
NA13-106	27.0	29.97		1.27		1.04		1.98		4.70	2.79		1.40		1.68	28.91	0.10(2)	1.12		0.97	1.45
NA13-112	28.6	31.72		1.27		1.02		1.98		4.70	2.95		1.45		1.82	30.61		1.09		1.02	1.52
NA13-118	30.0	33.50		1.27		1.02		1.98		4.70	3.05		1.47		1.95	32.13		1.09		1.07	1.60
NA13-118	30.2	33.50		1.27		1.02		1.98		4.70	3.05		1.47		1.95	32.31		1.09		1.07	1.60
NA13-125	31.7	35.26	+0.64	1.27	±0.05	0.99		1.98		4.70	3.15	±0.15	1.57	±0.15	2.18	34.09		1.07		1.17	1.75
NA13-125	32.0	35.26	−0.51	1.27		0.99		1.98		4.70	3.15		1.57		2.18	34.32		1.07		1.17	1.75
NA13-131	33.3	36.98		1.27		0.99		1.98		4.70	3.30		1.57		2.27	35.76		1.07		1.22	1.83
NA13-137	34.9	38.76		1.27		0.97		1.98		4.70	3.30		1.60		2.32	37.47		1.04		1.27	1.91
NA13-137	35.0	38.76		1.27		0.97	±0.03	1.98		4.70	3.30		1.60		2.32	37.54	+0.10	1.04	+0.13	1.27	1.91
NA13-143	36.5	40.54		1.27		0.94		1.98		4.70	3.38		1.65		2.63	39.93	0	1.02	0	1.32	1.98
NA13-145	37.0	41.05		1.27		0.94		1.98		4.70	3.38		1.65		2.91	39.67	0.13(2)	1.02		1.35	1.98
NA13-150	38.1	42.16		1.27		0.94		1.98		4.70	3.38		1.68		2.95	40.74		1.02		1.32	1.98
NA13-156	39.7	44.04		1.57		1.22		1.98		5.26	3.99		1.98		4.04	42.52		1.32		1.42	2.13
NA13-156	40.0	44.04		1.57		1.22		1.98		5.26	3.99		1.98		4.04	42.85		1.32		1.42	2.13
NA13-162	41.3	45.82		1.57		1.19		1.98		5.97	4.17		2.08		4.54	44.27		1.30		1.50	2.24
NA13-165	42.0	46.61		1.57		1.19		1.98		5.97	4.24		2.11		4.72	45.03		1.30		1.52	2.29
NA13-168	42.9	47.60	+0.89	1.57		1.17		1.98	+0.38	5.97	4.32		2.16		4.90	45.97	+0.13	1.27		1.55	2.31
NA13-175	44.4	49.33	−0.64	1.57		1.17		1.98	0.05	6.07	4.34		2.11		4.68	47.70	0	1.27		1.63	2.44
NA13-181	46.0	51.10		1.57		1.17		2.36		6.07	4.32	±0.18	2.13	±0.18	5.22	49.38	0.13(2)	1.27		1.68	2.51
NA13-185	47.0	52.17		1.57		1.17		2.36		6.07	4.32		2.16		5.81	50.39		1.27		1.70	2.54
NA13-187	47.6	52.17		1.57		1.17		2.36		6.07	4.32		2.16		5.81	51.08		1.27		1.73	2.59
NA13-193	49.2	54.38		1.57		1.14		2.36		5.97	4.32		2.16		6.04	52.88		1.24		1.83	2.74
NA13-200	50.8	56.13		1.57		1.12		2.36		6.22	4.32		2.16		6.36	54.46		1.22		1.83	2.74
NA13-206	52.0	57.91		1.98		1.52		2.36		6.48	4.72		2.31		8.17	55.75		1.65		1.88	2.82
NA13-206	52.4	57.91		1.98		1.52		2.36		6.48	4.72		2.31		8.17	56.13		1.65		1.88	2.82
NA13-212	54.0	59.69		1.98		1.52		2.36		6.73	4.95		2.44		8.81	57.89		1.65		1.96	2.92
NA13-218	55.0	61.34		1.98		1.50		2.36		6.73	5.05		2.49		8.90	59.11		1.63		2.06	3.07
NA13-218	55.6	61.34	+1.02	1.98	±0.08	1.50	±0.04	2.36		6.73	5.05		2.49		8.90	59.69	+0.15	1.63		2.06	3.07
NA13-225	57.1	63.25	−0.76	1.98		1.50		2.36		7.24	5.16		2.51		9.90	61.47	0	1.63		2.16	3.23
NA13-231	58.7	64.39		1.98		1.47		2.36		6.99	5.31		2.59		10.26	63.09	0.15(2)	1.60	+0.18	2.18	3.28
NA13-237	60.3	66.80		1.98		1.47		2.36		7.24	5.26		2.59		10.53	64.82		1.60	0	2.26	3.38
NA13-244	62.0	68.63		1.98		1.45		2.79		7.24	5.31		2.62		11.53	66.50		1.57		2.26	3.38
NA13-250	63.5	70.49		1.98		1.45		2.79		7.24	5.33		2.62		11.58	68.17		1.57		2.34	3.51
NA13-250	64.3	70.49		1.98		1.45		2.79		7.24	5.33		2.62		11.34	69.01		1.57		2.36	3.53
NA13-256	65.1	72.24		2.36		1.83		2.79		7.75	5.64		2.77		15.12	69.85		1.98		2.39	3.58
NA13-262	66.7	73.91		2.36		1.80		2.79		7.49	5.74		2.82		15.35	71.63		1.96		2.46	3.68
NA13-268	68.0	75.69		2.36		1.80		2.79		7.75	5.84		2.87		15.89	73.05		1.96		2.51	3.76
NA13-268	68.3	75.69		2.36		1.80		2.79		7.75	5.84		2.87		15.89	73.33		1.96		2.51	3.76
NA13-275	69.8	77.47		2.36		1.78	±0.05	2.79		7.75	5.94		2.92		16.12	75.06		1.93		2.59	3.89
NA13-281	71.4	79.27		2.36		1.78		2.79		7.75	5.84		2.92		16.34	76.71		1.93		2.64	3.96
NA13-281	72.0	79.27		2.36		1.78		2.79		7.75	5.84		2.92		16.34	77.29		1.93		2.64	3.96
NA13-287	73.0	81.05		2.36		1.78		2.79		8.00	6.10		3.05		18.61	78.36		1.93		2.67	3.99
NA13-300	75.0	84.46		2.36		1.73		2.79		7.75	6.35		3.10		19.30	80.72		1.88		2.84	4.27
NA13-300	76.2	84.46		2.36		1.73		2.79		7.75	6.35		3.10		19.30	81.92		1.88		2.84	4.27
NA13-306	77.8	86.82	±1.40	2.77		2.08	±0.06	3.18		8.08	6.45	±0.20	3.20	±0.20	24.06	83.57		2.26	+0.20	2.90	4.34
NA13-312	79.4	88.60		2.77		2.08		3.18		8.08	6.58		3.28		25.42	85.22		2.26	0	2.92	4.37

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TABLE G NA13 REFERENCE METRIC VALUES (DIMENSIONS) (CONT'D)

Ring Series and Size No.	Housing Diameter	Ring Size and Weight													Groove Dimensions					
		Free Diameter		Thickness [Note (1)]		Thickness Beveled End [Note (1)]		Hole Diameter		Lug Height (Max.)	Large Section		Small Section		Approx. Weight per 1000 Pcs.	Diameter		Width		Depth	Edge Margin
	S, mm	*D*	Tol.	*T*	Tol.	*U*	Tol.	*P*	Tol.	*B*	*E*	Tol.	*J*	Tol.	kg	*G*	Tol.	*W*	Tol.	(*d*)	*Z*
NA13-315	80.0	89.48		2.77		2.08		3.18		8.08	6.65		3.28		25.88	85.88		2.26		2.95	4.42
NA13-315	80.2	89.48	±1.40	2.77	±0.08	2.08	±0.06	3.18		8.08	6.65		3.28		25.88	86.06		2.26	+0.20	2.95	4.42
NA13-325	82.5	92.02		2.77		2.08		3.18		8.89	6.83		3.43		27.24	88.62		2.26	0	3.02	4.52
NA13-334	85.0	94.84		2.77		2.08		3.18		8.89	7.01		3.56		29.51	91.21		2.26		3.10	4.65
NA13-347	88.1	97.97		2.77		2.08		3.18		8.89	7.26		3.66		31.33	94.64	+0.15	2.26		3.25	4.88
NA13-350	88.9	98.81		2.77		2.08		3.18		8.89	7.34		3.61		32.23	95.50	0	2.26		3.30	4.95
NA13-354	90.0	99.97		2.77		2.08		3.18	+0.38	8.89	7.42		3.61		32.69	96.67	0.15(2)	2.26		3.35	5.03
NA13-354	90.5	99.97		2.77		2.08		3.18	−0.05	8.89	7.42		3.61		32.69	97.28		2.26		3.40	5.11
NA13-362	92.1	102.21		2.77		2.08		3.18		8.89	7.59		3.81		33.14	99.06		2.26		3.48	5.21
NA13-375	95.0	105.59		2.77		2.08		3.18		8.89	7.85		3.94		35.41	102.36		2.26		3.68	5.51
NA13-375	95.2	105.59		2.77		2.08		3.18		8.89	7.85	±0.20	3.94	±0.20	35.41	102.62		2.26		3.68	5.51
NA13-387	98.4	108.99		2.77		2.08		3.18		9.60	8.10		4.06		39.50	105.94		2.26		3.76	5.64
NA13-393	100.0	110.69		2.77		2.08		3.18		9.60	8.23		4.09		39.95	107.59		2.26		3.78	5.66
NA13-400	101.6	112.37		2.77		2.08		3.18		9.60	8.38		4.22		42.22	109.27		2.26		3.84	5.74
NA13-412	104.8	115.77		2.77		2.08		3.18		9.60	8.38		4.34		44.04	112.60		2.26		3.91	5.87
NA13-425	108.0	119.15		2.77		2.08		3.18		9.60	8.51		4.57		45.85	115.87		2.26		3.96	5.94
NA13-433	110.0	120.80		2.77		2.08		3.96		10.49	8.71		4.57		47.67	118.03		2.26		4.01	6.02
NA13-450	114.3	125.48		2.77		2.08		3.96		10.49	8.92		4.60		50.39	122.53		2.26		4.11	6.17
NA13-462	117.5	128.93		2.77		2.08		3.96		10.49	9.14		4.65		53.12	125.86		2.26		4.19	6.27
NA13-475	120.0	132.41		2.77		2.08		3.96		10.49	9.40		4.65		56.30	128.52		2.26		4.27	6.40
NA13-475	120.6	132.41		2.77		2.08		3.96		10.49	9.40		4.65		56.30	129.18		2.26		4.27	6.40
NA13-500	127.0	139.32		2.77		2.08		3.96		10.49	9.91		4.72		61.74	135.79		2.26		4.39	6.58
NA13-525	133.3	146.56	±1.65	3.18		2.41		3.96	+0.51	11.81	10.36		5.03		79.00	142.54	+0.18	2.59		4.60	6.88
NA13-537	136.5	150.11		3.18	±0.10	2.41		3.96	−0.13	11.81	10.36	±0.23	5.03	±0.23	81.27	145.77	0	2.59		4.62	6.93
NA13-550	139.7	154.08		3.18		2.41	±0.08	3.96		11.81	10.36		5.03		83.08	148.95	0.15(2)	2.59		4.62	6.93
NA13-575	146.0	160.93		3.18		2.41		3.96		11.81	10.36		5.03		87.17	155.45		2.59		4.70	7.04
NA13-600	152.4	168.15		3.18		2.41		3.96		11.81	10.36		4.98		91.25	161.90		2.59		4.75	7.11
NA13-625	158.7	175.13		3.96		3.07		4.75		11.81	10.74		5.36		120.76	168.71		3.28		4.98	7.47
NA13-650	165.1	182.12		3.96		3.07		4.75		12.57	11.13		5.56		127.57	175.46		3.28		5.18	7.77
NA13-662	168.3	185.62	±2.03	3.96		3.07		4.75		12.57	11.35		5.61		138.47	178.87		3.28	+0.25	5.28	7.92
NA13-675	171.4	189.10		3.96		3.05		4.75		13.72	11.58		5.69		147.55	182.22		3.25	0	5.38	8.08
NA13-700	177.8	196.09		3.96		3.05		4.75		13.72	12.04		5.89		156.18	189.00		3.25		5.59	8.38
NA13-725	184.1	203.07		4.75		3.81		4.75		14.48	12.42		6.05		194.31	195.78	+0.20	4.04		5.82	8.71
NA13-750	190.5	210.06		4.75		3.81		4.75		14.48	12.88		6.27		220.19	202.54	0	4.04		6.02	9.02
NA13-775	196.8	217.04		4.75		3.81		4.75		14.48	13.28		6.48		236.08	209.30	0.15(2)	4.04		6.22	9.32
NA13-800	203.2	224.03		4.75		3.71		4.75		15.49	13.72		6.65		251.97	216.08		3.94		6.43	9.63
NA13-825	209.5	231.01		4.75		3.71		4.75		15.49	14.17	±0.25	6.86	±0.25	273.76	222.83		3.94		6.63	9.93
NA13-850	215.9	235.84	±2.29	4.75	±0.13	3.61		4.75		17.02	14.55		7.04		287.84	229.62		3.84		6.86	10.29
NA13-875	222.2	242.77		4.75		3.61		4.75		17.02	15.01		7.26		296.46	236.40		3.84		7.06	10.59
NA13-900	228.6	249.68		4.75		3.61		4.75		17.02	15.47		7.47		332.33	243.15		3.84		7.26	10.90
NA13-925	235.0	256.59		4.75		3.61		4.75		17.02	15.88		7.59		348.22	249.89		3.84		7.47	11.20
NA13-950	241.3	263.53		4.75		3.51		4.75		18.92	16.31		7.72		364.56	256.69		3.73		7.70	11.53
NA13-975	247.7	270.46		4.75		3.51		4.75		18.92	16.71		7.85		378.18	263.45		3.73		7.90	11.84
NA13-1000	254.0	277.37		4.75		3.51		4.75		18.92	17.15		8.00		391.80	270.23		3.73		8.10	12.14

GENERAL NOTE: See Table 9 for illustrations.

NOTES:
(1) For plating rings, add 0.05 mm to the listed maximum thickness (*T*) and beveled end thickness (*U*) values.
(2) *F.I.M. (Full Indicator Movement)*: maximum allowable run out of groove diameter to housing.

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NONMANDATORY APPENDIX H
TYPE NA13 REFERENCE METRIC VALUES
(SUPPLEMENTARY INFORMATION)

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TABLE H NA13 REFERENCE METRIC VALUES (SUPPLEMENTARY INFORMATION)

Ring Series and Size No.	Application Data								
	Clearance Diameter		Gap Width Ring in Groove	Allowable Thrust Load [Note (1)] Square Corner Abutment		Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.	End Play Take Up
	Compressed in Housing	Released in Groove		UNS G10600–G10900 and Stainless Steel Rings Used in Hardened Bores (50 HRc, Min.)	All Standard Rings Used in Low Carbon Steel Bores				
	C1	*C2*	*A*, Min.	*Pr* (kN) [Note (2)]	*Pg* (kN)	*R*, Max.	*Ch*, Max.	*P'r* (kN)	mm
NA13-100	16.89	17.78	3.68	26.86	7.12	1.07	0.86	7.34	0.13
NA13-102	17.53	18.42	3.81	27.32	7.56	1.07	0.86	7.34	0.13
NA13-106	17.40	18.29	3.63	33.64	7.56	1.12	0.89	10.68	0.13
NA13-112	18.92	19.81	3.99	35.67	8.45	1.19	0.91	10.68	0.13
NA13-118	20.07	21.08	3.81	37.92	9.34	1.19	0.91	10.68	0.14
NA13-118	20.32	21.21	4.29	37.92	9.34	1.19	0.91	10.68	0.14
NA13-125	22.23	23.37	4.67	39.73	10.68	1.22	0.97	10.68	0.15
NA13-125	22.48	23.62	5.31	39.73	10.68	1.22	0.97	10.68	0.15
NA13-131	23.62	24.64	5.03	41.99	11.79	1.22	0.97	10.68	0.15
NA13-137	25.15	26.16	5.36	43.80	12.90	1.22	0.97	10.68	0.17
NA13-137	25.15	26.16	5.56	43.80	12.90	1.22	0.97	10.68	0.17
NA13-143	26.92	28.19	5.61	46.05	13.79	1.22	0.97	10.68	0.18
NA13-145	27.43	28.70	5.74	46.50	14.46	1.22	0.97	10.68	0.18
NA13-150	28.45	29.72	6.05	47.63	14.68	1.22	0.97	10.68	0.18
NA13-156	28.96	29.21	6.05	61.85	16.01	1.63	1.27	17.35	0.19
NA13-156	29.21	29.46	6.99	61.85	16.01	1.63	1.27	17.35	0.19
NA13-162	29.21	30.99	6.15	64.11	17.79	1.63	1.27	17.35	0.20
NA13-165	29.72	30.99	6.30	65.47	18.68	1.63	1.27	17.35	0.20
NA13-168	30.73	32.77	6.48	66.82	19.13	1.63	1.27	17.35	0.20
NA13-175	32.00	33.27	6.78	69.30	20.91	1.63	1.27	17.35	0.22
NA13-181	33.53	35.05	7.04	71.79	22.46	1.63	1.27	17.35	0.23
NA13-185	34.54	36.07	7.21	73.14	23.13	1.63	1.27	17.35	0.23
NA13-187	35.31	36.58	7.87	74.27	24.02	1.63	1.27	17.35	0.23
NA13-193	36.83	38.35	8.33	76.75	26.24	1.63	1.27	17.35	0.24
NA13-200	38.10	39.88	8.43	79.01	27.13	1.63	1.27	17.35	0.24
NA13-206	38.61	40.39	7.90	102.71	28.91	1.93	1.55	27.58	0.24
NA13-206	39.12	40.89	8.86	102.71	28.91	1.98	1.57	27.58	0.24
NA13-212	40.13	41.91	8.76	105.64	31.14	1.98	1.57	27.58	0.25
NA13-218	40.89	42.93	8.20	108.81	33.14	1.98	1.57	27.58	0.25
NA13-218	41.66	43.69	9.47	108.81	33.14	1.98	1.57	27.58	0.25
NA13-225	42.93	44.96	9.35	112.19	35.81	1.98	1.57	27.58	0.27
NA13-231	44.45	46.23	9.19	114.90	37.36	1.98	1.57	27.58	0.28
NA13-237	45.97	48.01	9.50	118.06	39.59	1.98	1.57	27.58	0.29
NA13-244	47.24	49.28	9.80	121.45	40.48	1.98	1.57	27.58	0.30
NA13-250	48.51	50.80	10.11	124.61	42.70	1.98	1.57	27.58	0.30
NA13-250	49.28	51.56	11.68	124.61	42.70	1.98	1.57	27.58	0.32
NA13-256	49.53	51.82	10.16	152.15	45.37	2.24	1.78	40.03	0.32
NA13-262	51.31	53.59	10.62	155.98	48.04	2.24	1.78	40.03	0.33
NA13-268	52.07	54.61	9.98	159.82	50.26	2.29	1.83	40.03	0.33
NA13-268	52.32	54.86	10.74	159.82	50.26	2.29	1.83	40.03	0.33
NA13-275	53.85	56.13	11.23	162.98	52.49	2.34	1.88	40.03	0.36
NA13-281	55.37	57.66	11.66	166.82	54.27	2.24	1.78	40.03	0.36
NA13-281	56.13	58.67	13.00	166.82	54.27	2.24	1.78	40.03	0.36
NA13-287	56.39	58.93	11.46	170.66	56.04	2.34	1.88	40.03	0.36
NA13-300	58.42	61.21	11.40	178.33	63.16	2.34	1.88	40.03	0.38
NA13-300	59.69	62.48	14.43	178.33	63.16	2.34	1.88	40.03	0.38
NA13-306	61.21	63.75	12.01	212.65	65.83	2.46	1.98	53.38	0.38
NA13-312	62.74	65.53	11.91	217.16	67.61	2.51	2.01	53.38	0.39

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TABLE H NA13 REFERENCE METRIC VALUES (SUPPLEMENTARY INFORMATION) (CONT'D)

Ring Series and Size No.	Application Data								
	Clearance Diameter		Gap Width Ring in Groove	Allowable Thrust Load [Note (1)] Square Corner Abutment		Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.	End Play Take Up
	Compressed in Housing	Released in Groove		UNS G10600–G10900 and Stainless Steel Rings Used in Hardened Bores (50 HRc, Min.)	All Standard Rings Used in Low Carbon Steel Bores				
	C1	*C2*	*A*, Min.	*Pr* (kN) [Note (2)]	*Pg* (kN)	*R*, Max.	*Ch*, Max.	*P'r* (kN)	mm
NA13-315	63.25	66.04	11.73	219.42	68.94	2.54	2.03	53.38	0.39
NA13-315	63.50	66.29	12.22	219.42	68.94	2.54	2.03	53.38	0.39
NA13-325	64.52	67.31	12.93	225.74	72.95	2.64	2.11	53.38	0.41
NA13-334	66.80	69.60	13.06	232.96	76.95	2.74	2.18	53.38	0.42
NA13-347	70.10	73.15	14.50	241.09	83.62	2.74	2.18	53.38	0.43
NA13-350	70.87	73.91	14.58	243.35	85.85	2.79	2.24	53.38	0.43
NA13-354	71.88	74.93	14.88	246.50	88.07	2.79	2.24	53.38	0.44
NA13-354	72.39	75.44	16.33	246.50	88.07	2.79	2.24	53.38	0.46
NA13-362	73.91	76.96	16.23	252.38	93.85	2.95	2.36	53.38	0.46
NA13-375	76.71	80.01	16.43	260.50	102.75	3.05	2.44	53.38	0.50
NA13-375	76.96	80.52	17.12	260.50	102.75	3.05	2.44	53.38	0.50
NA13-387	78.99	82.55	17.27	269.08	108.09	3.12	2.49	53.38	0.51
NA13-393	80.52	84.07	17.45	274.05	110.76	3.15	2.51	53.38	0.51
NA13-400	82.04	85.60	17.63	278.56	113.87	3.25	2.59	53.38	0.51
NA13-412	85.34	89.15	18.24	287.14	119.65	3.30	2.64	53.38	0.53
NA13-425	88.39	92.20	18.87	295.72	124.99	3.51	2.79	53.38	0.53
NA13-433	88.90	92.71	20.40	300.68	128.99	3.61	2.90	53.38	0.53
NA13-450	92.96	96.77	19.99	312.87	137.44	3.71	2.97	53.38	0.56
NA13-462	96.27	100.33	20.88	321.90	144.12	3.84	3.07	53.38	0.56
NA13-475	98.55	102.62	19.63	330.48	150.34	3.91	3.12	53.38	0.58
NA13-475	99.06	103.12	21.41	330.48	150.34	3.91	3.12	53.38	0.58
NA13-500	103.63	107.95	19.13	347.63	172.14	4.01	3.20	53.38	0.58
NA13-525	109.47	113.79	22.50	418.52	179.25	4.27	3.40	66.72	0.61
NA13-537	112.01	116.33	22.68	428.45	184.59	4.27	3.40	66.72	0.61
NA13-550	115.06	119.38	22.33	438.83	189.04	4.27	3.40	66.72	0.61
NA13-575	121.41	125.98	22.99	458.70	200.60	4.27	3.40	66.72	0.64
NA13-600	127.76	132.33	23.60	478.11	211.72	4.27	3.40	66.72	0.64
NA13-625	133.10	137.92	24.28	621.68	231.30	4.50	3.61	102.30	0.66
NA13-650	139.45	144.27	26.42	646.96	249.98	4.60	3.68	102.30	0.69
NA13-662	142.24	147.32	27.00	659.15	259.76	4.65	3.71	102.30	0.71
NA13-675	143.51	148.59	25.02	671.79	269.99	4.78	3.81	102.30	0.71
NA13-700	149.35	154.69	26.34	696.62	290.45	4.98	3.99	102.30	0.74
NA13-725	154.43	160.02	27.56	864.57	313.14	5.13	4.11	151.23	0.79
NA13-750	160.78	166.62	28.91	894.82	335.38	5.28	4.22	151.23	0.81
NA13-775	167.13	173.23	29.92	924.61	358.06	5.44	4.34	151.23	0.84
NA13-800	171.45	177.55	31.45	954.41	381.64	5.59	4.47	151.23	0.86
NA13-825	177.80	184.15	32.23	984.21	406.10	5.82	4.65	151.23	0.89
NA13-850	181.10	187.71	36.68	1014.01	432.79	5.97	4.78	151.23	0.91
NA13-875	187.45	194.31	37.62	1040.19	459.03	6.12	4.90	151.23	0.94
NA13-900	193.80	200.91	39.09	1073.60	485.72	6.32	5.05	151.23	0.97
NA13-925	200.15	207.26	39.60	1103.40	512.85	6.43	5.13	151.23	0.99
NA13-950	202.69	210.06	40.54	1133.19	543.10	6.55	5.23	151.23	1.04
NA13-975	209.04	216.41	42.67	1162.99	572.01	6.68	5.33	151.23	1.07
NA13-1000	215.39	223.01	42.85	1192.79	601.81	6.86	5.49	151.23	1.09

GENERAL NOTE: See Mandatory Appendix IV for illustrations.

NOTES:
(1) *Safety Factors for Pr and Pg*: The allowable thrust load values listed include the following safety factors: *Pr*: 4 *Pg*: 2.
(2) *Pr* values listed apply to rings made from UNS G10600–G10900 and UNS S15700 stainless steel. *Pr* values for rings made from beryllium copper can be calculated by multiplying listed values by 0.75.

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STD.ASME B18.27-ENGL 1998 ■ 0759670 0613028 12T ■

ASME B18.27-1998

TAPERED AND REDUCED CROSS SECTION RETAINING RINGS (INCH SERIES)

Incorporating ASME B18.27.1, B18.27.2, B18.27.3, B18.27.4, and B18.27.5

AN AMERICAN NATIONAL STANDARD



The American Society of Mechanical Engineers

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The American Society of Mechanical Engineers

AN AMERICAN NATIONAL STANDARD

TAPERED AND REDUCED CROSS SECTION RETAINING RINGS (INCH SERIES)

Incorporating ASME B18.27.1, B18.27.2, B18.27.3, B18.27.4, and B18.27.5

ASME B18.27-1998

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FOREWORD

American National Standards Committee B27 for the standardization of plain and lock washers was organized in March 1926 as Sectional Committee B27, under the aegis of the American Standards Association (later the United States of America Standards Institute and, as of October 6, 1969, the American National Standards Institute, Inc.), with the Society of Automotive Engineers and The American Society of Mechanical Engineers as joint secretariats. In 1950, this Committee was designated as responsible for the standardization of washers and machine rings.

At a meeting of ANSI B27 Standards Committee held on February 4, 1971, it was recommended to the secretariats (ASME and SAE) that Subcommittees 1, 2, and 4 on Washers be merged into ANSI B18 Standards Committee and that Subcommittee 3 on Retaining Rings become a separate Standards Committee retaining the B27 designation. This change was subsequently approved by ANSI.

Formation of Subcommittee 1 on Tapered and Reduced Section Retaining Rings was authorized by Standards Committee B27 at its meeting on October 15, 1974. At this meeting, it was decided that no further effort should be expended on inch dimensional products and Subcommittee 1 was assigned the responsibility of preparing American metric standards for tapered and reduced section retaining rings.

Subcommittee 1 prepared a draft proposal, General Purpose Tapered and Reduced Cross Section Retaining Rings, which was balloted on June 16, 1975. At a subcommittee meeting held on February 17, 1976, results from the letter ballot were reviewed. The proposal was accepted by the Subcommittee and presented to the B27 Standards Committee at its May 7, 1976, meeting. At that meeting, a letter ballot of the entire committee was authorized. The Standard was duly approved by the Committee and its sponsors and submitted to the American National Standards Institute for designation as an American Standard. This designation was granted on October 20, 1977.

It was recommended that American National Standards Committee B27 be made part of ASME B18 Main Committee. As a result, Subcommittee 27 of ASME B18 has the responsibility of developing and maintaining standards for retaining rings.

A need evolved for commercial and military requirements to develop inch series standards for General Purpose Tapered and Reduced Cross Section Type Retaining Rings. It was agreed by the ASME B18 Main Committee to have Subcommittee 27 develop these required inch series standards. The first of the inch standards, B18.27.1, covering External Type NA1, Internal Type NA2, and E-Ring Type NA3 rings, was approved by ANSI on July 16, 1998.

The second of the inch standards, B18.27.2, covering Heavy Duty External Type NA4, Reinforced E-Rings NA5, and C-Rings Type NA6, was approved by ANSI on July 16, 1998.

The third standard of the B18.27 series, B18.27.3, covering Bowed External Rings NA7, Bowed Internal Rings NA8, and Bowed External E-Rings NA9, was approved by ANSI on July 16, 1998.

The intent is to add two further inch series standards to ASME B18.27 through addenda during the next few years.

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Standardization of Bolts, Nuts, Rivets, Screws, Washers, and Similar Fasteners

(The following is the roster of the Committee at the time of approval of this Standard.)

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Secretary, B18 Main Committee
The American Society of Mechanical Engineers
Three Park Avenue
New York, NY 10016-5990

Proposing Revisions. Revisions are made periodically to the Standard to incorporate changes that appear necessary or desirable, as demonstrated by the experience gained from the application of the Standard. Approved revisions will be published periodically.

The Committee welcomes proposals for revisions to this Standard. Such proposals should be as specific as possible, citing the paragraph number(s), the proposed wording, and a detailed description of the reasons for the proposal, including any pertinent documentation.

Interpretations. Upon request, the B18 Committee will render an interpretation of any requirement of the Standard. Interpretations can only be rendered in response to a written request sent to the Secretary of the B18 Main Committee.

The request for interpretation should be clear and unambiguous. It is further recommended that the inquirer submit his/her request in the following format:

Subject:	Cite the applicable paragraph number(s) and the topic of the inquiry.
Edition:	Cite the applicable edition of the Standard for which the interpretation is being requested.
Question:	Phrase the question as a request for an interpretation of a specific requirement suitable for general understanding and use, not as a request for an approval of a proprietary design or situation. The inquirer may also include any plans or drawings, which are necessary to explain the question; however, they should not contain proprietary names or information.

Requests that are not in this format will be rewritten in this format by the Committee prior to being answered, which may inadvertently change the intent of the original request.

ASME procedures provide for reconsideration of any interpretation when or if additional information that might affect an interpretation is available. Further, persons aggrieved by an interpretation may appeal to the cognizant ASME Committee or Subcommittee. ASME does not "approve," "certify," "rate," or "endorse" any item, construction, proprietary device, or activity.

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PREFACE

ORGANIZATION OF THIS DOCUMENT

This Standard compiles the following standards:

Standard	*Title*
ASME B18.27.1	External Type NA1, Internal Type NA2, E-Ring Type NA3
ASME B18.27.2	Heavy Duty External Type NA4, Reinforced E-Rings NA5, C-Rings Type NA6
ASME B18.27.3	Bowed External Rings NA7, Bowed Internal Rings NA8, Bowed External E-Rings NA9
ASME B18.27.4	In preparation
ASME B18.27.5	In preparation

ADDENDA SERVICE

This edition of ASME B18.27-1998 includes an automatic addenda subscription service up to the publication of the next edition. The addenda subscription service will include the additional B18.27 documents not already included in the initial publication and approved revisions to the existing parts.

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ASME B18.27.4 In preparation

ASME B18.27.5 In preparation

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ASME B18.27.1

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EXTERNAL TYPE NA1, INTERNAL TYPE NA2, E-RING TYPE NA3

1 INTRODUCTORY NOTES

1.1 Scope

This Standard covers complete general and dimensional data for three series of general purpose tapered and reduced cross section retaining rings, which may be used with the nominal size shafts and housings listed and in grooves of the recommended dimensions listed. Also included are formulas and tolerances on which dimensional data are based. Three appendices include guidance for assembly and recommended standard drawing formats.

The inclusion of dimensional data in this Standard is not intended to imply that all of the products described are stock production sizes. Consumers should consult with suppliers concerning lists of stock production sizes.

1.2 ISO Standard

There are no existing ISO Standards for these products.

1.3 Ring Types

1.3.1 External Rings. Dimensions of basic external retaining rings and grooves for various shaft sizes are given in Table 6. See Nonmandatory Appendix A for equivalent metric data.

1.3.2 Internal Rings. Dimensions for basic internal retaining rings and grooves for various housing sizes are given in Table 7. See Nonmandatory Appendix C for equivalent metric data.

1.3.3 External E-Rings. Dimensions of E-Type external retaining rings and grooves for various shaft sizes are given in Table 8. See Nonmandatory Appendix E for equivalent metric data.

1.4 Designations

Retaining rings in this Standard shall be designated by the following data in the sequence shown: ring series type number; size; material; protective finish, if required or by, optionally, ASME B18.24.3 PIN Code. See examples below:

NA1-37, Carbon spring steel, phosphate
R271NAA0037NN056NNAA1

NA2-75, Corrosion resistant steel
R271NAB0075NN519NNAB1

NA3-S118, Beryllium copper
R271NACS118NN643NNAA1

1.5 Applicability

The rings covered by this Standard are intended primarily for use with the shaft, housing, and groove sizes recommended; however, in certain cases these diameters may be altered somewhat to suit the requirements of a particular design. When such changes are made, care should be taken to not alter the shaft or housing size to such an extent that the ring will take enough permanent set to allow a loose fit after the ring has been assembled into the groove. Neither should the groove diameter be altered to the extent to permit the ring to fit loosely.

1.6 Dimensions

All dimensions in this Standard are in inches unless otherwise stated.

1.7 Supplementary Information

Allowable loads, maximum radii and chamfers, clearance dimensions, and gaging diameters for all three ring series are included in Mandatory Appendices I, II, and III. RPM limits for external basic and external E-rings are included in Mandatory Appendices I and III.

1.8 Reference Standards

Unless otherwise specified, the referenced standard shall be the most recent issue at the time of order placement.

ASTM E 18, Standard Test Method for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials

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ASTM B 117, Standard Practice for Operating Salt Spray (Fog) Testing Apparatus

ASTM A 380, Standard Practice for Cleaning and Descaling Stainless Steel Parts, Equipment, and Systems

ASTM B 695, Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel

ASTM DS-56F/SAE HS-1086, Unified Numbering System (UNS) for Metal and Alloys

Publisher: The American Society for Testing and Materials (ASTM), 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959

2 GENERAL DATA

2.1 Basic Retaining Rings

Type NA1 retaining rings covered by this Standard are spread over a shaft by means of a pliers or special tool and allowed to relax and seat in a circumferential groove, thereby providing an external protruding shoulder that can be used for locating and retaining a part on the shaft.

Type NA2 retaining rings covered by this Standard are compressed into a housing by means of a pliers or special tool and allowed to relax and seat in a circumferential groove, thereby providing an internal protruding shoulder that can be used for locating and retaining a part contained inside of the housing.

In both cases, the rings have a tapered section to provide a more uniform distribution of stresses during expansion or compression.

2.2 E-Type Retaining Rings

Type NA3 retaining rings covered by this Standard contain three prongs connected by a reduced section bridge to provide greater resilience during installation. The rings are installed radially, usually by means of an applicator, and provide a high shoulder for abutment by a retained part.

3 MATERIAL

Standard materials used in the manufacture of the retaining rings shall be carbon spring steel, corrosion-resistant steel, or beryllium copper.

3.1 Carbon Spring Steel

Retaining rings made from carbon spring steel shall conform to the chemical composition of UNS G10600 to UNS G10900 or equivalent and have the following physical properties.

3.1.1 Heat Treatment. The retaining rings shall be heat treated by austempering up to Size 345. For sizes from 350 to 1000, the rings shall be heat treated by either austempering or by quench and temper. All sizes are to be heat treated to the hardness shown in Table 1.

3.1.2 Surface Treatment

3.1.2.1 Phosphate Coating. Finish shall consist of basic zinc phosphate treatment and subsequent supplementary treatment to enhance Shelf Life (example of supplementary treatment: *wax, light drying oil).*

3.1.2.2 Zinc Plating. Finish shall consist of mechanically applied zinc with a dichromate conversion treatment similar to ASTM B 695 Type II, Class 8. The resulting treatment shall be capable of withstanding 72 hours to white corrosion or red rust. Salt spray corrosion resistance test method shall be similar to ASTM B 117.

NOTE: Electroplating has the potential of introducing Hydrogen Embrittlement. Therefore, its application for retaining rings is not allowed.

3.1.2.3 Oil Finish. To extend Shelf Life, rings shall be coated with a thin film of non-tacky water displacing rust preventative oil.

3.2 Corrosion-Resistant Steel

Retaining rings made from corrosion-resistant steel shall conform to the chemical composition of UNS S15700 or equivalent (AISI 632, AMS 5520).

Optional Material: For rings with thickness of 0.062 or greater, retaining rings may be made from UNS S17700.

3.2.1 Heat Treatment. The retaining rings should be heat treated to the hardness values as specified in Table 2.

3.2.2 Surface Treatment. Retaining rings shall be cleaned free of scale, grease, oil, and other foreign material in conformance to ASTM A 380.

3.3 Beryllium Copper

Retaining rings made from beryllium copper shall conform to the chemical composition of Alloy 25, CDA 172 or equivalent (UNS C17200) and have the following physical properties.

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TABLE 1 HARDNESS RANGES FOR TAPERED AND REDUCED CROSS SECTION RETAINING RINGS (CARBON SPRING STEEL)

NA1		NA2	
Ring Size	**Hardness**	**Ring Size**	**Hardness**
25 through 46	69.5–73 HR30N (51–55 HRC)	25 and 31	84–87 HR15N (47–53 HRC)
50 through 81	66–71 HR30N (47–53 HRC)	37 through 102	66–71 HR30N (47–53 HRC)
87 through 102	47–53 HRC	106 through 347	47–52 HRC
106 through 343	47–52 HRC	350 through 700	44–50 HRC
350 through 700	44–51 HRC	725 through 1000	42–49 HRC
725 through 1000	40–47 HRC		

NA3	
Ring Thickness [Note (2)]	**Hardness**
0.010 in. thick [Note (1)]	84.5–87 HR15N (48–53 HRC)
0.015 in. and 0.020 in. thick	84.5–87 HR15N (48–53 HRC)
0.025 in. thick	66.5–71 HR30N (48–53 HRC)
0.035 in., 0.042 in., 0.050 in., and 0.062 in. thick	47–52 HRC

NOTES:
(1) These parts can only be checked by mounting for microhardness testing.
(2) See Table 8 for ring sizes.

3.3.1 Heat Treatment. The retaining rings should be heat treated to the hardness values as specified in Table 3.

3.3.2 Surface Treatment. Retaining rings shall be cleaned to remove oxide formed as a result of the heat treating process. Since these rings have extremely high resistance to most types of atmospheric corrosion, further protective finishes are usually not required.

4 HARDNESS TESTING PROCEDURE

The surfaces of both sides of each sample retaining ring shall be prepared for hardness testing by removal of all plating and other surface conditions that may affect the hardness reading. Hardness testing procedure shall be in conformance to ASTM E 18.

5 PERMANENT SET LIMITS

The following procedures should be used for determining if the permanent set of the ring is within the allowable limits.

5.1 NA1 Basic External Retaining Rings

Step 1. Expand the ring with a plier until it just fits over a shaft 1% larger than the nominal shaft diameter. Repeat this procedure 4 more times with the same ring. The ring shall not crack during this procedure.

Step 2. Measure the ring diameter (D) in the three places shown in Fig. 1.

Step 3. Compute the average of the 3 diameters and compare it to the minimum groove diameter listed in the Table 6 for that ring. In all cases, the average diameter after permanent set shall be less than the minimum groove

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TABLE 2 HARDNESS RANGES FOR TAPERED AND REDUCED CROSS SECTION RETAINING RINGS (CORROSION-RESISTANT STEEL)

NA1		NA2	
Ring Size	**Hardness**	**Ring Size**	**Hardness**
25 through 81	63–69.5 HR30N (44–51 HRC)	25 and 31	82.5–86 HR15N (44–51 HRC)
87 and over	44–51 HRC	37 through 102	63–69.5 HR30N (44–51 HRC)
		106 and over	44–51 HRC

NA3	
Ring Thickness [Note (2)]	**Hardness**
0.010 in. thick	82.5–86 HR15N [Note (1)] (44–51 HRC)
0.015 in. and 0.020 in. thick	82.5–86 HR15N (44–51 HRC)
0.025 in. thick	63–69.5 HR30N (44–51 HRC)
0.035 in., 0.042 in., 0.050 in., and 0.062 in. thick	44–51 HRC

NOTES:
(1) These parts can only be checked by mounting for microhardness testing.
(2) See Table 8 for ring sizes.

TABLE 3 HARDNESS RANGES FOR TAPERED AND REDUCED CROSS SECTION RETAINING RINGS (BERYLLIUM COPPER)

NA1		NA2	
Ring Size	**Hardness**	**Ring Size**	**Hardness**
12 through 23	77–82 HR15N [Note (1)] (34–43 HRC)	25 and 31	77–82 HR15N (34–43 HRC)
25 through 102	56.5–62 HR30N (37–43 HRC)	37 through 102	54–62 HR30N (34–43 HRC)
106 and over	37–43 HRC	106 and over	34–43 HRC

NA3	
Ring Thickness [Note (2)]	**Hardness**
0.010 in. thick	79–82 HR15N [Note (1)] (37–43 HRC)
0.015 in. and 0.020 in. thick	79–82 HR15N (37–43 HRC)
0.025 in. thick	56.5–62 HR30N (37–43 HRC)
0.035 in., 0.042 in., 0.050 in., and 0.062 in. thick	37–43 HRC

NOTES:
(1) These parts can only be checked by mounting for microhardness testing.
(2) See Table 8 for ring sizes.

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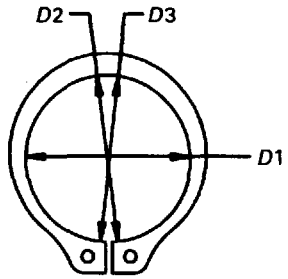


FIG. 1 PERMANENT SET MEASUREMENTS FOR TYPE NA1 RINGS

diameter to ensure that the ring will seat tightly.

5.2 NA2 Basic Internal Retaining Rings

Step 1. Compress the ring with a plier until the lugs abut each other. Repeat this procedure 4 more times.

Step 2. Measure the ring diameter (D) in the three places shown in Fig. 2.

Step 3. Compute the average of the 3 diameters and compare it to the maximum groove diameter listed in the Table 7 for the ring. In all cases, the average diameter after permanent set must be greater than the maximum groove diameter to insure that the ring will seat tightly.

5.3 NA3 E-Type External Retaining Rings

The rings shall, upon being installed in the minimum groove diameter by an applicator or similar tool, grip the minimum groove diameter and shall have no less than 3 point contact.

6 IRREGULARITY LIMITATIONS

6.1 Dish

Dish limitations of tapered and reduced section retaining rings as shown in Fig. 3 shall not exceed the dimensions specified in Table 4 for the applicable ring series thickness.

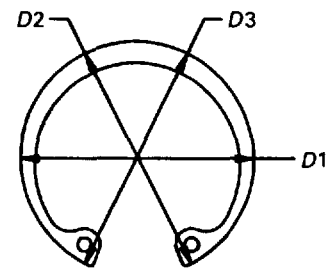


FIG. 2 PERMANENT SET MEASUREMENTS FOR TYPE NA2 RINGS

6.2 Pitch

Pitch limitations of tapered and reduced section retaining rings as shown in Fig. 4 shall not exceed the dimensions specified in Table 5 for the applicable ring series thickness.

7 WORKMANSHIP

Workmanship shall be in accordance with high grade commercial practice. Rings shall be free from rust, loose scale, hanging burrs, cracks, and any other defects that might affect their functioning.

8 ADDITIONAL DATA

8.1 Dimensional Data

Dimensional data and performance information on rings and grooves for tapered and reduced cross section retaining rings are shown in Tables 6, 7, and 8 and Mandatory Appendices I, II, and III.

8.2 Metric Values

For reference purposes only, metric values are shown in Nonmandatory Appendices A, B, C, D, E, and F.

8.3 Additional Information

Consult with suppliers for additional information not included in this Standard.

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NA1 and NA2 Rings NA3 Rings

FIG. 3 DISH FOR TYPE NA1, TYPE NA2, AND TYPE NA3 RINGS

TABLE 4 DISH LIMITATIONS FOR TAPERED AND REDUCED SECTION RETAINING RINGS

Types NA1 and NA2 [Note (1)]		Type NA3 [Note (2)]	
Ring Thickness	Max. Dish	Ring Thickness	Max. Dish
0.010–0.015	0.002	0.010–0.015	0.002
0.025–0.035	0.003	0.025–0.035	0.003
0.042–0.093	0.005	0.042–0.062	0.005
0.109–0.125	0.010	...	...
0.156–0.187	0.015	...	...

NOTES:
(1) See Tables 6 and 7, respectively, for ring sizes.
(2) See Table 8 for ring sizes.



NA1 and NA2 Rings NA3 Rings

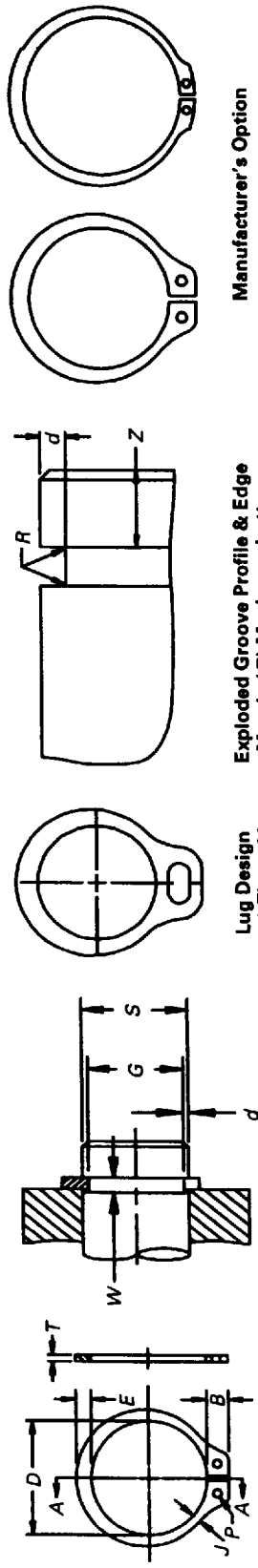
FIG. 4 PITCH FOR TYPE NA1, TYPE NA2, AND TYPE NA3 RINGS

TABLE 5 PITCH LIMITATIONS FOR TAPERED AND REDUCED SECTION RETAINING RINGS

Types NA1 and NA2		Type NA3	
Ring Size, in.	Overall Pitch, Max.	Ring Size, in.	Overall Pitch, Max.
All Sizes	3T	Up to ½ in.	1.5T
		Over ½ in.	2T

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TABLE 6 ILLUSTRATION



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TABLE 6 NA1 BASIC EXTERNAL RETAINING RINGS

Ring Series And Size No.	Shaft Diameter			Free Diameter		Thickness [Note (1)]		Hole Diameter		Lug Height (Max.)	Large Section		Small Section		Approx. Mass per 1000 Pcs.	Groove Dimensions					Edge Margin
																Diameter		Width		Depth	
	S, Dec.	*S*, Frac.	*S*, mm	*D*	Tol.	*T*	Tol.	*P*	Tol.	*B*	*E*	Tol.	*J*	Tol.	lb	*G*	Tol.	*W*	Tol.	(*d*)	*Z*
NA1-12 (2)	0.125	1/8	3.2	0.112		0.010	±0.001	0.026		0.048	0.018	±0.0015	0.011	±0.0015	0.018	0.117		0.012		0.004	0.012
NA1-15 (2)	0.156	5/32	4.0	0.142		0.010		0.026		0.056	0.026		0.016		0.037	0.146		0.012		0.005	0.015
NA1-18 (2)	0.188	3/16	4.8	0.168	+0.002	0.015		0.025		0.052	0.025		0.016		0.059	0.175	±0.0015	0.018	+0.002	0.006	0.018
NA1-19 (2)	0.197	...	5.0	0.179	−0.004	0.015		0.026		0.058	0.026	±0.002	0.016	±0.002	0.063	0.185	0.0015 (3)	0.018	−0.000	0.006	0.018
NA1-21 (2)	0.219	7/32	5.6	0.196		0.015		0.026		0.058	0.028		0.017		0.074	0.205		0.018		0.007	0.021
NA1-23 (2)	0.236	15/64	6.0	0.215		0.015		0.026		0.058	0.030		0.019		0.086	0.222		0.018		0.007	0.021
NA1-25	0.250	1/4	6.4	0.225		0.025		0.041		0.083	0.035		0.025		0.21	0.230		0.029		0.010	0.030
NA1-27	0.276	...	7.0	0.250		0.025		0.041		0.084	0.035		0.026		0.23	0.255		0.029		0.010	0.031
NA1-28	0.281	9/32	7.1	0.256		0.025		0.041		0.083	0.038		0.026		0.24	0.261		0.029		0.010	0.030
NA1-31	0.312	5/16	7.9	0.281		0.025		0.041		0.090	0.040		0.026		0.27	0.290		0.029		0.011	0.033
NA1-34	0.344	11/32	8.7	0.309		0.025		0.041		0.090	0.042		0.0265		0.31	0.321	±0.002	0.029		0.011	0.033
NA1-35	0.354	...	9.0	0.320	+0.002	0.025		0.041		0.090	0.046	±0.003	0.029	±0.003	0.35	0.330	0.002 (3)	0.029		0.012	0.036
NA1-37	0.375	3/8	9.5	0.338	−0.005	0.025		0.041		0.091	0.050		0.0305		0.39	0.352		0.029		0.012	0.036
NA1-39	0.394	...	10.0	0.354		0.025		0.041		0.090	0.052		0.031		0.42	0.369		0.029		0.012	0.037
NA1-40	0.406	13/32	10.3	0.366		0.025		0.041		0.090	0.054		0.033		0.43	0.382		0.029		0.012	0.036
NA1-43	0.438	7/16	11.1	0.395		0.025	±0.002	0.041	+0.010	0.091	0.055		0.033		0.50	0.412		0.029		0.013	0.039
NA1-46	0.469	15/32	11.9	0.428		0.025		0.041	−0.002	0.091	0.060		0.035		0.54	0.443		0.029	+0.003	0.013	0.039
NA1-50	0.500	1/2	12.7	0.461		0.035		0.047		0.111	0.065		0.040		0.91	0.468		0.039	−0.000	0.016	0.048
NA1-55	0.551	...	14.0	0.509		0.035		0.047		0.111	0.053		0.036		0.90	0.519	±0.002	0.039		0.016	0.048
NA1-56	0.562	9/16	14.3	0.521		0.035		0.047		0.111	0.072		0.041		1.1	0.530	0.004 (3)	0.039		0.016	0.048
NA1-59	0.594	19/32	15.1	0.550		0.035		0.047		0.112	0.076	±0.004	0.043	±0.004	1.2	0.559		0.039		0.017	0.052
NA1-62	0.625	5/8	15.9	0.579		0.035		0.047		0.113	0.080		0.045		1.3	0.588		0.039		0.018	0.055
NA1-66	0.669	...	17.0	0.621	+0.005	0.035		0.047		0.113	0.082		0.043		1.4	0.629		0.039		0.020	0.060
NA1-66	0.672	43/64	17.1	0.621	−0.010	0.035		0.047		0.113	0.082		0.043		1.4	0.631		0.039		0.020	0.060
NA1-68	0.688	11/16	17.5	0.635		0.042		0.052		0.140	0.084		0.048		1.8	0.646		0.046		0.021	0.063
NA1-75	0.750	3/4	19.0	0.693		0.042		0.052		0.140	0.092		0.051		2.1	0.704	±0.003	0.046		0.023	0.069
NA1-78	0.781	25/32	19.8	0.722		0.042		0.052		0.140	0.094		0.052		2.2	0.733	0.004 (3)	0.046		0.024	0.072
NA1-81	0.812	13/16	20.6	0.751		0.042		0.052		0.140	0.096		0.0531		2.5	0.762		0.046		0.025	0.075
NA1-84	0.844	...	21.4	0.780		0.042		0.052		0.141	0.100		0.057		2.7	0.791		0.046		0.026	0.078
NA1-87	0.875	7/8	22.2	0.810		0.042		0.052		0.141	0.104	±0.005	0.057	±0.005	2.8	0.821		0.046		0.027	0.081
NA1-93	0.938	15/16	23.8	0.867		0.042		0.078		0.170	0.110		0.063		3.1	0.882		0.046		0.028	0.084
NA1-98	0.984	63/64	25.0	0.910		0.042		0.078		0.171	0.114		0.0637		3.5	0.926		0.046		0.029	0.087
NA1-100	1.000	1	25.4	0.925		0.042		0.078	+0.015	0.171	0.116		0.0645		3.6	0.940		0.046		0.030	0.090
NA1-102	1.023	...	26.0	0.946		0.042		0.078	−0.002	0.172	0.118		0.066		3.9	0.961		0.046		0.031	0.093
NA1-106	1.062	1 1/16	27.0	0.982	+0.010	0.050		0.078		0.185	0.122	±0.006	0.069	±0.006	4.8	0.998	±0.004	0.056	+0.004	0.032	0.096
NA1-112	1.125	1 1/8	28.6	1.041	−0.015	0.050		0.078		0.186	0.128		0.071		5.1	1.059	0.005 (3)	0.056	−0.000	0.033	0.099

(continued)

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TABLE 6 NA1 BASIC EXTERNAL RETAINING RINGS (CONT'D)

Ring Series And Size No.	Shaft Diameter			Free Diameter		Thickness [Note (1)]		Hole Diameter		Lug Height (Max.)	Large Section		Small Section		Approx. Mass per 1000 Pcs.	Groove Dimensions					Edge Margin
																Diameter		Width		Depth	
	S, Dec.	*S*, Frac.	*S*, mm	*D*	Tol.	*T*	Tol.	*P*	Tol.	*B*	*E*	Tol.	*J*	Tol.	lb	*G*	Tol.	*W*	Tol.	(*d*)	*Z*
NA1-118	1.188	1 3/16	30.2	1.098		0.050		0.078		0.187	0.132		0.072		5.6	1.118		0.056		0.035	0.105
NA1-125	1.250	1 1/4	31.7	1.156		0.050		0.078		0.187	0.140		0.076		5.9	1.176		0.056		0.037	0.111
NA1-131	1.312	1 5/16	33.3	1.214	+0.010	0.050	±0.002	0.078		0.187	0.146		0.079		6.8	1.232	±0.004	0.056		0.040	0.120
NA1-137	1.375	1 3/8	34.9	1.272	−0.015	0.050		0.078		0.188	0.152		0.082		7.2	1.291	0.005 (3)	0.056		0.042	0.126
NA1-143	1.438	1 7/16	36.5	1.333		0.050		0.078		0.188	0.160		0.086		8.1	1.350		0.056		0.044	0.132
NA1-150	1.500	1 1/2	38.1	1.387		0.050		0.120		0.218	0.168	±0.006	0.091	±0.006	9.0	1.406		0.056		0.047	0.141
NA1-156	1.562	1 9/16	39.7	1.446		0.062		0.125		0.239	0.172		0.093		12.4	1.468		0.068		0.047	0.141
NA1-162	1.625	1 5/8	41.3	1.503		0.062		0.125		0.239	0.180		0.097		13.2	1.529		0.068	+0.004	0.048	0.144
NA1-168	1.6888	1 11/16	42.9	1.560		0.062		0.125		0.239	0.184		0.099		14.8	1.589		0.068	−0.000	0.049	0.148
NA1-175	1.750	1 3/4	44.4	1.618	+0.013	0.062		0.125		0.241	0.188		0.101		15.3	1.650	±0.005	0.068		0.050	0.150
NA1-177	1.772	...	45.0	1.637	−0.020	0.062		0.125		0.241	0.190		0.102		15.4	1.669	0.005 (3)	0.068		0.051	0.154
NA1-181	1.812	1 13/16	46.0	1.675		0.062		0.125		0.242	0.192		0.102		16.2	1.708		0.068		0.052	0.156
NA1-187	1.875	1 7/8	47.6	1.735		0.062		0.125		0.243	0.196		0.104		17.3	1.769		0.068		0.053	0.159
NA1-196	1.969	1 31/32	50.0	1.819		0.062		0.125		0.266	0.200		0.106		18.0	1.857		0.068		0.056	0.168
NA1-200	2.000	2	50.8	1.850		0.062		0.125	+0.015	0.243	0.204		0.108		19.0	1.886		0.068		0.057	0.171
NA1-206	2.062	2 1/16	52.4	1.906		0.078		0.125	−0.002	0.272	0.208		0.111		25.0	1.946		0.086		0.058	0.174
NA1-212	2.125	2 1/8	54.0	1.964		0.078		0.125		0.272	0.212		0.113		26.1	2.003		0.086		0.061	0.183
NA1-215	2.156	2 5/32	54.8	1.993		0.078		0.125		0.272	0.212		0.113		26.3	2.032		0.086		0.062	0.186
NA1-225	2.250	2 1/4	57.1	2.081	+0.015	0.078		0.125		0.272	0.220		0.116		27.7	2.120		0.086		0.065	0.195
NA1-231	2.312	2 5/16	58.7	2.139	−0.025	0.078		0.125		0.272	0.222		0.118		28.0	2.178		0.086		0.067	0.201
NA1-237	2.375	2 3/8	60.3	2.197		0.078	±0.003	0.125		0.272	0.224		0.119		29.2	2.239		0.086		0.068	0.204
NA1-243	2.438	2 7/16	61.9	2.255		0.078		0.125		0.273	0.228	±0.007	0.120	±0.007	29.5	2.299		0.086		0.069	0.207
NA1-250	2.500	2 1/2	63.5	2.313		0.078		0.125		0.273	0.232		0.122		29.7	2.360		0.086		0.070	0.210
NA1-255	2.559	...	65.0	2.377		0.078		0.125		0.273	0.238		0.125		33.9	2.419	±0.006	0.086	+0.005	0.070	0.210
NA1-262	2.625	2 5/8	66.7	2.428		0.078		0.125		0.273	0.242		0.127		35.0	2.481	0.006 (3)	0.086	−0.000	0.072	0.216
NA1-268	2.688	2 11/16	68.3	2.485		0.078		0.125		0.273	0.246		0.129		36.0	2.541		0.086		0.073	0.219
NA1-275	2.750	2 3/4	69.8	2.543		0.093		0.125		0.329	0.248		0.131		42.5	2.602		0.103		0.074	0.222
NA1-287	2.875	2 7/8	73.0	2.659		0.093		0.125		0.313	0.256		0.133		48.5	2.721		0.103		0.077	0.231
NA1-293	2.938	2 15/16	74.6	2.717	+0.020	0.093		0.125		0.313	0.260		0.136		50.0	2.779		0.103		0.079	0.237
NA1-300	3.000	3	76.2	2.775	−0.030	0.093		0.125		0.313	0.264		0.138		52.0	2.838		0.103		0.081	0.243
NA1-306	3.062	3 1/16	77.8	2.832		0.093		0.125		0.303	0.252		0.131		47.5	2.898		0.103		0.082	0.246
NA1-312	3.125	3 1/8	79.4	2.892		0.093		0.125		0.313	0.272		0.141		58.0	2.957		0.103		0.084	0.252
NA1-315	3.156	3 5/32	80.2	2.920		0.093		0.125		0.313	0.274		0.143		59.0	2.986		0.103		0.085	0.255
NA1-325	3.250	3 1/4	82.5	3.006		0.093		0.125		0.313	0.280	±0.008	0.145	±0.008	62.0	3.076		0.103		0.087	0.261
NA1-334	3.346	3 11/32	85.0	3.092		0.093		0.125		0.313	0.286		0.147		64.0	3.166		0.103		0.090	0.270
NA1-343	3.438	3 7/16	87.3	3.179		0.093		0.125		0.313	0.292		0.148		66.0	3.257		0.103		0.090	0.270
NA1-350	3.500	3 1/2	88.9	3.237		0.109		0.125		0.293	0.285		0.148		72.0	3.316		0.120		0.092	0.276

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TABLE 6 NA1 BASIC EXTERNAL RETAINING RINGS (CONT'D)

Ring Series And Size No.	Shaft Diameter			Free Diameter		Thickness [Note (1)]		Hole Diameter		Lug Height (Max.)	Large Section		Small Section		Approx. Mass per 1000 Pcs.	Groove Dimensions					Edge Margin
																Diameter		Width		Depth	
	S, Dec.	*S*, Frac.	*S*, mm	*D*	Tol.	*T*	Tol.	*P*	Tol.	*B*	*E*	Tol.	*J*	Tol.	lb	*G*	Tol.	*W*	Tol.	(*d*)	*Z*
NA1-354	3.543	...	90	3.277		0.109		0.125		0.333	0.288		0.149		73.0	3.357		0.120		0.093	0.279
NA1-362	3.625	3 5/8	92.1	3.352		0.109		0.125		0.333	0.296		0.153		76.0	3.435		0.120		0.095	0.285
NA1-368	3.688	3 11/16	93.7	3.410		0.109		0.125		0.335	0.302		0.156		80.0	3.493		0.120		0.097	0.291
NA1-375	3.750	3 3/4	95.2	3.468		0.109		0.125		0.337	0.310	±0.008	0.160	±0.008	83.0	3.552		0.120		0.099	0.297
NA1-387	3.875	3 7/8	98.40	3.584		0.109		0.125	+0.015	0.335	0.318		0.163		88.0	3.673		0.120		0.101	0.303
NA1-393	3.938	3 15/16	100.0	3.642	+0.020	0.109	±0.003	0.125	−0.002	0.347	0.318		0.163		95.0	3.734	±0.006	0.120	+0.005	0.102	0.306
NA1-400	4.000	4	101.6	3.700	−0.030	0.109		0.125		0.357	0.318		0.163		101.0	3.792	0.006 (3)	0.120	−0.000	0.104	0.312
NA1-425	4.250	4 1/4	108.0	3.989		0.109		0.125		0.350	0.318		0.176		112.0	4.065		0.120		0.092	0.276
NA1-437	4.375	4 3/8	111.1	4.106		0.109		0.125		0.403	0.318		0.181		115.0	4.190		0.120		0.092	0.276
NA1-450	4.500	4 1/2	114.3	4.223		0.109		0.125		0.452	0.285		0.128		101.0	4.310		0.120		0.095	0.285
NA1-475	4.750	4 3/4	120.6	4.458		0.109		0.125		0.437	0.303		0.136		113.0	4.550		0.120		0.100	0.300
NA1-500	5.000	5	127.0	4.692		0.109		0.156		0.458	0.360	±0.010	0.194	±0.010	149.0	4.790		0.120		0.105	0.315
NA1-525	5.250	5 1/4	133.3	4.927		0.125		0.156		0.480	0.372		0.211		190.0	5.030		0.139		0.110	0.330
NA1-550	5.500	5 1/2	139.7	5.162	+0.020	0.125	±0.004	0.156		0.505	0.390		0.209		202.5	5.265	±0.007	0.139	+0.006	0.117	0.351
NA1-575	5.750	5 3/4	146.0	5.396	−0.040	0.125		0.156		0.526	0.408		0.220		220.0	5.505	0.006 (3)	0.139	−0.000	0.122	0.366
NA1-600	6.000	6	152.4	5.631		0.125		0.156		0.548	0.381		0.171		210.0	5.745		0.139		0.127	0.381
NA1-625	6.250	6 1/4	158.7	5.866		0.156		0.156		0.573	0.396		0.176		282.0	5.985		0.174		0.132	0.396
NA1-650	6.500	6 1/2	165.1	6.100	+0.020	0.156		0.156		0.598	0.438		0.236		330.0	6.225		0.174		0.137	0.411
NA1-675	6.750	6 3/4	171.4	6.335	−0.050	0.156		0.187	+0.020	0.620	0.456		0.246		356.0	6.465		0.174		0.142	0.426
NA1-700	7.000	7	177.8	6.570		0.156		0.187	−0.005	0.542	0.474		0.256		371.0	6.705		0.174		0.147	0.441
NA1-725	7.250	7 1/4	184.2	6.775		0.187		0.187		0.672	0.490		0.267		510.0	6.942		0.209		0.154	0.460
NA1-750	7.500	7 1/2	190.5	7.009		0.187		0.187		0.688	0.507		0.277		534.0	7.180		0.209		0.160	0.480
NA1-775	7.750	7 3/4	196.9	7.243	+0.050	0.187	±0.005	0.187		0.672	0.523	±0.015	0.285	±0.015	545.0	7.420	±0.008	0.209	+0.008	0.165	0.495
NA1-800	8.000	8	203.2	7.478	−0.130	0.187		0.187		0.747	0.540		0.294		640.0	7.660	0.006 (3)	0.209	−0.000	0.170	0.510
NA1-825	8.250	8 1/4	209.6	7.712		0.187		0.187		0.747	0.556		0.304		665.0	7.900		0.209		0.175	0.525
NA1-850	8.500	8 1/2	215.9	7.947		0.187		0.187		0.747	0.573		0.314		692.0	8.140		0.209		0.180	0.540
NA1-875	8.750	8 3/4	222.3	8.181		0.187		0.187		0.747	0.591		0.322		712.0	8.380		0.209		0.185	0.555
NA1-900	9.000	9	228.6	8.415		0.187		0.187		0.747	0.609		0.333		737.0	8.620		0.209		0.190	0.570
NA1-925	9.250	9 1/4	234.9	8.650		0.187		0.187		0.747	0.625		0.341		760.0	8.860		0.209		0.195	0.585
NA1-950	9.500	9 1/2	241.3	8.885		0.187		0.187		0.747	0.642		0.350		785.0	9.100		0.209		0.200	0.600
NA1-975	9.750	9 3/4	247.6	9.120		0.187		0.187		0.747	0.658		0.358		845.0	9.338		0.209		0.206	0.618
NA1-1000	10.000	10	254.0	9.355		0.187		0.187		0.747	0.675		0.367		910.0	9.575		0.209		0.212	0.636

GENERAL NOTE: For reference, see Table 6 Illustration beginning on page 9.

NOTES:

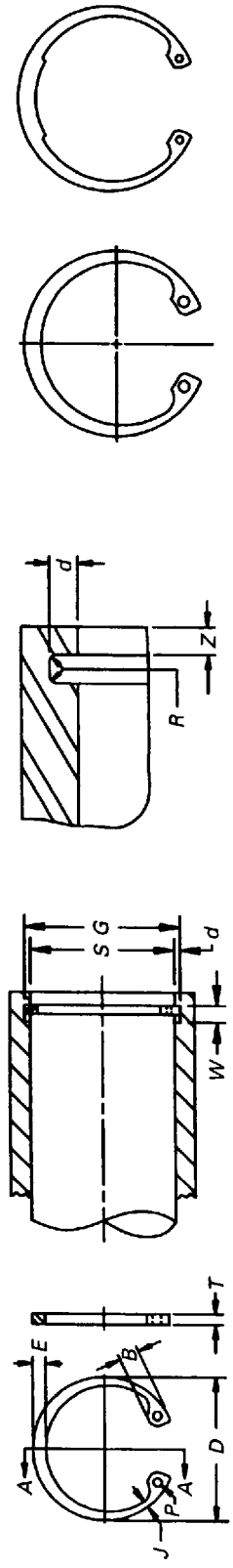
(1) For plated rings, add 0.002 in. to the listed maximum thickness except that maximum ring thickness after plating will be a minimum of 0.0002 in. less than the listed groove width (*W*) minimum.

(2) Sizes -12 through -23 available in beryllium copper only.

(3) *F.I.M. (Full Indicator Movement)*: maximum circular run out of groove to shaft.

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TABLE 7 ILLUSTRATION



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TABLE 7 NA2 BASIC INTERNAL RETAINING RINGS

Ring Series and Size No.	Housing Diameter			Free Diameter		Thickness [Note (1)]		Hole Diameter		Lug Height (Max.)	Large Section		Small Section		Approx. Mass per 1000 Pcs.	Groove Dimensions					Edge Margin
																Diameter		Width		Depth	
	S, Dec.	*S*, Frac.	*S*, mm	*D*	Tol.	*T*	Tol.	*P*	Tol.	*B*	*E*	Tol.	*J*	Tol.	lb	*G*	Tol.	*W*	Tol.	(*d*)	*Z*
NA2-25	0.250	1/4	6.4	0.280		0.015		0.031		0.068	0.025	±0.002	0.015	±0.002	0.08	0.268	±0.001	0.020	+0.002	0.009	0.027
NA2-31	0.312	5/16	7.9	0.346		0.015		0.031		0.069	0.033		0.018		0.11	0.330	0.0015 (2)	0.020	−0.000	0.009	0.027
NA2-37	0.375	3/8	9.5	0.415		0.025		0.041		0.085	0.040		0.028		0.25	0.397	±0.002	0.029		0.011	0.033
NA2-43	0.438	7/16	11.1	0.482		0.025		0.041		0.101	0.049	±0.003	0.029	±0.003	0.37	0.461	0.002 (2)	0.029		0.012	0.036
NA2-45	0.453	29/64	11.5	0.498		0.025		0.047		0.101	0.050		0.030		0.43	0.477		0.029		0.012	0.036
NA2-50	0.500	1/2	12.7	0.548	+0.010	0.035		0.047		0.117	0.053		0.035		0.70	0.530		0.039		0.015	0.045
NA2-51	0.512	...	13.0	0.560	−0.005	0.035		0.047		0.119	0.053		0.035		0.77	0.542		0.039		0.015	0.045
NA2-56	0.562	9/16	14.3	0.620		0.035		0.047	+0.010	0.137	0.053	±0.004	0.035	±0.004	0.86	0.596	±0.002	0.039		0.017	0.051
NA2-62	0.625	5/8	15.9	0.694		0.035		0.062	−0.002	0.137	0.060		0.035		1.0	0.665	0.004 (2)	0.039		0.020	0.060
NA2-68	0.688	11/16	17.5	0.763		0.035		0.062		0.137	0.063		0.036		1.2	0.732		0.039		0.022	0.066
NA2-75	0.750	3/4	19.0	0.831		0.035		0.062		0.147	0.070		0.040		1.3	0.796		0.039	+0.003	0.023	0.069
NA2-77	0.777	...	19.7	0.859		0.042		0.062		0.151	0.074		0.044		1.7	0.825		0.046	−0.000	0.024	0.072
NA2-81	0.812	13/16	20.6	0.901		0.042		0.062		0.160	0.077		0.044		1.9	0.862		0.046		0.025	0.075
NA2-86	0.866	...	22.0	0.961		0.042	±0.002	0.062		0.160	0.081		0.045		2.0	0.920		0.046		0.027	0.081
NA2-87	0.875	7/8	22.2	0.971		0.042		0.062		0.160	0.084		0.045		2.1	0.931	±0.003	0.046		0.028	0.084
NA2-90	0.901	...	22.9	1.000	+0.015	0.042		0.062		0.160	0.087	±0.005	0.047	±0.005	2.2	0.959	0.004 (2)	0.046		0.029	0.087
NA2-93	0.938	15/16	23.8	1.041	−0.010	0.042		0.062		0.160	0.091		0.050		2.4	1.000		0.046		0.031	0.093
NA2-100	1.000	1	25.4	1.111		0.042		0.062		0.160	0.104		0.052		2.7	1.066		0.046		0.033	0.099
NA2-102	1.023	...	26.0	1.136		0.042		0.062		0.160	0.106		0.054		2.8	1.091		0.046		0.034	0.102
NA2-106	1.062	1 1/16	27.0	1.180		0.050		0.078		0.185	0.110		0.055		3.7	1.130		0.056		0.034	0.102
NA2-112	1.125	1 1/8	28.6	1.249		0.050		0.078		0.185	0.116		0.057		4.0	1.197		0.056		0.036	0.108
NA2-118	1.181	...	30.0	1.319		0.050		0.078		0.185	0.120		0.058		4.3	1.255		0.056		0.037	0.111
NA2-118	1.188	1 3/16	30.2	1.319		0.050		0.078		0.185	0.120		0.058		4.3	1.262		0.056		0.037	0.111
NA2-125	1.250	1 1/4	31.7	1.388	+0.025	0.050		0.078		0.185	0.124		0.062		4.8	1.330		0.056		0.040	0.120
NA2-125	1.259	...	32.0	1.388	−0.020	0.050		0.078	+0.015	0.185	0.124	±0.006	0.062	±0.006	4.8	1.339	±0.004	0.056		0.040	0.120
NA2-131	1.312	1 5/16	33.3	1.456		0.050		0.078	−0.002	0.185	0.130		0.062		5.0	1.396	0.005 (2)	0.056		0.042	0.126
NA2-137	1.375	1 3/8	34.9	1.526		0.050		0.078		0.185	0.130		0.063		5.1	1.461		0.056		0.043	0.129
NA2-137	1.378	...	35.0	1.526		0.050		0.078		0.185	0.130		0.063		5.1	1.464		0.056	+0.004	0.043	0.129
NA2-143	1.438	1 7/16	36.5	1.596		0.050		0.078		0.185	0.133		0.065		5.8	1.528		0.056	−0.000	0.045	0.135
NA2-145	1.456	...	37.0	1.616		0.050		0.078		0.185	0.133		0.065		6.4	1.548		0.056		0.046	0.138
NA2-150	1.500	1 1/2	38.1	1.660		0.050		0.078		0.185	0.133		0.066		6.5	1.594		0.056		0.047	0.141
NA2-156	1.562	1 9/16	39.7	1.734		0.062		0.078		0.207	0.157		0.078		8.9	1.658		0.068		0.048	0.144
NA2-156	1.575	...	40.0	1.734	+0.035	0.062		0.078		0.207	0.157		0.078		8.9	1.671	±0.005	0.068		0.048	0.144
NA2-162	1.625	1 5/8	41.3	1.804	−0.025	0.062	±0.003	0.078		0.232	0.164	±0.007	0.082	±0.007	10.0	1.725	0.005 (2)	0.068		0.050	0.150
NA2-165	1.653	...	42.0	1.835		0.062		0.078		0.235	0.167		0.083		10.4	1.755		0.068		0.051	0.153
NA2-168	1.688	1 11/16	42.9	1.874		0.062		0.078		0.235	0.170		0.085		10.8	1.792		0.068		0.052	0.156

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TABLE 7 NA2 BASIC INTERNAL RETAINING RINGS (CONT'D)

Ring Series and Size No.	Housing Diameter			Free Diameter		Thickness [Note (1)]		Hole Diameter		Lug Height (Max.)	Large Section		Small Section		Approx. Mass per 1000 Pcs.	Groove Dimensions					Edge Margin
																Diameter		Width		Depth	
	S, Dec.	*S*, Frac.	*S*, mm	*D*	Tol.	*T*	Tol.	*P*	Tol.	*B*	*E*	Tol.	*J*	Tol.	lb	*G*	Tol.	*W*	Tol.	(*d*)	*Z*
NA2-175	1.750	1 3/4	44.4	1.942		0.062		0.078		0.239	0.171		0.083		10.3	1.858		0.068		0.054	0.162
NA2-181	1.812	1 13/16	46.0	2.012		0.062		0.093		0.239	0.170		0.085		11.5	1.922		0.068		0.055	0.165
NA2-185	1.850	...	47.0	2.054	+0.035	0.062		0.093		0.239	0.170		0.085		12.8	1.962	±0.005	0.068	+0.004	0.056	0.168
NA2-187	1.875	1 7/8	47.6	2.072	−0.025	0.062		0.093		0.239	0.170		0.085		12.8	1.989	0.005 (2)	0.068	−0.000	0.057	0.171
NA2-193	1.938	1 15/16	49.2	2.141		0.062		0.093		0.235	0.170		0.085		13.3	2.056		0.068		0.059	0.177
NA2-200	2.000	2	50.8	2.210		0.062		0.093		0.245	0.170		0.085		14.0	2.122		0.068		0.061	0.183
NA2-206	2.047	...	52.0	2.280		0.078		0.093		0.255	0.186		0.091		18.0	2.171		0.086		0.062	0.186
NA2-206	2.062	2 1/16	52.4	2.280		0.078		0.093		0.255	0.186		0.091		18.0	2.186		0.086		0.062	0.186
NA2-212	2.125	2 1/8	54.0	2.350		0.078		0.093		0.265	0.195		0.096		19.4	2.251		0.086		0.063	0.189
NA2-218	2.165	...	55.0	2.415		0.078		0.093		0.269	0.199		0.098		19.6	2.295		0.086		0.065	0.195
NA2-218	2.188	2 3/16	55.6	2.415		0.078		0.093		0.269	0.199		0.098		19.6	2.318		0.086		0.065	0.195
NA2-225	2.250	2 1/4	57.1	2.490		0.078		0.093		0.285	0.203	±0.007	0.099	±0.007	21.8	2.382		0.086		0.066	0.198
NA2-231	2.312	2 5/16	58.7	2.535		0.078		0.093		0.285	0.206		0.100		22.6	2.450		0.086		0.069	0.207
NA2-237	2.375	2 3/8	60.3	2.630		0.078		0.093		0.285	0.207		0.102		23.2	2.517		0.086		0.071	0.213
NA2-244	2.440	2 7/16	62.0	2.702	+0.040	0.078	±0.003	0.110	+0.015	0.285	0.209		0.103		25.4	2.584		0.086		0.072	0.216
NA2-250	2.500	2 1/2	63.5	2.775	0.030	0.078		0.110	−0.002	0.285	0.210		0.103		25.5	2.648		0.086		0.074	0.222
NA2-250	2.531	2 17/32	64.3	2.775		0.078		0.110		0.285	0.210		0.103		25.5	2.681		0.086		0.075	0.225
NA2-256	2.562	2 9/16	65.1	2.844		0.093		0.110		0.305	0.222		0.109		34.0	2.714		0.103		0.076	0.228
NA2-262	2.625	2 5/8	66.7	2.910		0.093		0.110		0.295	0.226		0.111		34.5	2.781	±0.006	0.103	+0.005	0.078	0.234
NA2-268	2.677	...	68.0	2.980		0.093		0.110		0.305	0.230		0.113		35.0	2.837	0.006 (2)	0.103	−0.000	0.080	0.240
NA2-268	2.688	2 11/16	68.3	2.980		0.093		0.110		0.305	0.230		0.113		35.0	2.848		0.103		0.080	0.240
NA2-275	2.750	2 3/4	69.8	3.050		0.093		0.110		0.305	0.234		0.115		35.5	2.914		0.103		0.082	0.246
NA2-281	2.812	2 13/16	71.4	3.121		0.093		0.110		0.305	0.230		0.115		36.0	2.980		0.103		0.084	0.252
NA2-281	2.835	...	72.0	3.121		0.093		0.110		0.305	0.230		0.115		36.0	3.006		0.103		0.085	0.255
NA2-287	2.875	2 7/8	73.0	3.191		0.093		0.110		0.315	0.240		0.120		41.0	3.051		0.103		0.088	0.264
NA2-295	2.953	...	75.0	3.325		0.093		0.110		0.315	0.250		0.122		42.5	3.135		0.103		0.091	0.273
NA2-300	3.000	3	76.2	3.325		0.093		0.110		0.329	0.250		0.122		42.5	3.182		0.103		0.091	0.273
NA2-306	3.062	3 1/16	77.8	3.418		0.109		0.125		0.318	0.254		0.126		53.0	3.248		0.120		0.093	0.279
NA2-312	3.125	3 1/8	79.4	3.488		0.109		0.125		0.318	0.259		0.129		56.0	3.315		0.120		0.095	0.285
NA2-315	3.149	...	80.0	3.523		0.109		0.125		0.318	0.262		0.129		57.0	3.341		0.120		0.096	0.288
NA2-315	3.156	3 5/32	80.2	3.523	±0.055	0.109		0.125		0.318	0.262	±0.008	0.129	±0.008	57.0	3.348		0.120		0.096	0.288
NA2-325	3.250	3 1/4	82.5	3.623		0.109		0.125		0.350	0.269		0.135		60.0	3.446		0.120		0.098	0.294
NA2-334	3.346	3 11/32	85.0	3.734		0.109		0.125		0.350	0.276		0.140		65.0	3.546		0.120		0.100	0.300
NA2-347	3.469	3 15/32	88.1	3.857		0.109		0.125		0.350	0.286		0.144		69.0	3.675		0.120		0.103	0.309
NA2-350	3.500	3 1/2	88.9	3.890		0.109		0.125		0.350	0.289		0.142		71.0	3.710		0.120		0.105	0.315

(continued)

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TABLE 7 NA2 BASIC INTERNAL RETAINING RINGS (CONT'D)

Ring Series and Size No.	Housing Diameter			Free Diameter		Thickness [Note (1)]		Hole Diameter		Lug Height (Max.)	Large Section		Small Section		Approx. Mass per 1000 Pcs.	Groove Dimensions					Edge Margin
																Diameter		Width		Depth	
	S, Dec.	*S*, Frac.	*S*, mm	*D*	Tol.	*T*	Tol.	*P*	Tol.	*B*	*E*	Tol.	*J*	Tol.	lb	*G*	Tol.	*W*	Tol.	(*d*)	*Z*
NA2-354	3.562	3 9/16	90.5	3.936	±0.055	0.109		0.125		0.350	0.292		0.142		72.0	3.776		0.120		0.107	0.321
NA2-362	3.625	3 5/8	92.1	4.024		0.109		0.125		0.350	0.299		0.150		73.0	3.841		0.120		0.108	0.324
NA2-375	3.740	...	95.0	4.157		0.109		0.125		0.350	0.309		0.155		78.0	3.964		0.120		0.112	0.336
NA2-375	3.750	3 3/4	95.2	4.157		0.109		0.125	+0.015	0.350	0.309	±0.008	0.155	±0.008	78.0	3.974		0.120		0.112	0.336
NA2-387	3.875	3 7/8	98.4	4.291		0.109		0.125	−0.002	0.378	0.319		0.160		87.0	4.107		0.120		0.116	0.348
NA2-393	3.938	3 15/16	100.0	4.358		0.109		0.125		0.378	0.324		0.161		88.0	4.174		0.120		0.118	0.354
NA2-400	4.000	4	101.6	4.424		0.109	±0.003	0.125		0.378	0.330		0.166		93.0	4.240	±0.006	0.120	+0.005	0.120	0.360
NA2-412	4.125	4 1/8	104.8	4.558		0.109		0.125		0.378	0.330		0.171		97.0	4.365	0.006 (2)	0.120	−0.000	0.120	0.360
NA2-425	4.250	4 1/4	108.0	4.691		0.109		0.125		0.378	0.335		0.180		101.0	4.490		0.120		0.120	0.360
NA2-433	4.331	...	110.0	4.756		0.109		0.156		0.413	0.343		0.180		105.0	4.571		0.120		0.120	0.360
NA2-450	4.500	4 1/2	114.3	4.940		0.109		0.156		0.413	0.351		0.181		111.0	4.740		0.120		0.120	0.360
NA2-462	4.625	4 5/8	117.5	5.076		0.109		0.156		0.413	0.360		0.183		117.0	4.865		0.120		0.120	0.360
NA2-475	4.724	...	120.0	5.213	±0.065	0.109		0.156		0.413	0.370		0.183		124.0	4.969		0.120		0.122	0.366
NA2-475	4.750	4 3/4	120.6	5.213		0.109		0.156		0.413	0.370		0.183		124.0	4.995		0.120		0.122	0.366
NA2-500	5.000	5	127.0	5.485		0.109		0.156		0.443	0.390	±0.009	0.186	±0.009	136.0	5.260		0.120		0.130	0.390
NA2-525	5.250	5 1/4	133.3	5.770		0.125		0.156		0.465	0.408		0.198		174.0	5.520		0.139		0.135	0.405
NA2-537	5.375	5 3/8	136.5	5.910		0.125		0.156		0.465	0.408		0.198		179.0	5.650	±0.007	0.139	+0.006	0.135	0.405
NA2-550	5.500	5 1/2	139.7	6.066		0.125	±0.004	0.156		0.465	0.408		0.198		183.0	5.770	0.006 (2)	0.139	−0.000	0.135	0.405
NA2-575	5.750	5 3/4	146.0	6.336		0.125		0.156		0.465	0.408		0.198		192.0	6.020		0.139		0.135	0.405
NA2-600	6.000	6	152.4	6.620		0.125		0.156		0.465	0.408		0.196		201.0	6.270		0.139		0.135	0.405
NA2-625	6.250	6 1/4	158.7	6.895		0.156		0.187		0.495	0.423		0.211		266.0	6.530		0.174		0.140	0.420
NA2-650	6.500	6 1/2	165.1	7.170		0.156		0.187		0.495	0.438		0.219		281.0	6.790		0.174		0.145	0.435
NA2-662	6.625	6 5/8	168.3	7.308	±0.080	0.156		0.187	+0.020	0.495	0.447		0.221		305.0	6.925		0.174		0.150	0.450
NA2-675	6.750	6 3/4	171.4	7.445		0.156		0.187	−0.005	0.540	0.456		0.224		325.0	7.055		0.174		0.152	0.456
NA2-700	7.000	7	177.8	7.720		0.156		0.187		0.540	0.474		0.232		344.0	7.315		0.174		0.157	0.471
NA2-725	7.250	7 1/4	184.1	7.995		0.187		0.187		0.570	0.489		0.238		428.0	7.575		0.209		0.162	0.486
NA2-750	7.500	7 1/2	190.5	8.270		0.187		0.187		0.570	0.507		0.247		485.0	7.840		0.209		0.170	0.510
NA2-775	7.750	7 3/4	196.8	8.545		0.187		0.187		0.570	0.523		0.255		520.0	8.100	±0.008	0.209	+0.008	0.175	0.525
NA2-800	8.000	8	203.2	8.820		0.187	±0.005	0.187		0.610	0.540		0.262		555.0	8.360	0.006 (2)	0.209	−0.000	0.180	0.540
NA2-825	8.250	8 1/4	209.5	9.095		0.187		0.187		0.610	0.558		0.270	±0.010	603.0	8.620		0.209		0.185	0.555
NA2-850	8.500	8 1/2	215.9	9.285		0.187		0.187		0.670	0.573		0.277		634.0	8.880		0.209		0.190	0.570
NA2-875	8.750	8 3/4	222.2	9.558	±0.090	0.187		0.187		0.670	0.591	±0.010	0.286		653.0	9.145		0.209		0.197	0.591
NA2-900	9.000	9	228.6	9.830		0.187		0.187		0.670	0.609		0.294		732.0	9.405		0.209		0.202	0.606
NA2-925	9.250	9 1/4	235.0	10.102		0.187		0.187		0.670	0.625		0.299		767.0	9.668		0.209		0.209	0.627
NA2-950	9.500	9 1/2	241.3	10.375		0.187		0.187		0.745	0.642		0.304		803.0	9.930		0.209		0.215	0.645
NA2-975	9.750	9 3/4	247.7	10.648		0.187		0.187		0.745	0.658		0.309		833.0	10.190		0.209		0.220	0.660
NA2-1000	10.000	10	254.0	10.920		0.187		0.187		0.745	0.675		0.315		863.0	10.450		0.209		0.225	0.675

GENERAL NOTE: For reference, see Table 7 Illustration beginning on page 13.

NOTES:

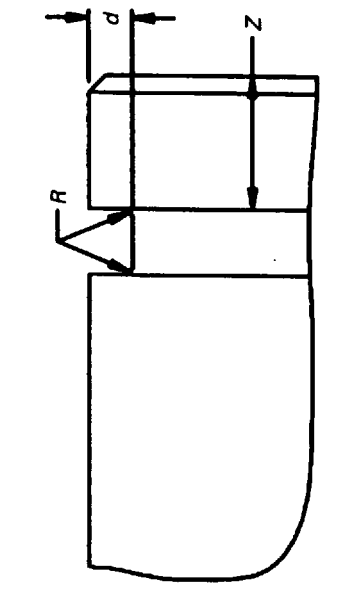
(1) For plated rings add 0.002 in. to the listed maximum thickness except that maximum thickness after plating will be a minimum of 0.0002 in. less than the listed groove width (*W*) minimum.

(2) *F.I.M. (Full Indicator Movement)*: maximum circular run out of groove to housing.

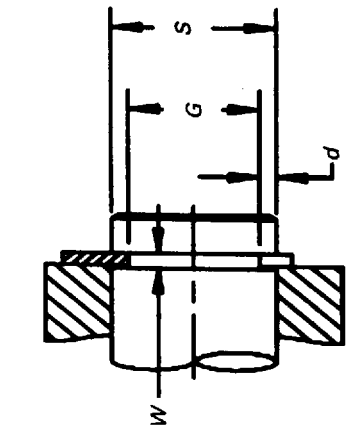
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EXTERNAL TYPE NA1, INTERNAL TYPE NA2,
E-RING TYPE NA3

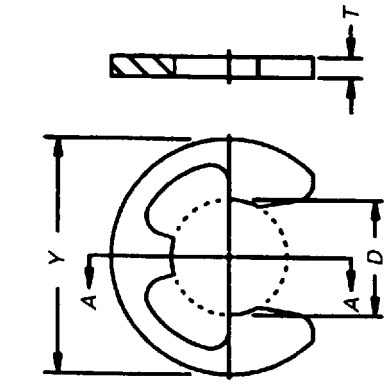
TABLE 8 ILLUSTRATION



Exploded Groove Profile & Edge Margin (Z)
Maximum bottom radii (R), Sharp corners-
for ring sizes -4 thru -6; 0.005 For sizes S9 thru -25; 0.010
For sizes S31 thru -43; 0.015 For sizes -50 thru S137



Detail of Groove



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TABLE 8 NA3 (E-TYPE) EXTERNAL RETAINING RINGS

Ring Series and Size No.	Shaft Diameter			Ring Size and Weight						Groove Size					Edge Margin
				Free Diameter		Thickness [Note (1)]		Free Outside Dia. Nom.	Approx. Mass per 1000 Pcs.	Diameter		Width		Depth	
	S, Dec.	*S*, Frac.	*S*, mm	*D*	Tol.	*T*	Tol.	*Y*	lb	*G*	Tol.	*W*	Tol.	(*d*)	*Z*
NA3-4 (2)	0.040	...	1.0	0.025		0.010	±.001	0.079	0.009	0.026		0.012		0.007	0.014
NA3-S6	0.062	1/16	1.6	0.051	+0.001	0.010		0.140	0.028	0.052		0.012		0.005	0.010
NA3-Y6	0.062	1/16	1.6	0.051	−0.003	0.020	±0.002	0.187	0.094	0.052		0.023		0.005	0.010
NA3-6	0.062	1/16	1.6	0.051		0.010	±0.001	0.156	0.030	0.052	+0.002	0.012		0.005	0.010
NA3-9	0.094	3/32	2.4	0.069	+0.002/-0.003	0.015		0.230	0.10	0.074	−0.000	0.020	+0.002	0.010	0.020
NA3-S9	0.094	3/32	2.4	0.073		0.015		0.187	0.058	0.074	0.0015 (3)	0.020	−0.000	0.010	0.020
NA3-S11	0.110	7/64	2.8	0.076		0.015		0.375	0.31	0.079		0.020		0.015	0.030
NA3-S12	0.125	1/8	3.2	0.094		0.025		0.214	0.12	0.095		0.029		0.015	0.030
NA3-12	0.125	1/8	3.2	0.094		0.015		0.230	0.087	0.095		0.020		0.015	0.030
NA3-S14	0.140	9/64	3.6	0.100		0.015		0.203	0.060	0.102		0.020		0.019	0.038
NA3-Y14	0.140	9/64	3.6	0.108		0.015		0.250	0.10	0.110		0.020		0.015	0.030
NA3-14	0.140	9/64	3.6	0.102	+0.001	0.025		0.270	0.21	0.105		0.029		0.017	0.034
NA3-S15	0.156	5/32	4.0	0.116	−0.003	0.042		0.375	0.76	0.118		0.046		0.019	0.038
NA3-15	0.156	5/32	4.0	0.114		0.025		0.282	0.21	0.116	+0.002	0.029		0.020	0.040
NA3-S17	0.172	11/64	4.4	0.125		0.025		0.312	0.24	0.127	−0.000	0.029		0.022	0.044
NA3-S18	0.188	3/16	4.8	0.122		0.025		0.375	0.45	0.125	0.002 (3)	0.029		0.031	0.062
NA3-Y18	0.188	3/16	4.8	0.145		0.025		0.470	0.70	0.147		0.029		0.020	0.040
NA3-18	0.188	3/16	4.8	0.145		0.025		0.335	0.29	0.147		0.029		0.020	0.040
NA3-S21	0.219	7/32	5.6	0.185		0.025	±0.002	0.437	0.47	0.188		0.029		0.015	0.030
NA3-25	0.250	1/4	6.3	0.207		0.025		0.527	0.76	0.210		0.029		0.020	0.040
NA3-S31	0.312	5/16	7.9	0.243		0.025		0.500	0.57	0.250		0.029		0.031	0.062
NA3-Y31	0.312	5/16	7.9	0.243		0.025		0.670	1.22	0.250		0.029	+0.003	0.031	0.062
NA3-S37	0.375	3/8	9.5	0.303	+0.002	0.035		0.567	1.05	0.306		0.039	−0.000	0.034	0.068
NA3-37	0.375	3/8	9.5	0.300	−0.004	0.035		0.660	1.5	0.303		0.039		0.036	0.072
NA3-43	0.438	7/16	11.1	0.337		0.035		0.687	1.5	0.343	+0.003	0.039		0.047	0.094
NA3-S43	0.438	7/16	11.1	0.375		0.035		0.600	1.0	0.380	−0.000	0.039		0.029	0.058
NA3-50	0.500	1/2	12.7	0.392		0.042		0.800	2.5	0.396	0.004 (3)	0.046		0.052	0.104
NA3-62	0.625	5/8	15.9	0.480		0.042		0.940	3.2	0.485		0.046		0.070	0.140
NA3-S74	0.750	3/4	19.0	0.616		0.050		1	4.3	0.625		0.056		0.062	0.124
NA3-75	0.750	3/4	19.0	0.574	+0.003	0.050		1.12	5.8	0.580		0.056		0.085	0.170
NA3-87	0.875	7/8	22.2	0.668	−0.005	0.050		1.3	7.6	0.675		0.056		0.100	0.200
NA3-S98	0.984	63/64	25.0	0.822		0.050		1.5	9.2	0.835		0.056		0.074	0.148
NA3-S98	1.000	1	25.4	0.822		0.050		1.5	9.2	0.835		0.056		0.082	0.164
NA3-S118	1.188	1 3/16	30.2	1.066	+0.006	0.062	±0.003	1.626	11.3	1.079	+0.005/−0.000	0.068	+0.004	0.054	0.108
NA3-S137	1.375	1 3/8	34.9	1.213	−0.010	0.062		1.875	15.4	1.230	0.005 (3)	0.068	−0.000	0.072	0.144

GENERAL NOTE: For reference, see Table 8 Illustration on previous page.

NOTES:

(1) For plated rings, add 0.002 in. to the listed maximum thickness except that maximum thickness after plating will be a minimum of 0.0002 in. less than the listed groove width (*W*) minimum.

(2) Available in beryllium copper only.

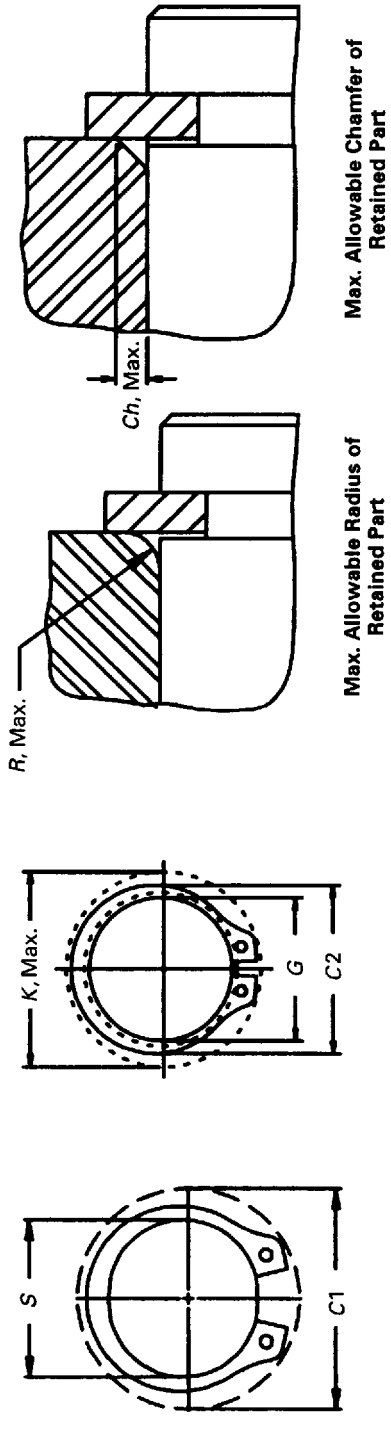
(3) *F.I.M. (Full Indicator Movement)*: maximum circular run out of groove to shaft.

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MANDATORY APPENDIX I
BASIC EXTERNAL SERIES NA1

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TABLE I ILLUSTRATION



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TABLE I NA1 BASIC EXTERNAL RETAINING RINGS

Ring Series and Size No.	Clearance Diameter		Gaging Diameter	Allowable Thrust Loads Square Corner Abutment		Maximum Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.	Calculated Allowable Assembly [Note (1)]
	Ring Expanded Over Shaft	Ring Seated in Groove	For Checking Ring When Seated in Groove	UNS G10600–G10900 and Stainless Steel Rings Used on Hardened Shafts (50 HRc, Min.)	All Standard Rings Used on Low Carbon Steel Shafts				
	C1	C2	*K*, Max.	*Pr* (lb) [Note (1)]	*Pg* (lb)	*R*, Max.	*Ch*, Max.	*P'r* (lb)	RPM
NA1-12 (1)	0.222	0.214	0.148	112	35	0.010	0.006	45	80000
NA1-15 (1)	0.270	0.260	0.189	132	55	0.015	0.009	45	80000
NA1-18 (1)	0.298	0.286	0.218	244	80	0.014	0.0085	105	80000
NA1-19 (1)	0.319	0.307	0.229	254	85	0.0145	0.009	105	80000
NA1-21 (1)	0.338	0.324	0.252	284	110	0.015	0.009	105	80000
NA1-23 (1)	0.355	0.341	0.272	315	120	0.0165	0.010	105	80000
NA1-25	0.45	0.43	0.290	599	175	0.018	0.011	470	80000
NA1-27	0.48	0.46	0.315	660	195	0.0175	0.0105	470	76000
NA1-28	0.49	0.47	0.326	670	200	0.020	0.012	470	74000
NA1-31	0.54	0.52	0.357	751	240	0.020	0.012	470	70000
NA1-34	0.57	0.55	0.390	812	265	0.021	0.0125	470	64000
NA1-35	0.59	0.57	0.405	832	300	0.023	0.014	470	62000
NA1-37	0.61	0.59	0.433	883	320	0.026	0.0155	470	60000
NA1-39	0.62	0.60	0.452	954	335	0.027	0.016	470	56500
NA1-40	0.63	0.61	0.468	964	350	0.0285	0.017	470	55000
NA1-43	0.66	0.64	0.501	1035	400	0.029	0.0175	470	50000
NA1-46	0.68	0.66	0.540	1117	450	0.031	0.018	470	42000
NA1-50	0.77	0.74	0.574	1675	550	0.034	0.020	910	40000
NA1-55	0.81	0.78	0.611	1800	600	0.027	0.0165	910	36000
NA1-56	0.82	0.79	0.644	1878	650	0.038	0.023	910	35000
NA1-59	0.86	0.83	0.680	1979	750	0.0395	0.0235	910	32000
NA1-62	0.90	0.87	0.715	2091	800	0.0415	0.025	910	30000
NA1-66	0.93	0.89	0.756	2233	950	0.040	0.024	910	29000
NA1-66	0.93	0.89	0.758	2233	950	0.040	0.024	910	29000
NA1-68	1.01	0.97	0.779	3451	1000	0.042	0.025	1340	28000
NA1-75	1.09	1.05	0.850	3756	1200	0.046	0.0275	1340	26500
NA1-78	1.12	1.08	0.883	3959	1300	0.047	0.028	1340	25500
NA1-81	1.15	1.10	0.914	4060	1450	0.047	0.028	1340	24500
NA1-84	1.18	1.13	0.950	4200	1500	0.047	0.028	1340	24000
NA1-87	1.21	1.16	0.987	4365	1650	0.051	0.0305	1340	23000

(continued)

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TABLE I NA1 BASIC EXTERNAL RETAINING RINGS (CONT'D)

Ring Series and Size No.	Clearance Diameter		Gaging Diameter	Allowable Thrust Loads Square Corner Abutment		Maximum Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.	Calculated Allowable Assembly [Note (1)]
	Ring Expanded Over Shaft	Ring Seated in Groove	For Checking Ring When Seated in Groove	UNS G10600–G10900 and Stainless Steel Rings Used on Hardened Shafts (50 HRc, Min.)	All Standard Rings Used on Low Carbon Steel Shafts				
	C1	C2	*K*, Max.	*Pr* (lb) [Note (1)]	*Pg* (lb)	*R*, Max.	*Ch*, Max.	*P'r* (lb)	RPM
NA1-93	1.34	1.29	1.054	4720	1850	0.055	0.033	1340	21500
NA1-98	1.39	1.34	1.106	4923	2000	0.056	0.0335	1340	20500
NA1-100	1.41	1.35	1.122	5024	2100	0.057	0.034	1340	20000
NA1-102	1.43	1.37	1.147	5126	2250	0.058	0.035	1340	19500
NA1-106	1.50	1.44	1.192	6293	2400	0.060	0.036	1950	19000
NA1-112	1.55	1.49	1.261	6699	2600	0.063	0.038	1950	18800
NA1-118	1.61	1.54	1.325	7105	2950	0.064	0.0385	1950	18000
NA1-125	1.69	1.62	1.396	7460	3250	0.068	0.041	1950	17000
NA1-131	1.75	1.67	1.458	7866	3700	0.068	0.041	1950	16500
NA1-137	1.80	1.72	1.529	8222	4100	0.072	0.043	1950	16000
NA1-143	1.87	1.79	1.600	8628	4500	0.076	0.045	1950	15000
NA1-150	1.99	1.90	1.668	8932	5000	0.079	0.047	1950	14800
NA1-156	2.10	2.01	1.740	11571	5200	0.082	0.049	3000	14000
NA1-162	2.17	2.08	1.812	12028	5500	0.087	0.052	3000	13200
NA1-168	2.24	2.15	1.877	12535	5850	0.090	0.054	3000	13000
NA1-175	2.31	2.21	1.945	12992	6200	0.091	0.054	3000	12200
NA1-177	2.33	2.23	1.967	13144	6400	0.092	0.055	3000	11700
NA1-181	2.38	2.28	2.010	13449	6650	0.092	0.055	3000	11500
NA1-187	2.44	2.34	2.076	13906	7000	0.094	0.056	3000	11000
NA1-196	2.54	2.43	2.170	14565	7800	0.094	0.056	3000	10500
NA1-200	2.55	2.44	2.205	14819	8050	0.096	0.057	3000	10000
NA1-206	2.68	2.57	2.275	19234	8450	0.098	0.059	5000	9600
NA1-212	2.75	2.63	2.337	19793	9150	0.098	0.059	5000	9500
NA1-215	2.78	2.66	2.366	20097	9450	0.097	0.058	5000	9400
NA1-225	2.87	2.74	2.466	21011	10350	0.100	0.060	5000	9200
NA1-231	2.94	2.81	2.528	21518	10950	0.100	0.060	5000	9000
NA1-237	3.01	2.88	2.591	22127	11400	0.100	0.060	5000	8800
NA1-243	3.07	2.94	2.657	22736	11900	0.102	0.061	5000	8600
NA1-250	3.12	2.98	2.724	23345	12350	0.104	0.062	5000	8400
NA1-255	3.18	3.04	2.792	23853	12650	0.108	0.065	5000	8200

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TABLE I NA1 BASIC EXTERNAL RETAINING RINGS (CONT'D)

Ring Series and Size No.	Clearance Diameter		Gaging Diameter	Allowable Thrust Loads Square Corner Abutment		Maximum Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.	Calculated Allowable Assembly [Note (1)]
	Ring Expanded Over Shaft	Ring Seated in Groove	For Checking Ring When Seated in Groove	SAE UNS G10600–G10900 and Stainless Steel Rings Used on Hardened Shafts (50 HRc, Min.)	All Standard Rings Used on Low Carbon Steel Shafts				
	C1	C2	*K*, Max.	*Pr* (lb) [Note (1)]	*Pg* (lb)	*R*, Max.	*Ch*, Max.	*P'r* (lb)	RPM
NA1-262	3.25	3.11	2.860	24462	13350	0.1095	0.066	5000	8000
NA1-268	3.32	3.18	2.926	25071	13850	0.1115	0.067	5000	7900
NA1-275	3.45	3.31	2.992	30551	14400	0.112	0.067	7350	7600
NA1-287	3.57	3.42	3.122	31973	15650	0.115	0.069	7350	7300
NA1-293	3.64	3.49	3.187	32683	16400	0.116	0.070	7350	7200
NA1-300	3.69	3.53	3.252	33394	17200	0.117	0.070	7350	6700
NA1-306	3.74	3.58	3.294	34003	17750	0.107	0.064	7350	6600
NA1-312	3.82	3.66	3.383	34815	18550	0.120	0.072	7350	6600
NA1-315	3.85	3.68	3.415	35119	18950	0.1205	0.072	7350	6500
NA1-325	3.95	3.78	3.515	36134	20000	0.123	0.074	7350	6400
NA1-334	4.04	3.87	3.613	37251	21000	0.126	0.076	7350	6000
NA1-343	4.14	3.96	3.712	38266	21900	0.129	0.077	7350	5900
NA1-350	4.25	4.07	3.764	45574	22800	0.122	0.073	10500	5900
NA1-354	4.29	4.11	3.809	46183	23300	0.123	0.074	10500	5800
NA1-362	4.37	4.18	3.898	47299	24300	0.127	0.076	10500	5700
NA1-368	4.43	4.24	3.966	48010	25300	0.130	0.078	10500	5600
NA1-375	4.50	4.31	4.037	48822	26200	0.133	0.080	10500	5500
NA1-387	4.60	4.40	4.169	50446	27700	0.137	0.082	10500	5100
NA1-393	4.70	4.50	4.230	51359	28400	0.137	0.082	10500	5200
NA1-400	4.78	4.58	4.288	52171	29400	0.135	0.081	10500	5000
NA1-425	5.09	4.91	4.558	55419	27600	0.146	0.088	10500	4800
NA1-437	5.22	5.04	4.683	57043	28400	0.146	0.088	10500	4700
NA1-450	5.37	5.18	4.730	58667	30200	0.102	0.061	10500	4500
NA1-475	5.67	5.47	4.996	61915	33600	0.115	0.069	10500	4200
NA1-500	5.96	5.75	5.346	65163	37100	0.165	0.099	10500	4000
NA1-525	6.27	6.05	5.605	78460	40800	0.169	0.101	13500	3900
NA1-550	6.57	6.34	5.867	82215	45500	0.175	0.105	13500	3700
NA1-575	6.86	6.62	6.134	85971	49600	0.184	0.110	13500	3500
NA1-600	7.16	6.91	6.302	89625	53800	0.143	0.086	13500	3400
NA1-625	7.46	7.20	6.568	116522	58300	0.148	0.089	21000	3100

(continued)

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TABLE I NA1 BASIC EXTERNAL RETAINING RINGS (CONT'D)

Ring Series and Size No.	Clearance Diameter		Gaging Diameter	Allowable Thrust Loads Square Corner Abutment		Maximum Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.	Calculated Allowable Assembly [Note (1)]
	Ring Expanded Over Shaft	Ring Seated in Groove	For Checking Ring When Seated in Groove	UNS G10600–G10900 and Stainless Steel Rings Used on Hardened Shafts (50 HRc, Min.)	All Standard Rings Used on Low Carbon Steel Shafts				
	C1	C2	*K*, Max.	*Pr* (lb) [Note (1)]	*Pg* (lb)	*R*, Max.	*Ch*, Max.	*P'r* (lb)	RPM
NA1-650	7.87	7.60	6.905	121191	62900	0.191	0.114	21000	3000
NA1-675	8.06	7.78	7.172	125860	67700	0.200	0.120	21000	3000
NA1-700	8.15	8.07	7.439	130529	72700	0.208	0.125	21000	2900
NA1-725	7.85	8.39	7.700	162096	78900	0.214	0.128	30000	2800
NA1-750	8.96	8.64	7.963	167678	84800	0.220	0.132	30000	2700
NA1-775	9.20	8.87	8.228	173261	90450	0.227	0.136	30000	2600
NA1-800	9.60	9.26	8.493	178843	96100	0.235	0.141	30000	2500
NA1-825	9.85	9.50	8.758	184426	102100	0.242	0.146	30000	2400
NA1-850	10.10	9.74	9.023	190008	108100	0.250	0.150	30000	2300
NA1-875	10.40	10.00	9.280	195591	114450	0.258	0.155	30000	2200
NA1-900	10.60	10.22	9.557	201173	120800	0.267	0.160	30000	2200
NA1-925	10.85	10.50	9.830	206756	128225	0.274	0.164	30000	2100
NA1-950	11.10	10.70	10.086	212338	134200	0.281	0.168	30000	2100
NA1-975	11.35	10.95	10.340	217921	142000	0.287	0.172	30000	2000
NA1-1000	11.60	11.20	10.610	223503	149800	0.294	0.176	30000	2000

GENERAL NOTES:

(a) The values listed above apply to rings made from UNS G10600–G10900 and UNS S15700 stainless steel except Sizes -12 through -23, which are supplied in beryllium copper only.

(b) *Safety Factors Pr and Pg*: the allowable thrust load values listed include the following safety factors: *Pr*: 4 *Pg*: 2.

(c) For reference, see Table I Illustration beginning on page 20.

NOTE:

(1) *Pr* values for other sizes made from beryllium copper can be calculated by multiplying listed values by 0.75.

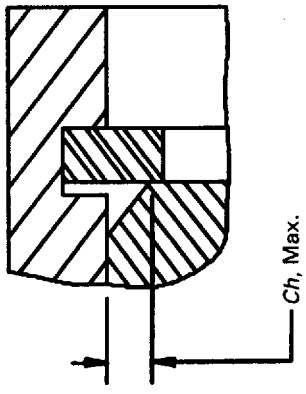
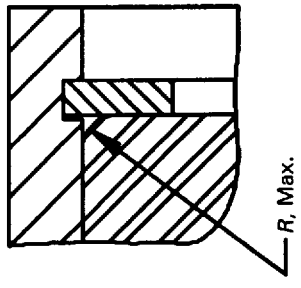
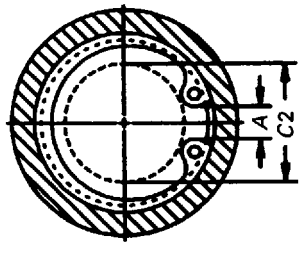
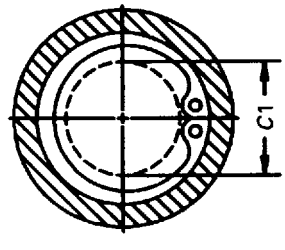
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MANDATORY APPENDIX II
BASIC INTERNAL SERIES NA2

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TABLE II ILLUSTRATION

	Max. Allowable Chamfer of Retained Part
	Max. Allowable Radius of Retained Part
	Ring Seated In Groove
	Ring Compressed In Bore

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TABLE II NA2 BASIC INTERNAL RETAINING RINGS

Ring Series and Size No.	Clearance Diameter		Gaging Diameter	Allowable Trust Loads Sharp Corner Abutment		Maximum Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.
	Ring Compressed in Housing	Ring Seated in Groove	For Checking Ring When Seated in Groove	UNS G10600–G10900 and Stainless Steel Rings Used in Hardened Housing (50 HRc, Min.)	All Standard Rings Used in Low Carbon Steel Housing			
	C1	C2	*A*, Min.	*Pr* (lb)	*Pg* (lb)	*R*, Max.	*Ch*, Max.	*P'r* (lb)
NA2-25	0.115	0.133	0.047	426	190	0.011	0.0085	190
NA2-31	0.173	0.191	0.055	538	240	0.016	0.013	190
NA2-37	0.204	0.226	0.063	1066	350	0.023	0.018	530
NA2-43	0.23	0.254	0.063	1238	440	0.027	0.021	530
NA2-45	0.25	0.274	0.071	1299	460	0.027	0.021	530
NA2-50	0.26	0.290	0.090	2010	510	0.027	0.021	1100
NA2-51	0.27	0.300	0.092	2060	520	0.027	0.021	1100
NA2-56	0.275	0.305	0.095	2253	710	0.027	0.021	1100
NA2-62	0.34	0.380	0.104	2507	1050	0.027	0.021	1100
NA2-68	0.40	0.440	0.118	2741	1280	0.027	0.021	1100
NA2-75	0.45	0.490	0.143	3045	1460	0.032	0.025	1100
NA2-77	0.475	0.520	0.145	4618	1580	0.035	0.028	1650
NA2-81	0.49	0.540	0.153	4872	1710	0.035	0.028	1650
NA2-86	0.54	0.590	0.172	5177	1980	0.035	0.028	1650
NA2-87	0.545	0.600	0.179	5227	2080	0.035	0.028	1650
NA2-90	0.565	0.620	0.188	5430	2200	0.038	0.030	1650
NA2-93	0.61	0.670	0.200	5684	2450	0.038	0.030	1650
NA2-100	0.665	0.730	0.212	6039	2800	0.042	0.034	1650
NA2-102	0.69	0.755	0.220	6141	3000	0.042	0.034	1650
NA2-106	0.685	0.750	0.213	7562	3050	0.044	0.035	2400
NA2-112	0.745	0.815	0.232	8019	3400	0.047	0.036	2400
NA2-118	0.79	0.860	0.226	8526	3700	0.047	0.036	2400
NA2-118	0.80	0.870	0.245	8526	3700	0.047	0.036	2400
NA2-125	0.875	0.955	0.265	8932	4250	0.048	0.038	2400
NA2-125	0.885	0.965	0.290	8932	4250	0.048	0.038	2400
NA2-131	0.93	1.01	0.284	9440	4700	0.048	0.038	2400
NA2-137	0.99	1.07	0.297	9846	5050	0.048	0.038	2400
NA2-137	0.99	1.07	0.305	9846	5050	0.048	0.038	2400
NA2-143	1.06	1.15	0.313	10353	5500	0.048	0.038	2400
NA2-145	1.08	1.17	0.320	10455	5700	0.048	0.038	2400

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TABLE II NA2 BASIC INTERNAL RETAINING RINGS (CONT'D)

Ring Series and Size No.	Clearance Diameter		Gaging Diameter	Allowable Trust Loads Sharp Corner Abutment		Maximum Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.
	Ring Compressed in Housing	Ring Seated in Groove	For Checking Ring When Seated in Groove	UNS G10600–G10900 and Stainless Steel Rings Used in Hardened Housing (50 HRc, Min.)	All Standard Rings Used in Low Carbon Steel Housing			
	C1	C2	*A*, Min.	*Pr* (lb)	*Pg* (lb)	*R*, Max.	*Ch*, Max.	*P'r* (lb)
NA2-150	1.12	1.21	0.340	10708	6000	0.048	0.038	2400
NA2-156	1.14	1.23	0.338	13906	6350	0.064	0.050	3900
NA2-156	1.15	1.24	0.374	13906	6350	0.064	0.050	3900
NA2-162	1.15	1.25	0.339	14413	6900	0.064	0.050	3900
NA2-165	1.17	1.27	0.348	14718	7200	0.064	0.050	3900
NA2-168	1.23	1.33	0.357	15022	7450	0.064	0.050	3900
NA2-175	1.26	1.36	0.372	15580	8050	0.064	0.050	3900
NA2-181	1.32	1.43	0.382	16139	8450	0.064	0.050	3900
NA2-185	1.34	1.45	0.360	16443	8750	0.064	0.050	3900
NA2-187	1.37	1.48	0.430	16697	9050	0.064	0.050	3900
NA2-193	1.44	1.56	0.438	17255	9700	0.064	0.050	3900
NA2-200	1.50	1.62	0.453	17763	10300	0.064	0.050	3900
NA2-206	1.52	1.64	0.428	23091	10850	0.078	0.061	6200
NA2-206	1.54	1.66	0.468	23091	10850	0.078	0.062	6200
NA2-212	1.58	1.70	0.460	23751	11350	0.078	0.062	6200
NA2-218	1.61	1.74	0.439	24461	12050	0.078	0.062	6200
NA2-218	1.64	1.77	0.489	24461	12050	0.078	0.062	6200
NA2-225	1.69	1.82	0.478	25223	12600	0.078	0.062	6200
NA2-231	1.75	1.88	0.486	25832	13550	0.078	0.062	6200
NA2-237	1.81	1.95	0.504	26542	14300	0.078	0.062	6200
NA2-244	1.86	2.00	0.518	27304	14900	0.078	0.062	6200
NA2-250	1.91	2.05	0.532	28014	15650	0.078	0.062	6200
NA2-250	1.94	2.09	0.597	28014	15650	0.078	0.062	6200
NA2-256	1.95	2.10	0.540	34206	16500	0.088	0.070	9000
NA2-262	2.02	2.17	0.558	35068	17350	0.088	0.070	9000
NA2-268	2.05	2.21	0.539	35931	18250	0.090	0.072	9000
NA2-268	2.06	2.22	0.568	35931	18250	0.090	0.072	9000
NA2-275	2.12	2.28	0.590	36642	19200	0.092	0.074	9000
NA2-281	2.18	2.34	0.615	37504	20050	0.088	0.070	9000
NA2-281	2.21	2.38	0.676	37504	20050	0.088	0.070	9000

(continued)

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TABLE II NA2 BASIC INTERNAL RETAINING RINGS (CONT'D)

Ring Series and Size No.	Clearance Diameter		Gaging Diameter	Allowable Trust Loads Sharp Corner Abutment		Maximum Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.
	Ring Compressed in Housing	Ring Seated in Groove	For Checking Ring When Seated in Groove	UNS G10600–G10900 and Stainless Steel Rings Used in Hardened Housing (50 HRc, Min.)	All Standard Rings Used in Low Carbon Steel Housing			
	C1	C2	*A*, Min.	*Pr* (lb)	*Pg* (lb)	*R*, Max.	*Ch*, Max.	*P'r* (lb)
NA2-287	2.22	2.39	0.626	38367	21500	0.092	0.074	9000
NA2-295	2.30	2.48	0.619	40093	23150	0.092	0.074	9000
NA2-300	2.35	2.53	0.738	40093	23150	0.092	0.074	9000
NA2-306	2.41	2.59	0.651	47807	24100	0.097	0.078	12000
NA2-312	2.47	2.66	0.655	48822	25200	0.099	0.079	12000
NA2-315	2.49	2.68	0.650	49329	25700	0.100	0.080	12000
NA2-315	2.50	2.69	0.669	49329	25700	0.100	0.080	12000
NA2-325	2.54	2.73	0.698	50750	27000	0.104	0.083	12000
NA2-334	2.63	2.83	0.705	52374	28300	0.108	0.086	12000
NA2-347	2.76	2.96	0.763	54201	30200	0.108	0.086	12000
NA2-350	2.79	3.00	0.774	54709	31200	0.110	0.088	12000
NA2-354	2.85	3.06	0.842	55419	31800	0.110	0.088	12000
NA2-362	2.91	3.12	0.833	56739	33200	0.116	0.093	12000
NA2-375	3.02	3.24	0.844	58566	35600	0.120	0.096	12000
NA2-375	3.03	3.25	0.871	58566	35600	0.120	0.096	12000
NA2-387	3.11	3.34	0.891	60494	38000	0.123	0.098	12000
NA2-393	3.17	3.40	0.905	61611	39300	0.124	0.099	12000
NA2-400	3.23	3.47	0.918	62626	40700	0.128	0.102	12000
NA2-412	3.36	3.60	0.940	64554	42000	0.130	0.104	12000
NA2-425	3.48	3.72	0.900	66483	43200	0.138	0.110	12000
NA2-433	3.50	3.74	1.000	67599	44500	0.142	0.114	12000
NA2-450	3.66	3.90	0.980	70340	45800	0.146	0.117	12000
NA2-462	3.79	4.03	1.000	72370	47000	0.151	0.121	12000
NA2-475	3.88	4.12	0.960	74298	49000	0.154	0.123	12000
NA2-475	3.90	4.14	1.030	74298	49000	0.154	0.123	12000
NA2-500	4.08	4.34	0.970	78155	55000	0.158	0.126	12000
NA2-525	4.31	4.58	1.10	94091	60000	0.168	0.134	15000
NA2-537	4.41	4.68	1.12	96324	61500	0.168	0.134	15000
NA2-550	4.53	4.80	1.09	98658	63300	0.168	0.134	15000
NA2-575	4.78	5.05	1.11	103124	65900	0.168	0.134	15000

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TABLE II NA2 BASIC INTERNAL RETAINING RINGS (CONT'D)

Ring Series and Size No.	Clearance Diameter		Gaging Diameter	Allowable Trust Loads Sharp Corner Abutment		Maximum Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.
	Ring Compressed in Housing	Ring Seated in Groove	For Checking Ring When Seated in Groove	UNS G10600–G10900 and Stainless Steel Rings Used in Hardened Housing (50 HRc, Min.)	All Standard Rings Used in Low Carbon Steel Housing			
	C1	C2	*A*, Min.	*Pr* (lb)	*Pg* (lb)	*R*, Max.	*Ch*, Max.	*P'r* (lb)
NA2-600	5.03	5.30	1.13	107489	68600	0.168	0.134	15000
NA2-625	5.24	5.52	1.16	139766	74100	0.177	0.142	23000
NA2-650	5.49	5.78	1.25	145450	79900	0.181	0.145	23000
NA2-662	5.60	5.90	1.28	148190	84200	0.183	0.146	23000
NA2-675	5.65	5.95	1.21	151032	87000	0.188	0.150	23000
NA2-700	5.88	6.19	1.26	156615	93100	0.196	0.157	23000
NA2-725	6.08	6.40	1.32	194373	99600	0.202	0.162	34000
NA2-750	6.33	6.67	1.39	201173	108100	0.208	0.166	34000
NA2-775	6.58	6.93	1.44	207872	115000	0.214	0.171	34000
NA2-800	6.75	7.11	1.50	214571	122000	0.220	0.176	34000
NA2-825	7.00	7.37	1.53	221270	129300	0.229	0.183	34000
NA2-850	7.13	7.51	1.71	227969	136900	0.235	0.188	34000
NA2-875	7.38	7.77	1.77	233856	145500	0.241	0.193	34000
NA2-900	7.63	8.03	1.83	241367	154100	0.249	0.199	34000
NA2-925	7.88	8.30	1.87	248066	163600	0.253	0.202	34000
NA2-950	7.98	8.41	1.91	254765	173100	0.258	0.206	34000
NA2-975	8.23	8.67	2.00	261464	181900	0.263	0.210	34000
NA2-1000	8.48	8.93	2.01	268163	190700	0.270	0.216	34000

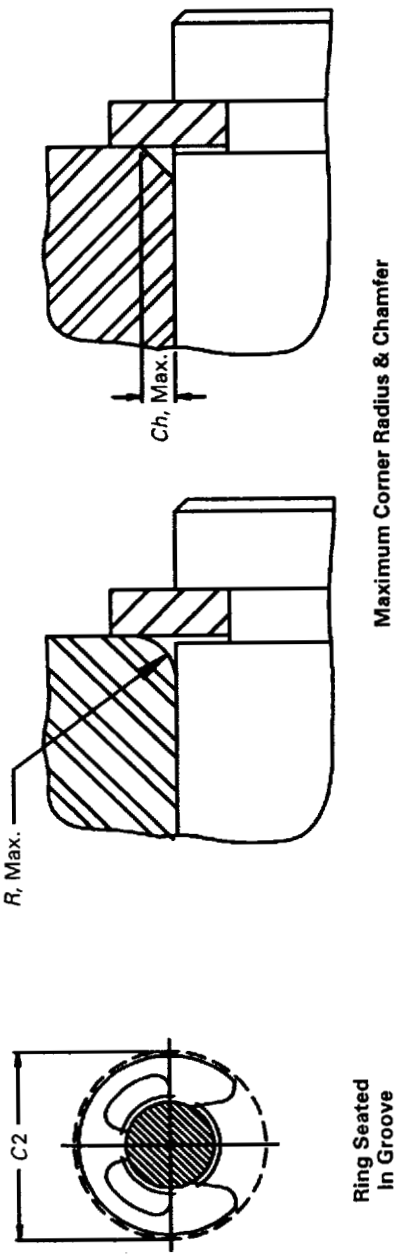
GENERAL NOTES:
(a) (1) The values listed above apply to rings made from UNS G10600–G10900 and UNS S15700 stainless steel.
(2) *Pr* values for rings made from beryllium copper can be calculated by multiplying listed values by 0.75.
(b) *Safety Factors Pr and Pg:* the allowable thrust load values listed include the following safety factors: *Pr*: 4 *Pg*: 2
(c) For reference, see Table II Illustration beginning on page 26.

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MANDATORY APPENDIX III
E-RING EXTERNAL SERIES NA3

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TABLE III ILLUSTRATION



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TABLE III NA3 (E-TYPE) EXTERNAL RETAINING RINGS

Ring Series and Size No.	Clearance Diameter	Allowable Thrust Load Sharp Corner Abutment		Maximum Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.	Calculated Allowable Assembly [Note (1)]
	Ring Seated in Groove	UNS G10600–G10900 and Stainless Steel Rings Used on Hardened Shafts 50 HRc, Min.	All Standard Rings Used on Low Carbon Steel Shafts				
	C2	*Pr* (lb) [Note (1)]	*Pg* (lb)	*R*, Max.	*Ch*, Max.	*P'r* (lb)	RPM
NA3-4 [Note (1)]	0.090	13	6	0.015	0.010	13	40000
NA3-S6	0.150	20	7	0.030	0.020	20	40000
NA3-Y6	0.200	41	7	0.035	0.025	40	40000
NA3-6	0.165	20	7	0.030	0.020	20	40000
NA3-9	0.245	46	20	0.053	0.040	45	36000
NA3-S9	0.200	46	20	0.040	0.030	45	36000
NA3-S11	0.390	61	40	0.080	0.060	60	35000
NA3-S12	0.225	110	45	0.040	0.030	108	35000
NA3-12	0.240	66	45	0.040	0.030	65	35000
NA3-S14	0.215	76	60	0.029	0.022	75	32000
NA3-Y14	0.265	76	45	0.040	0.030	75	32000
NA3-14	0.285	173	60	0.060	0.045	170	32000
NA3-S15	0.390	300	70	0.080	0.060	250	31000
NA3-15	0.295	178	75	0.060	0.045	175	31000
NA3-S17	0.325	183	90	0.060	0.045	180	30000
NA3-S18	0.39	203	135	0.060	0.045	200	30000
NA3-Y18	0.485	193	90	0.060	0.045	190	25000
NA3-18	0.35	193	90	0.060	0.045	190	30000
NA3-S21	0.45	228	75	0.060	0.045	225	26000
NA3-25	0.54	259	115	0.060	0.045	255	25000
NA3-S31	0.52	330	225	0.060	0.045	325	22000
NA3-Y31	0.685	325	220	0.060	0.045	320	15000
NA3-S37	0.587	680	300	0.060	0.045	680	20000
NA3-37	0.68	700	315	0.065	0.050	690	20000
NA3-43	0.71	842	480	0.065	0.050	830	16500

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TABLE III NA3 (E-TYPE) EXTERNAL RETAINING RINGS (CONT'D)

Ring Series and Size No.	Clearance Diameter	Allowable Thrust Load Sharp Corner Abutment		Maximum Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.	Calculated Allowable Assembly [Note (1)]
	Ring Seated in Groove	UNS G10600–G10900 and Stainless Steel Rings Used on Hardened Shafts 50 HRc, Min.	All Standard Rings Used on Low Carbon Steel Shafts				
	C2	*Pr* (lb) [Note (1)]	*Pg* (lb)	*R*, Max.	*Ch*, Max.	*P'r* (lb)	RPM
NA3-S43	0.62	812	280	0.050	0.035	800	16500
NA3-50	0.82	1127	600	0.080	0.060	1110	14000
NA3-62	0.96	1441	1050	0.080	0.060	1420	12000
NA3-S74	1.02	1979	1100	0.057	0.042	1900	11000
NA3-75	1.14	2030	1500	0.085	0.065	2000	10500
NA3-87	1.32	2385	2050	0.085	0.065	2350	9000
NA3-S98	1.53	2639	1750	0.085	0.065	2700	6500
NA3-S98	1.53	2690	1900	0.077	0.057	2700	6500
NA3-S118	1.67	3501	1500	0.090	0.070	3450	5500
NA3-S137	1.92	4162	2350	0.090	0.070	4100	4000

GENERAL NOTES:

(a) The values listed above apply to rings made from UNS G10600–G10900 and UNS S15700 stainless steel except Size -4, which is supplied in beryllium copper only.

(b) *Safety Factors Pr and Pg:* the allowable thrust load values listed include the following safety factors: *Pr* : 3 *Pg* : 2

(c) For reference, see Table III Illustration beginning on page 32.

NOTE:

(1) *Pr* values for other sizes made from beryllium copper can be calculated by multiplying listed values by 0.75.

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NONMANDATORY APPENDIX A
TYPE NA1 REFERENCE METRIC VALUES (DIMENSIONS)

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TABLE A TYPE NA1 REFERENCE METRIC VALUES (DIMENSIONS)

Ring Series and Size No.	Shaft Diameter	Free Diameter		Thickness [Note (1)]		Hole Diameter		Lug Height (Max.)	Large Section		Small Section		Approx. Mass per 1000 Pcs.	Groove Dimensions				Edge Margin
														Diameter		Width		Depth	
	S, mm	*D*	Tol.	*T*	Tol.	*P*	Tol.	*B*	*E*	Tol.	*J*	Tol.	kg	*G*	Tol.	*W*	Tol.	(*d*)	*Z*
NA1-12 (2)	3.2	2.84		0.25	±0.03	0.66		1.22	0.46	±0.04	0.28	±0.04	0.01	2.97		0.30		0.10	0.30
NA1-15 (2)	4.0	3.61		0.25		0.66		1.42	0.66		0.41		0.02	3.71		0.38		0.13	0.36
NA1-18 (2)	4.8	4.27	+0.05	0.38		0.64		1.32	0.64		0.41		0.03	4.45	±0.04	0.46	+0.05	0.15	0.46
NA1-19 (2)	5.0	4.55	−0.10	0.36		0.66		1.47	0.66	±0.05	0.41	±0.05	0.03	4.70	0.04 (3)	0.46	0	0.15	0.46
NA1-21 (2)	5.6	4.98		0.38		0.66		1.47	0.71		0.43		0.03	5.21		0.46		0.18	0.53
NA1-23 (2)	6.0	5.46		0.38		0.66		1.47	0.76		0.48		0.04	5.54		0.46		0.18	0.53
NA1-25	6.4	5.72		0.64		1.04		2.11	0.89		0.64		0.10	5.84		0.74		0.25	0.76
NA1-27	7.0	6.35		0.64		1.04		2.13	0.89		0.66		0.10	6.48		0.74		0.25	0.79
NA1-28	7.1	6.50		0.64		1.04		2.11	0.97		0.66		0.11	6.83		0.74		0.25	0.76
NA1-31	7.9	7.14		0.64		1.04		2.29	1.02		0.66		0.12	7.37		0.74		0.28	0.84
NA1-34	8.7	7.85		0.64		1.04		2.29	1.07		0.67		0.14	8.15	±0.05	0.74		0.28	0.84
NA1-35	9.0	8.13	+0.05	0.64		1.04		2.29	1.17	±0.08	0.74	±0.08	0.16	8.38	0.05 (3)	0.74		0.30	0.91
NA1-37	9.5	8.59	−0.13	0.64		1.04		2.31	1.27		0.77		0.18	8.94		0.74		0.30	0.91
NA1-39	10.0	8.99		0.64		1.04		2.29	1.32		0.79		0.19	7.37		0.74		0.30	0.94
NA1-40	10.3	9.30		0.64		1.04		2.29	1.37		0.84		0.20	9.70		0.74		0.30	0.91
NA1-43	11.1	10.03		0.64		1.04	+0.25	2.31	1.40		0.84		0.23	10.46		0.74		0.33	0.99
NA1-46	11.9	10.87		0.64		1.04	−0.05	2.31	1.52		0.89		0.25	11.25		0.74		0.33	0.99
NA1-50	12.7	11.71		0.89		1.19		2.82	1.65		1.02		0.41	11.89	±0.05	0.99		0.41	1.22
NA1-55	14.0	12.93		0.89		1.19		2.82	1.35		0.91		0.41	13.18	0.10 (3)	0.99		0.41	1.22
NA1-56	14.3	13.23		0.89		1.19		2.82	1.83		1.04		0.50	13.46		0.99		0.41	1.22
NA1-59	15.1	13.97		0.89		1.19		2.84	1.93	±0.10	1.09	±0.10	0.54	14.20		0.99	+0.08	0.43	1.32
NA1-62	15.9	14.71		0.89	±0.05	1.19		2.87	2.03		1.14		0.59	14.94		0.99	0	0.46	1.40
NA1-66	17.0	15.77	+0.13	0.89		1.19		2.87	2.08		1.09		0.64	15.98		0.99		0.51	1.52
NA1-66	17.1	15.77	−0.25	0.89		1.19		2.87	2.08		1.09		0.64	16.03		0.99		0.51	1.52
NA1-68	17.5	16.13		1.07		1.32		3.56	2.13		1.22		0.82	16.41		1.17		0.53	1.80
NA1-75	19.0	17.80		1.07		1.32		3.56	2.34		1.30		0.95	17.88	±0.08	1.17		0.58	1.75
NA1-78	19.8	18.34		1.07		1.32		3.56	2.39		1.32		1.00	18.62	0.10 (3)	1.17		0.81	1.83
NA1-81	20.6	19.08		1.07		1.32		3.56	2.44		1.35		1.13	19.35		1.17		0.64	1.91
NA1-84	21.4	19.81		1.07		1.32		3.58	2.54		1.45		1.23	20.08		1.17		0.86	1.98
NA1-87	22.2	20.57		1.07		1.32		3.58	2.64	±0.13	1.45	±0.13	1.27	20.85		1.17		0.69	2.06
NA1-93	23.8	22.02		1.07		1.98		4.32	2.79		1.60		1.41	22.40		1.17		0.71	2.13
NA1-98	25.0	23.11		1.07		1.98		4.34	2.90		1.62		1.59	23.52		1.17		0.74	2.21
NA1-100	26.4	23.50		1.07		1.98	+0.38	4.34	2.96		1.64		1.63	23.88		1.17		0.76	2.29
NA1-102	26.0	24.03		1.07		1.98	−0.05	4.37	3.00		1.68		1.77	24.41		1.17		0.79	2.36
NA1-106	27.0	24.94	+0.25	1.27		1.98		4.70	3.10	±0.15	1.75	±0.15	2.18	25.35	±0.10	1.42	+0.10	0.81	2.44
NA1-112	28.6	26.44	−0.38	1.27		1.98		4.72	3.25		1.80		2.31	26.90	0.13 (3)	1.42	0	0.84	2.51

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TABLE A TYPE NA1 REFERENCE METRIC VALUES (DIMENSIONS) (CONT'D)

Ring Series and Size No.	Shaft Diameter	Free Diameter		Thickness [Note (1)]		Hole Diameter		Lug Height (Max.)	Large Section		Small Section		Approx. Mass per 1000 Pcs.	Groove Dimensions					Edge Margin
														Diameter		Width		Depth	
	S, mm	*D*	Tol.	*T*	Tol.	*P*	Tol.	*B*	*E*	Tol.	*J*	Tol.	kg	*G*	Tol.	*W*	Tol.	(*d*)	*Z*
NA1-118	30.2	27.89		1.27		1.96		4.75	3.35		1.83		2.54	28.40		1.42		0.89	2.67
NA1-125	31.7	29.36		1.27		1.98		4.75	3.56		1.93		2.68	29.87		1.42		0.94	2.82
NA1-131	33.3	30.84	+0.25	1.27	±0.05	1.98		4.75	3.71		2.01		3.08	31.29	±0.10	1.42		1.02	3.05
NA1-137	34.9	32.31	−0.38	1.27		1.98		4.78	3.86		2.08		3.27	32.79	0.13 (3)	1.42		1.07	3.20
NA1-143	36.5	33.86		1.27		1.98		4.78	4.06		2.18		3.67	34.29		1.42		1.12	3.35
NA1-150	38.1	35.23		1.27		3.06		5.54	4.27		2.31		4.08	36.71		1.42		1.19	3.58
NA1-156	39.7	36.73		1.57		3.18		6.07	4.37		2.36		5.62	37.29		1.73		1.19	3.58
NA1-162	41.3	38.18		1.57		3.18		6.07	4.57	±0.15	2.46	±0.15	5.99	38.87		1.73	+0.10	1.22	3.66
NA1-168	42.9	39.62		1.57		3.18		6.07	4.67		2.51		6.71	40.36	±0.13	1.73	0	1.24	3.76
NA1-175	44.4	41.10	+0.33	1.57		3.18		6.12	4.78		2.57		6.94	41.91	0.13 (3)	1.73		1.27	3.81
NA1-177	45.0	41.58	−0.51	1.57		3.18		6.12	4.83		2.59		6.99	42.39		1.73		1.30	3.91
NA1-181	46.0	42.55		1.57		3.18		6.15	4.88		2.59		7.35	43.36		1.73		1.32	3.96
NA1-187	47.6	44.07		1.57		3.18		6.17	4.98		2.64		7.85	44.93		1.73		1.35	4.04
NA1-196	50.0	46.20		1.57		3.18		6.76	5.08		2.69		8.16	47.17		1.73		1.42	4.27
NA1-200	50.6	46.99		1.57		3.18		6.17	5.18		2.74		8.62	47.90		1.73		1.45	4.34
NA1-206	52.4	48.41		1.98		3.18		6.91	5.28		2.82		11.34	49.43		2.18		1.47	4.42
NA1-212	54.0	49.89		1.96		3.18		6.91	5.38		2.87		11.84	50.58		2.18		1.55	4.65
NA1-215	54.8	50.62		1.96		3.18		6.91	5.38		2.87		11.93	51.61		2.18		1.57	4.72
NA1-225	57.1	52.86	+0.38	1.96		3.18	+0.38	6.91	5.59		2.95		12.56	53.86		2.18		1.65	4.95
NA1-231	58.7	54.33	−0.63	1.96		3.18	−0.05	6.91	5.64		3.00		12.70	56.32		2.18		1.70	5.11
NA1-237	60.3	55.80		1.98	±0.08	3.18		6.91	5.69		3.02		13.25	56.87		2.18		1.73	5.18
NA1-243	61.9	57.28		1.96		3.18		6.93	5.79	±0.18	3.05	±0.18	13.38	58.39		2.18		1.75	5.26
NA1-250	63.5	58.75		1.98		3.18		6.93	5.89		3.10		13.47	59.94		2.18		1.78	5.33
NA1-256	65.0	60.38		1.98		3.18		6.93	6.05		3.18		15.38	61.44		2.18		1.78	5.33
NA1-262	66.7	61.67		1.98		3.18		6.93	6.15		3.23		15.88	63.02	±0.15	2.18	+0.13	1.83	5.49
NA1-268	68.3	63.12		1.98		3.18		6.93	6.25		3.28		16.33	64.54	0.15 (3)	2.18	0	1.85	5.56
NA1-275	69.8	64.59		2.36		3.18		8.36	6.30		3.33		19.28	66.09		2.62		1.88	5.64
NA1-287	73.0	67.54		2.36		3.18		7.95	6.50		3.38		22.00	69.11		2.62		1.96	5.87
NA1-293	74.6	69.01	+0.51	2.36		3.18		7.95	6.60		3.45		22.68	70.59		2.62		2.01	6.02
NA1-300	76.2	70.49	−0.76	2.36		3.18		7.95	6.71		3.51		23.58	72.09		2.62		2.06	6.17
NA1-306	77.8	71.93		2.36		3.18		7.70	6.40		3.33		21.55	73.61		2.62		2.08	6.25
NA1-312	79.4	73.46		2.36		3.18		7.95	6.91		3.58		26.31	75.11		2.62		2.13	6.40
NA1-315	80.2	74.17		2.36		3.18		7.95	6.96		3.63		26.76	75.84		2.62		2.16	6.48
NA1-325	82.5	76.35		2.36		3.18		7.95	7.11	±0.20	3.68	±0.20	28.12	76.13		2.62		2.21	6.63
NA1-334	85.0	78.54		2.36		3.18		7.95	7.26		3.73		29.03	80.42		2.62		2.29	6.86
NA1-343	87.3	80.75		2.36		3.18		7.95	7.42		3.76		29.94	82.73		2.62		2.29	6.86
NA1-350	86.9	82.22		2.77		3.18		7.37	7.24		3.76		32.86	84.23		3.06		2.34	7.01

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TABLE A TYPE NA1 REFERENCE METRIC VALUES (DIMENSIONS) (CONT'D)

Ring Series and Size No.	Shaft Diameter	Free Diameter		Thickness [Note (1)]		Hole Diameter		Lug Height (Max.)	Large Section		Small Section		Approx. Mass per 1000 Pcs.	Groove Dimensions					Edge Margin
														Diameter		Width		Depth	
	S, mm	*D*	Tol.	*T*	Tol.	*P*	Tol.	*B*	*E*	Tol.	*J*	Tol.	kG	*G*	Tol.	*W*	Tol.	(*d*)	*Z*
NA1-354	90.0	83.24		2.77		3.18		8.46	7.32		3.78		0.07	85.27		3.05		2.36	7.09
NA1-362	92.1	85.14		2.77		3.18		8.46	7.52		3.89		0.07	87.25		3.05		2.41	7.24
NA1-368	93.7	86.61		2.77		3.18		8.51	7.67		3.96		0.07	88.72		3.05		2.46	7.39
NA1-375	95.2	88.09		2.77		3.18		8.56	7.87	±0.20	4.06	±0.20	0.07	90.22		3.05		2.51	7.54
NA1-387	98.4	91.03		2.77		3.18	+0.38	8.51	8.08		4.14		0.07	93.29		3.05		2.57	7.70
NA1-393	100.0	92.51	+0.051	2.77	±0.08	3.18	−0.05	8.81	8.08		4.14		0.07	94.84	±0.15	3.05	+0.13	2.59	7.77
NA1-400	101.6	93.98	−0.76	2.77		3.18		9.07	8.08		4.14		0.07	96.32	0.15 (3)	3.05	0	2.64	7.92
NA1-425	108.0	101.32		2.77		3.18		8.71	8.08		4.47		0.08	103.25		3.05		2.34	7.01
NA1-437	111.1	104.29		2.77		3.18		8.71	8.08		4.60		0.08	106.43		3.05		2.34	7.01
NA1-450	114.3	107.26		2.77		3.18		11.48	7.24		3.25		0.06	109.47		3.05		2.41	7.24
NA1-475	120.6	113.23		2.77		3.18		11.10	7.70		3.45		0.06	115.57		3.05		2.54	7.62
NA1-500	127.0	119.18		2.77		3.96		11.63	9.14	±0.25	4.93	±0.25	0.09	121.67		3.05		2.67	8.00
NA1-525	133.3	125.15		3.18		3.96		12.19	9.45		5.36		0.10	127.76		3.53		2.79	8.38
NA1-550	139.7	131.11	+0.051	3.18	±0.10	3.96		12.78	9.91		5.31		0.09	133.73	±0.18	3.53	+0.15	2.97	8.92
NA1-575	146.0	137.06	−1.02	3.18		3.96		13.36	10.36		5.59		0.10	139.83	0.15 (3)	3.53	0	3.10	9.30
NA1-600	152.4	143.03		3.18		3.96		13.92	9.68		4.34		0.08	145.92		3.53		3.23	9.68
NA1-625	158.7	149.00		3.96		3.96		14.55	10.06		4.47		0.08	152.02		4.42		3.35	10.06
NA1-650	165.1	154.94	+0.051	3.96		3.96		15.19	11.13		5.99		0.11	158.12		4.42		3.48	10.44
NA1-675	171.4	160.91	−1.27	3.96		4.75	+0.51	15.75	11.58		6.25		0.11	164.21		4.42		3.61	10.82
NA1-700	177.8	166.88		3.96		4.75	−0.13	13.77	12.04		6.50		0.12	170.31		4.42		3.73	11.20
NA1-725	184.2	172.09		4.75		4.75		17.07	12.45		6.78		0.12	176.33		5.31		3.91	11.68
NA1-750	190.5	178.03		4.75		4.75		17.48	12.88		7.04		0.13	182.37		5.31		4.06	12.19
NA1-775	196.9	183.97		4.75	±0.13	4.75		17.07	13.28	±0.38	7.24	±0.38	0.13	188.47	±0.20	5.31	+0.20	4.19	12.57
NA1-800	203.2	189.94	+1.27	4.75		4.75		18.97	13.72		7.47		0.13	194.56	0.15 (3)	5.31	0	4.32	12.95
NA1-825	209.6	195.88	−1.30	4.75		4.75		18.97	14.12		7.72		0.14	200.66		5.31		4.45	13.34
NA1-850	215.9	201.85		4.75		4.75		18.97	14.55		7.98		0.14	206.76		5.31		4.57	13.72
NA1-875	222.3	207.80		4.75		4.75		18.97	15.01		8.18		0.15	212.85		5.31		4.70	14.10
NA1-900	228.6	213.74		4.75		4.75		18.97	15.47		8.46		0.15	218.95		5.31		4.83	14.48
NA1-925	234.9	219.71		4.75		4.75		18.97	15.88		8.66		0.15	225.04		5.31		4.95	14.86
NA1-950	241.3	225.68		4.75		4.75		18.97	16.31		8.89		0.16	231.14		5.31		5.08	15.24
NA1-975	247.6	231.65		4.75		4.75		18.97	16.71		9.09		0.16	237.19		5.31		5.23	15.70
NA1-1000	254.0	237.62		4.75		4.75		18.97	17.15		9.32		0.17	243.21		5.31		5.38	16.15

GENERAL NOTE: See Table 6 for illustrations.

NOTES:

(1) For plated rings, add 0.05 mm to the listed maximum thickness except that maximum thickness after plating will be a minimum of 0.005 mm less than the listed groove width (*W*) minimum.

(2) Sizes -12 through -23 available in beryllium copper only.

(3) *F.I.M. (Full Indicator Movement)*: maximum circular run out of groove to shaft.

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NONMANDATORY APPENDIX B
TYPE NA1 REFERENCE METRIC VALUES
(SUPPLEMENTARY INFORMATION)

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TABLE B TYPE NA1 REFERENCE METRIC VALUES (SUPPLEMENTARY INFORMATION)

Ring Series and Size No.	Clearance Diameter		Gaging Diameter	Allowable Thrust Loads Square Corner Abutment		Maximum Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.	Calculated Allowable Assembly [Note (1)]
	Ring Expanded Over Shaft	Ring Seated in Groove	For Checking Ring When Seated in Groove	UNS G10600–G10900 and Stainless Steel Rings Used on Hardened Shafts (50 HRc, Min.)	All Standard Rings Used on Low Carbon Steel Shafts				
	C1	C2	*K*, Max.	*Pr* (kN) [Note (1)]	*Pg* (kN)	*R*, Max.	*Ch*, Max.	*P'r* (kN)	RPM
NA1-12 (1)	5.64	5.44	3.76	0.50	0.16	0.25	0.15	0.20	80000
NA1-15 (1)	6.86	6.60	4.80	0.59	0.24	0.38	0.23	0.20	80000
NA1-18 (1)	7.57	7.26	5.54	1.09	0.36	0.36	0.22	0.47	80000
NA1-19 (1)	8.10	7.80	5.82	1.13	0.38	0.37	0.23	0.47	80000
NA1-21 (1)	8.59	8.23	6.40	1.26	0.49	0.38	0.23	0.47	80000
NA1-23 (1)	9.02	8.66	6.91	1.40	0.53	0.42	0.25	0.47	80000
NA1-25	11.43	10.92	7.37	2.66	0.78	0.46	0.28	2.09	80000
NA1-27	12.19	11.68	8.00	2.94	0.87	0.44	0.27	2.09	76000
NA1-28	12.45	11.94	8.28	2.98	0.89	0.51	0.30	2.09	74000
NA1-31	13.72	13.21	9.07	3.34	1.07	0.51	0.30	2.09	70000
NA1-34	14.48	13.97	9.91	3.61	1.18	0.53	0.32	2.09	64000
NA1-35	14.99	14.48	10.29	3.70	1.33	0.58	0.36	2.09	62000
NA1-37	15.49	14.99	11.00	3.93	1.42	0.66	0.39	2.09	60000
NA1-39	15.75	15.24	11.48	4.24	1.49	0.69	0.41	2.09	56500
NA1-40	16.00	15.49	11.89	4.29	1.56	0.72	0.43	2.09	55000
NA1-43	16.76	16.26	12.73	4.60	1.78	0.74	0.44	2.09	50000
NA1-46	17.27	16.76	13.72	4.97	2.00	0.79	0.46	2.09	42000
NA1-50	19.56	18.80	14.58	7.45	2.45	0.86	0.51	4.05	40000
NA1-55	20.57	19.81	15.52	8.01	2.67	0.69	0.42	4.05	36000
NA1-56	20.83	20.07	16.36	8.35	2.89	0.97	0.58	4.05	35000
NA1-59	21.84	21.08	17.27	8.80	3.34	1.00	0.60	4.05	32000
NA1-62	22.86	22.10	18.16	9.30	3.56	1.05	0.64	4.05	30000
NA1-66	23.62	22.61	19.20	9.93	4.23	1.02	0.61	4.05	29000
NA1-66	23.62	22.61	19.25	9.93	4.23	1.02	0.61	4.05	29000
NA1-68	25.65	24.64	19.79	15.35	4.45	1.07	0.64	5.96	28000
NA1-75	27.69	26.67	21.59	16.71	5.34	1.17	0.70	5.96	26500
NA1-78	28.45	27.43	22.43	17.61	5.78	1.19	0.71	5.96	25500
NA1-81	29.21	27.94	23.22	18.06	6.45	1.19	0.71	5.96	24500
NA1-84	29.97	28.70	24.13	18.68	6.67	1.19	0.71	5.96	24000

(continued)

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TABLE B TYPE NA1 REFERENCE METRIC VALUES (SUPPLEMENTARY INFORMATION) (CONT'D)

Ring Series and Size No.	Clearance Diameter		Gaging Diameter	Allowable Thrust Loads Square Corner Abutment		Maximum Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.	Calculated Allowable Assembly [Note (1)]
	Ring Expanded Over Shaft	Ring Seated in Groove	For Checking Ring When Seated in Groove	UNS G10600–G10900 and Stainless Steel Rings Used on Hardened Shafts (50 HRc, Min.)	All Standard Rings Used on Low Carbon Steel Shafts				
	C1	C2	*K*, Max.	*Pr* (kN) [Note (1)]	*Pg* (kN)	*R*, Max.	*Ch*, Max.	*P'r* (kN)	RPM
NA1-87	30.73	29.46	25.07	19.42	7.34	1.30	0.77	5.96	23000
NA1-93	34.04	32.77	26.77	20.99	8.23	1.40	0.84	5.96	21500
NA1-98	35.31	34.04	28.09	21.90	8.90	1.42	0.85	5.96	20500
NA1-100	35.81	34.29	28.50	22.35	9.34	1.45	0.86	5.96	20000
NA1-102	36.32	34.80	29.13	22.80	10.01	1.47	0.89	5.96	19500
NA1-106	38.10	36.58	30.28	27.99	10.68	1.52	0.91	8.67	19000
NA1-112	39.37	37.85	32.03	29.80	11.56	1.60	0.97	8.67	18800
NA1-118	40.89	39.12	33.66	31.60	13.12	1.63	0.98	8.67	18000
NA1-125	42.93	41.15	35.46	33.18	14.46	1.73	1.04	8.67	17000
NA1-131	44.45	42.42	37.03	34.99	16.46	1.73	1.04	8.67	16500
NA1-137	45.72	43.69	38.84	36.57	18.24	1.83	1.09	8.67	16000
NA1-143	47.50	45.47	40.64	38.38	20.02	1.93	1.14	8.67	15000
NA1-150	50.55	48.26	42.37	39.73	22.24	2.01	1.19	8.67	14800
NA1-156	53.34	51.05	44.20	51.47	23.13	2.08	1.24	13.34	14000
NA1-162	55.12	52.83	46.02	53.50	24.46	2.21	1.32	13.34	13200
NA1-168	56.90	54.61	47.68	55.76	26.02	2.29	1.37	13.34	13000
NA1-175	58.67	56.13	49.40	57.79	27.58	2.31	1.37	13.34	12200
NA1-177	59.18	56.64	49.96	58.46	28.47	2.34	1.40	13.34	11700
NA1-181	60.45	57.91	51.05	59.82	29.58	2.34	1.40	13.34	11500
NA1-187	61.98	59.44	52.73	61.85	31.14	2.39	1.42	13.34	11000
NA1-196	64.52	61.72	55.12	64.79	34.69	2.39	1.42	13.34	10500
NA1-200	64.77	61.98	56.01	65.91	35.81	2.44	1.45	13.34	10000
NA1-206	68.07	65.28	57.79	85.55	37.59	2.49	1.50	22.24	9600
NA1-212	69.85	66.80	59.36	88.04	40.70	2.49	1.50	22.24	9500
NA1-215	70.61	67.56	60.10	89.39	42.03	2.46	1.47	22.24	9400
NA1-225	72.90	69.60	62.64	93.46	46.04	2.54	1.52	22.24	9200
NA1-231	74.68	71.37	64.21	95.71	48.71	2.54	1.52	22.24	9000
NA1-237	76.45	73.15	65.81	98.42	50.71	2.54	1.52	22.24	8800
NA1-243	77.98	74.68	67.49	101.13	52.93	2.59	1.55	22.24	8600
NA1-250	79.25	75.69	69.19	103.84	54.93	2.64	1.57	22.24	8400

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TABLE B TYPE NA1 REFERENCE METRIC VALUES (SUPPLEMENTARY INFORMATION) (CONT'D)

Ring Series and Size No.	Clearance Diameter		Gaging Diameter	Allowable Thrust Loads Square Corner Abutment		Maximum Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.	Calculated Allowable Assembly [Note (1)]
	Ring Expanded Over Shaft	Ring Seated in Groove	For Checking Ring When Seated in Groove	UNS G10600–G10900 and Stainless Steel Rings Used on Hardened Shafts (50 HRc, Min.)	All Standard Rings Used on Low Carbon Steel Shafts				
	C1	C2	*K*, Max.	*Pr* (kN) [Note (1)]	*Pg* (kN)	*R*, Max.	*Ch*, Max.	*P'r* (kN)	RPM
NA1-255	80.77	77.22	70.92	106.10	56.27	2.74	1.65	22.24	8200
NA1-262	82.55	78.99	72.64	108.81	59.38	2.78	1.68	22.24	8000
NA1-268	84.33	80.77	74.32	111.52	61.60	2.83	1.70	22.24	7900
NA1-275	87.63	84.07	76.00	135.89	64.05	2.84	1.70	32.69	7600
NA1-287	90.68	86.87	79.30	142.22	69.61	2.92	1.75	32.69	7300
NA1-293	92.46	88.65	80.95	145.37	72.95	2.95	1.78	32.69	7200
NA1-300	93.73	89.66	82.60	148.54	76.51	2.97	1.78	32.69	6700
NA1-306	95.00	90.93	83.67	151.25	78.95	2.72	1.63	32.69	6600
NA1-312	97.03	92.96	85.93	154.86	82.51	3.05	1.83	32.69	6600
NA1-315	97.79	93.47	86.74	156.21	84.29	3.06	1.83	32.69	6500
NA1-325	100.33	96.01	89.28	160.72	88.96	3.12	1.88	32.69	6400
NA1-334	102.62	98.30	91.77	165.69	93.41	3.20	1.93	32.69	6000
NA1-343	105.16	100.58	94.28	170.21	97.41	3.28	1.96	32.69	5900
NA1-350	107.95	103.38	95.61	202.71	101.41	3.10	1.85	46.70	5900
NA1-354	108.97	104.39	96.75	205.42	103.64	3.12	1.88	46.70	5800
NA1-362	111.00	106.17	99.01	210.39	108.09	3.23	1.93	46.70	5700
NA1-368	112.52	107.70	100.74	213.55	112.53	3.30	1.98	46.70	5600
NA1-375	114.30	109.47	102.54	217.16	116.54	3.38	2.03	46.70	5500
NA1-387	116.84	111.76	105.89	224.38	123.21	3.48	2.08	46.70	5100
NA1-393	119.38	114.30	107.44	228.44	126.32	3.48	2.08	46.70	5200
NA1-400	121.41	116.33	108.92	232.06	130.77	3.43	2.06	46.70	5000
NA1-425	129.29	124.71	115.77	246.50	122.76	3.71	2.24	46.70	4800
NA1-437	132.59	128.02	118.95	253.73	126.32	3.71	2.24	46.70	4700
NA1-450	136.40	131.57	120.14	260.95	134.33	2.59	1.55	46.70	4500
NA1-475	144.02	138.94	126.90	275.40	149.45	2.92	1.75	46.70	4200
NA1-500	151.38	146.05	135.79	289.85	165.02	4.19	2.51	46.70	4000
NA1-525	159.26	153.67	142.37	348.99	181.48	4.29	2.57	60.05	3900
NA1-550	166.88	161.04	149.02	365.69	202.38	4.45	2.67	60.05	3700
NA1-575	174.24	168.15	155.80	382.40	220.62	4.67	2.79	60.05	3500
NA1-600	181.86	175.51	160.07	398.65	239.30	3.63	2.18	60.05	3400

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TABLE B TYPE NA1 REFERENCE METRIC VALUES (SUPPLEMENTARY INFORMATION) (CONT'D)

Ring Series and Size No.	Clearance Diameter		Gaging Diameter	Allowable Thrust Loads Square Corner Abutment		Maximum Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.	Calculated Allowable Assembly [Note (1)]
	Ring Expanded Over Shaft	Ring Seated in Groove	For Checking Ring When Seated in Groove	UNS G10600–G10900 and Stainless Steel Rings Used on Hardened Shafts (50 HRc, Min.)	All Standard Rings Used on Low Carbon Steel Shafts				
	C1	C2	*K*, Max.	*Pr* (kN) [Note (1)]	*Pg* (kN)	*R*, Max.	*Ch*, Max.	*P'r* (kN)	RPM
NA1-625	189.48	182.88	166.83	518.29	259.32	3.76	2.26	93.41	3100
NA1-650	199.90	193.04	175.39	539.06	279.78	4.85	2.90	93.41	3000
NA1-675	204.72	197.61	182.17	559.83	301.13	5.08	3.05	93.41	3000
NA1-700	207.01	204.98	188.95	580.59	323.37	5.28	3.18	93.41	2900
NA1-725	199.39	213.11	195.58	721.00	350.95	5.44	3.25	133.44	2800
NA1-750	227.58	219.46	202.26	745.83	377.19	5.59	3.35	133.44	2700
NA1-775	233.68	225.30	208.99	770.66	402.32	5.77	3.45	133.44	2600
NA1-800	243.84	235.20	215.72	795.49	427.45	5.97	3.58	133.44	2500
NA1-825	250.19	241.30	222.45	820.33	454.14	6.15	3.71	133.44	2400
NA1-850	256.54	247.40	229.18	845.16	480.83	6.35	3.81	133.44	2300
NA1-875	264.16	254.00	235.71	869.99	509.07	6.55	3.94	133.44	2200
NA1-900	269.24	259.59	242.75	894.82	537.32	6.78	4.06	133.44	2200
NA1-925	275.59	266.70	249.68	919.65	570.34	6.96	4.17	133.44	2100
NA1-950	281.94	271.78	256.18	944.48	596.92	7.14	4.27	133.44	2100
NA1-975	288.29	278.13	262.64	969.31	631.62	7.29	4.37	133.44	2000
NA1-1000	294.64	284.48	269.49	994.14	666.31	7.47	4.47	133.44	2000

GENERAL NOTES:
(a) For reference see Mandatory Appendix I illustrations.
(b) The values listed apply to rings made from UNS G10600–G10900 and UNS S15700 stainless steel except Sizes -12 through -23, which are supplied in beryllium copper only.
(c) *Safety Factors Pr and Pg*: the allowable thrust load values include the following safety factors: *Pr*: 4 *Pg*: 2.

NOTE:
(1) *Pr* values for other sizes made from beryllium copper can be calculated by multiplying listed values by 0.75.

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NONMANDATORY APPENDIX C
TYPE NA2 REFERENCE METRIC VALUES (DIMENSIONS)

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STD·ASME B18·27-ENGL 1998 ■ 0759670 0613080 303 ■

TABLE C TYPE NA2 REFERENCE METRIC VALUES (DIMENSIONS)

Ring Series and Size No.	Housing Diameter	Free Diameter		Thickness [Note (1)]		Hole Diameter		Lug Height (Max.)	Large Section		Small Section		Approx. Mass per 1000 Pcs.	Groove Dimensions					Edge Margin
														Diameter		Width		Depth	
	S, mm	*D*	Tol.	*T*	Tol.	*P*	Tol.	*B*	*E*	Tol.	*J*	Tol.	kg	*G*	Tol.	*W*	Tol.	(*d*)	*Z*
NA2-25	6.4	7.11		0.38		0.79		1.73	1.73	±0.05	0.38	±0.05	0.04	6.81	±0.03	0.51	+0.05	0.23	0.69
NA2-31	7.9	8.79		0.38		0.79		1.75	1.75		0.46		0.05	8.38	0.038 (2)	0.51	0	0.23	0.69
NA2-37	9.5	10.54		0.64		1.04		2.16	2.16		0.71		0.11	10.08	±0.05	0.74		0.28	0.84
NA2-43	11.1	12.24		0.64		1.04		2.57	2.57	±0.80	0.74	±0.80	0.17	11.71	0.05 (2)	0.74		0.30	0.91
NA2-45	11.5	12.65		0.64		1.19		2.57	2.57		0.76		0.20	12.12		0.74		0.30	0.91
NA2-50	12.7	13.92	+0.25	0.89		1.19		2.97	2.97		0.89		0.32	13.46		0.99		0.38	1.14
NA2-51	13.0	14.22	−0.13	0.89		1.19		3.02	3.02		0.89		0.35	13.77		0.99		0.38	1.14
NA2-56	14.3	15.75		0.89		1.19	+0.25	3.48	3.48	±0.10	0.89	±0.10	0.39	15.14	±0.05	0.99		0.43	1.30
NA2-62	15.9	17.63		0.89		1.57	−0.05	3.48	3.48		0.89		0.45	16.89	0.10 (2)	0.99		0.51	1.52
NA2-68	17.5	19.38		0.89		1.57		3.48	3.48		0.91		0.54	18.59		0.99		0.56	1.68
NA2-75	19	21.11		0.89		1.57		3.73	3.73		1.02		0.59	20.22		0.99	+0.08	0.58	1.75
NA2-77	19.7	21.82		1.07		1.57		3.84	3.84		1.12		0.77	20.96		1.17	0	0.61	1.83
NA2-81	20.6	22.89		1.07		1.57		4.06	4.06		1.12		0.86	21.89		1.17		0.64	1.91
NA2-86	22	24.41		1.07		1.57		4.06	4.06		1.14		0.91	23.37		1.17		0.69	2.06
NA2-87	22.2	24.66		1.07	±0.05	1.57		4.06	4.06		1.14		0.95	23.65	±0.08	1.17		0.71	2.13
NA2-90	22.9	25.40	+0.38	1.07		1.57		4.06	4.06	±0.13	1.19	±0.13	1.00	24.36	0.10 (2)	1.17		0.74	2.21
NA2-93	23.8	26.44	−0.25	1.07		1.57		4.06	4.06		1.27		1.09	25.40		1.17		0.79	2.36
NA2-100	25.4	28.22		1.07		1.57		4.06	4.06		1.32		1.22	27.08		1.17		0.84	2.51
NA2-102	26.0	28.85		1.07		1.57		4.06	4.06		1.37		1.27	27.71		1.17		0.86	2.59
NA2-106	27	29.97		1.27		1.98		4.70	4.70		1.40		1.68	28.70		1.42		0.86	2.59
NA2-112	28.6	31.72		1.27		1.98		4.70	4.70		1.45		1.81	30.40		1.42		0.91	2.74
NA2-118	30.0	33.50		1.27		1.98		4.70	4.70		1.47		1.95	31.88		1.42		0.94	2.82
NA2-118	30.2	33.50		1.27		1.98		4.70	4.70		1.47		1.95	32.05		1.42		0.94	2.82
NA2-125	31.7	35.26	+0.64	1.27		1.98		4.70	4.70		1.57		2.18	33.78		1.42		1.02	3.05
NA2-125	32	35.26	−0.51	1.27		1.98		4.70	4.70	±0.15	1.57	±0.15	2.18	34.01	±0.10	1.42		1.02	3.05
NA2-131	33.3	36.98		1.27		1.98		4.70	4.70		1.57		2.27	35.46	0.13 (2)	1.42		1.07	3.20
NA2-137	34.9	38.76		1.27		1.98	+0.38	4.70	4.70		1.60		2.31	37.11		1.42		1.09	3.28
NA2-137	35.0	38.76		1.27		1.98	−0.50	4.70	4.70		1.60		2.31	37.19		1.42	+0.10	1.09	3.28
NA2-143	36.5	40.54		1.27		1.98		4.70	4.70		1.65		2.63	38.81		1.42	0	1.14	3.43
NA2-145	37.0	41.05		1.27		1.98		4.70	4.70		1.65		2.90	39.32		1.42		1.17	3.51
NA2-150	38.1	42.16		1.27		1.98		4.70	4.70		1.68		2.95	40.49		1.42		1.19	3.58
NA2-156	39.7	44.04		1.57		1.98		5.26	5.26		1.98		4.04	42.11		1.73		1.22	3.66
NA2-156	40	44.04	+0.89	1.57		1.98		5.26	5.26		1.98		4.04	42.44	±0.13	1.73		1.22	3.66
NA2-162	41.3	45.82	−0.64	1.57	±0.80	1.98		5.89	5.89	±0.18	2.08	±0.18	4.54	43.82	0.13 (2)	1.73		1.27	3.81
NA2-165	42	46.61		1.57		1.98		5.89	5.89		2.11		4.72	44.58		1.73		1.30	3.89
NA2-168	42.9	47.60		1.57		1.98		5.89	5.89		2.16		4.90	45.52		1.73		1.32	3.96

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TABLE C TYPE NA2 REFERENCE METRIC VALUES (DIMENSIONS) (CONT'D)

Ring Series and Size No.	Housing Diameter	Free Diameter		Thickness [Note (1)]		Hole Diameter		Lug Height (Max.)	Large Section		Small Section		Approx. Mass per 1000 Pcs.	Groove Dimensions					Edge Margin
														Diameter		Width		Depth	
	S, mm	*D*	Tol.	*T*	Tol.	*P*	Tol.	*B*	*E*	Tol.	*J*	Tol.	kg	*G*	Tol.	*W*	Tol.	(*d*)	*Z*
NA2-175	44.4	49.33		1.57		1.98		6.07	6.07		2.11		4.67	47.19		1.73		1.37	4.11
NA2-181	46	51.10		1.57		2.36		6.07	6.07		2.16		5.22	48.82		1.73		1.40	4.19
NA2-185	47	52.17	+0.89	1.57		2.36		6.07	6.07		2.16		5.81	49.83	±0.13	1.73	+0.10	1.42	4.27
NA2-187	47.6	52.17	−0.64	1.57		2.36		6.07	6.07		2.16		5.81	50.52	0.13 (2)	1.73	0	1.45	4.34
NA2-193	49.2	54.38		1.57		2.36		5.97	5.97		2.16		6.03	52.22		1.73		1.50	4.50
NA2-200	50.8	56.13		1.57		2.36		6.22	6.22		2.16		6.35	53.90		1.73		1.55	4.65
NA2-206	52	57.91		1.98		2.36		6.48	6.48		2.31		8.16	55.14		2.18		1.57	4.72
NA2-206	52.4	57.91		1.98		2.36		6.48	6.48		2.31		8.16	55.52		2.18		1.57	4.72
NA2-212	54	59.69		1.98		2.36		6.73	6.73		2.44		8.80	57.18		2.18		1.60	4.80
NA2-218	55	61.34		1.98		2.36		6.83	6.83		2.49		8.89	58.29		2.18		1.65	4.95
NA2-218	55.6	61.34		1.98		2.36		6.73	6.73		2.49		8.89	58.88		2.18		1.65	4.95
NA2-225	57.1	63.25		1.98		2.36		7.24	7.24		2.51		9.89	60.50		2.18		1.68	5.03
NA2-231	58.7	64.39		1.98		2.36		7.24	7.24		2.54		10.25	62.23		2.18		1.75	5.26
NA2-237	60.3	66.80		1.98		2.36		7.24	7.24	±0.18	2.59	±0.18	10.52	63.93		2.18		1.80	5.41
NA2-244	62	68.63	+1.02	1.98		2.79	+0.38	7.24	7.24		2.62		11.52	65.63		2.18		1.83	5.49
NA2-250	63.5	70.49	−0.76	1.98	±0.08	2.79	−0.05	7.24	7.24		2.62		11.57	67.26		2.18		1.88	5.64
NA2-250	64.3	70.49		1.98		2.79		7.24	7.24		2.62		11.57	68.10		2.18		1.91	5.72
NA2-256	65.1	72.24		2.36		2.79		7.75	7.75		2.77		15.42	68.94		2.62		1.93	5.79
NA2-262	66.7	73.91		2.36		2.79		7.49	7.49		2.82		15.65	70.64	±0.15	2.62	+0.13	1.98	5.94
NA2-268	68	75.69		2.36		2.79		7.75	7.75		2.87		15.88	72.06	0.15 (2)	2.62	−0.00	2.03	6.10
NA2-268	68.3	75.69		2.36		2.79		7.75	7.75		2.87		15.88	72.34		2.62		2.03	6.10
NA2-275	69.8	77.47		2.36		2.79		7.75	7.75		2.92		16.10	74.02		2.62		2.08	6.25
NA2-281	71.4	79.27		2.36		2.79		7.75	7.75		2.92		16.33	75.69		2.62		2.13	6.40
NA2-281	72	79.27		2.36		2.79		7.75	7.75		2.92		16.33	76.35		2.62		2.16	6.48
NA2-287	73	81.05		2.36		2.79		8.00	8.00		3.05		18.60	77.50		2.62		2.24	6.71
NA2-295	75	84.46		2.36		2.79		8.00	8.00		3.10		19.28	79.63		2.62		2.31	6.93
NA2-300	76.2	84.46		2.36		2.79		8.36	8.36		3.10		19.28	80.82		2.62		2.31	6.93
NA2-306	77.8	86.82		2.77		3.18		8.08	8.08		3.20		24.04	82.50		3.05		2.36	7.09
NA2-312	79.4	88.60		2.77		3.18		8.08	8.08		3.28		25.40	84.20		3.05		2.41	7.24
NA2-315	80	89.48		2.77		3.18		8.08	8.08		3.28		25.86	84.86		3.05		2.44	7.32
NA2-315	80.2	89.48	±1.40	2.77		3.18		8.08	8.08	±0.20	3.28	±0.20	25.86	85.04		3.05		2.44	7.32
NA2-325	82.5	92.02		2.77		3.18		8.89	8.89		3.43		27.22	87.53		3.05		2.49	7.47
NA2-334	85	94.84		2.77		3.18		8.89	8.89		3.56		29.48	90.07		3.05		2.54	7.62
NA2-347	88.1	97.97		2.77		3.18		8.89	8.89		3.66		31.30	93.35		3.05		2.62	7.85
NA2-350	88.9	98.81		2.77		3.18		8.89	8.89		3.61		32.21	94.23		3.05		2.67	8.00

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TABLE C TYPE NA2 REFERENCE METRIC VALUES (DIMENSIONS) (CONT'D)

Ring Series and Size No.	Housing Diameter	Free Diameter		Thickness [Note (1)]		Hole Diameter		Lug Height (Max.)	Large Section		Small Section		Approx. Mass per 1000 Pcs.	Groove Dimensions					Edge Margin
														Diameter		Width		Depth	
	S, mm	*D*	Tol.	*T*	Tol.	*P*	Tol.	*B*	*E*	Tol.	*J*	Tol.	kg	*G*	Tol.	*W*	Tol.	(*d*)	*Z*
NA2-354	90.5	99.97	±1.40	2.77		3.18		8.89	8.89		3.61		32.66	95.91		3.05		2.72	8.15
NA2-362	92.1	102.21		2.77		3.18		8.89	8.89		3.81		33.11	97.56		3.05		2.74	8.23
NA2-375	95.0	105.59		2.77		3.18		8.89	8.89		3.94		35.38	100.69		3.05		2.84	8.53
NA2-375	95.2	105.59		2.77		3.18	+0.38	8.89	8.89	±0.20	3.94	±0.20	35.38	100.94		3.05		2.84	8.53
NA2-387	98.4	108.99		2.77		3.18	−0.05	9.60	9.60		4.06		39.46	104.32		3.05		2.95	8.84
NA2-393	100.0	110.69		2.77		3.18		9.60	9.60		4.09		39.92	106.02	±0.15	3.05	+0.13	3.00	8.99
NA2-400	101.6	112.37		2.77	±0.08	3.18		9.60	9.60		4.22		42.18	107.70	0.15 (2)	3.05	0	3.05	9.14
NA2-412	104.8	115.77		2.77		3.18		9.60	9.60		4.34		44.00	110.87		3.05		3.05	9.14
NA2-425	108.0	119.15		2.77		3.18		9.60	9.60		4.57		45.81	114.05		3.05		3.05	9.14
NA2-433	110.0	120.80	±1.65	2.77		3.96		10.49	10.49		4.57		47.63	116.10		3.05		3.05	9.14
NA2-450	114.3	125.48		2.77		3.96		10.49	10.49		4.60		50.35	120.40		3.05		3.05	9.14
NA2-462	117.5	128.93		2.77		3.96		10.49	10.49		4.65		53.07	123.57		3.05		3.05	9.14
NA2-475	120.0	132.41		2.77		3.96		10.49	10.49		4.65		56.25	126.21		3.05		3.10	9.30
NA2-475	120.6	132.41		2.77		3.96		10.49	10.49		4.65		56.25	126.87		3.05		3.10	9.30
NA2-500	127.0	139.32		2.77		3.96		11.25	11.25	±0.23	4.72	±0.23	61.69	133.60		3.05		3.30	9.91
NA2-525	133.3	146.56		3.18		3.96		11.81	11.81		5.03		78.93	140.21		3.53		3.43	10.29
NA2-537	136.5	150.11		3.18	±0.10	3.96		11.81	11.81		5.03		81.19	143.51	±0.18	3.53	+0.15	3.43	10.29
NA2-550	139.7	154.08		3.18		3.96		11.81	11.81		5.03		83.01	146.56	0.15 (2)	3.53	0	3.43	10.29
NA2-575	146.0	160.93		3.18		3.96		11.81	11.81		5.03		87.09	152.91		3.53		3.43	10.29
NA2-600	152.4	168.15		3.18		3.96		11.81	11.81		4.98		91.17	159.26		3.53		3.43	10.29
NA2-625	158.7	175.13		3.96		4.75		12.57	12.57		5.36		120.66	165.86		4.42		3.56	10.67
NA2-650	165.1	182.12		3.96		4.75		12.57	12.57		5.56		127.46	172.47		4.42		3.68	11.05
NA2-662	168.3	185.62	±2.03	3.96		4.75	+0.51	12.57	12.57		5.61		138.35	175.90		4.42		3.81	11.43
NA2-675	171.4	189.10		3.96		4.75	−0.13	13.72	13.72		5.69		147.42	179.20		4.42		3.86	11.58
NA2-700	177.8	196.09		3.96		4.75		13.72	13.72		5.89		156.04	185.80		4.42		3.99	11.96
NA2-725	184.1	203.07		4.75		4.75		14.48	14.48		6.05		194.14	192.41		5.31		4.11	12.34
NA2-750	190.5	210.06		4.75		4.75		14.48	14.48		6.27		219.99	199.14	±0.20	5.31	+0.20	4.32	12.95
NA2-775	196.8	217.04		4.75		4.75		14.48	14.48		6.48		235.87	205.74	0.15 (2)	5.31	0	4.45	13.34
NA2-800	203.2	224.03	±2.29	4.75	±0.13	4.75		15.49	15.49		6.65		251.75	212.34		5.31		4.57	13.72
NA2-825	209.5	231.01		4.75		4.75		15.49	15.49		6.86		273.52	218.95		5.31		4.70	14.10
NA2-850	215.9	235.84		4.75		4.75		17.02	17.02		7.04		287.58	225.55		5.31		4.83	14.48
NA2-875	222.2	242.77		4.75		4.75		17.02	17.02	±0.25	7.26	±0.25	296.20	232.28		5.31		5.00	15.01
NA2-900	228.6	249.68		4.75		4.75		17.02	17.02		7.47		332.03	238.89		5.31		5.13	15.39
NA2-925	235.0	256.59		4.75		4.75		17.02	17.02		7.59		347.91	245.57		5.31		5.31	15.93
NA2-950	241.3	263.53		4.75		4.75		18.92	18.92		7.72		364.24	252.22		5.31		5.46	16.38
NA2-975	247.7	270.46		4.75		4.75		18.92	18.92		7.85		377.85	258.83		5.31		5.59	16.76
NA2-1000	254.0	277.37		4.75		4.75		18.92	18.92		8.00		391.45	265.43		5.31		5.72	17.15

GENERAL NOTE: See Table 7 for illustrations.

NOTES:

(1) For plated rings, add 0.05 mm to the listed maximum thickness except that maximum thickness after plating will be a minimum of 0.005 mm less than the listed groove width (*W*) minumum.

(2) *F.I.M. (Full Indicator Movement)*: maximum circular run out of groove to housing.

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NONMANDATORY APPENDIX D
TYPE NA2 REFERENCE METRIC VALUES
(SUPPLEMENTARY INFORMATION)

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TABLE D TYPE NA2 REFERENCE METRIC VALUES (SUPPLEMENTARY INFORMATION)

Ring Series and Size No.	Clearance Diameter		Gaging Diameter	Allowable Trust Loads Sharp Corner Abutment		Maximum Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.
	Ring Compressed in Housing	Ring Seated in Groove	For Checking Ring When Seated in Groove	UNS G10600–G10900 and Stainless Steel Rings Used in Hardened Housing (50 HRc, Min.)	All Standard Rings Used in Low Carbon Steel Housing			
	C1	C2	*A*, Min.	*Pr* (kN) [Note (1)]	*Pg* (kN)	*R*, Max.	*Ch*, Max.	*P'r* (kN)
NA2-25	2.92	3.38	1.19	1.89	0.85	0.28	0.22	0.85
NA2-31	4.39	4.85	1.40	2.39	1.07	0.41	0.33	0.85
NA2-37	5.18	5.74	1.60	4.74	1.56	0.58	0.46	2.36
NA2-43	5.84	6.45	1.60	5.51	1.96	0.69	0.53	2.36
NA2-45	6.35	6.96	1.80	5.78	2.05	0.69	0.53	2.36
NA2-50	6.60	7.37	2.29	8.94	2.27	0.69	0.53	4.89
NA2-51	6.86	7.62	2.34	9.16	2.31	0.69	0.53	4.89
NA2-56	6.99	7.75	2.41	10.02	3.16	0.69	0.53	4.89
NA2-62	8.64	9.65	2.64	11.15	4.67	0.69	0.53	4.89
NA2-68	10.16	11.18	3.00	12.19	5.69	0.69	0.53	4.89
NA2-75	11.43	12.45	3.63	13.54	6.49	0.81	0.64	4.89
NA2-77	12.07	13.21	3.68	20.54	7.03	0.89	0.71	7.34
NA2-81	12.45	13.72	3.89	21.67	7.61	0.89	0.71	7.34
NA2-86	13.72	14.99	4.37	23.03	8.81	0.89	0.71	7.34
NA2-87	13.84	15.24	4.55	23.25	9.25	0.89	0.71	7.34
NA2-90	14.35	15.75	4.78	24.15	9.79	0.97	0.76	7.34
NA2-93	15.49	17.02	5.08	25.28	10.90	0.97	0.76	7.34
NA2-100	16.89	18.54	5.38	26.86	12.45	1.07	0.86	7.34
NA2-102	17.53	19.18	5.59	27.32	13.34	1.07	0.86	7.34
NA2-106	17.40	19.05	5.41	33.64	13.57	1.12	0.89	10.68
NA2-112	18.92	20.70	5.89	35.67	15.12	1.19	0.91	10.68
NA2-118	20.07	21.84	5.74	37.92	16.46	1.19	0.91	10.68
NA2-118	20.32	22.10	6.22	37.92	16.46	1.19	0.91	10.68
NA2-125	22.23	24.26	6.73	39.73	18.90	1.22	0.97	10.68
NA2-125	22.48	24.51	7.37	39.73	18.90	1.22	0.97	10.68
NA2-131	23.62	25.65	7.21	41.99	20.91	1.22	0.97	10.68
NA2-137	25.15	27.18	7.54	43.80	22.46	1.22	0.97	10.68
NA2-137	25.15	27.18	7.75	43.80	22.46	1.22	0.97	10.68
NA2-143	26.92	29.21	7.95	46.05	24.46	1.22	0.97	10.68
NA2-145	27.43	29.72	8.13	46.50	25.35	1.22	0.97	10.68

(continued)

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TABLE D TYPE NA2 REFERENCE METRIC VALUES (SUPPLEMENTARY INFORMATION) (CONT'D)

Ring Series and Size No.	Clearance Diameter		Gaging Diameter	Allowable Trust Loads Sharp Corner Abutment		Maximum Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.
	Ring Compressed in Housing	Ring Seated in Groove	For Checking Ring When Seated in Groove	UNS G10600–G10900 and Stainless Steel Rings Used in Hardened Housing (50 HRc, Min.)	All Standard Rings Used in Low Carbon Steel Housing			
	C1	C2	*A*, Min.	*Pr* (kN) [Note (1)]	*Pg* (kN)	*R*, Max.	*Ch*, Max.	*P'r* (kN)
NA2-150	28.45	30.73	8.64	47.63	26.69	1.22	0.97	10.68
NA2-156	28.96	31.24	8.59	61.85	28.24	1.63	1.27	17.35
NA2-156	29.21	31.50	9.50	61.85	28.24	1.63	1.27	17.35
NA2-162	29.21	31.75	8.61	64.11	30.69	1.63	1.27	17.35
NA2-165	29.72	32.26	8.84	65.47	32.03	1.63	1.27	17.35
NA2-168	31.24	33.78	9.07	66.82	33.14	1.63	1.27	17.35
NA2-175	32.00	34.54	9.45	69.30	35.81	1.63	1.27	17.35
NA2-181	33.53	36.32	9.70	71.79	37.59	1.63	1.27	17.35
NA2-185	34.04	36.83	9.14	73.14	38.92	1.63	1.27	17.35
NA2-187	34.80	37.59	10.92	74.27	40.25	1.63	1.27	17.35
NA2-193	36.58	39.62	11.13	76.75	43.15	1.63	1.27	17.35
NA2-200	38.10	41.15	11.51	79.01	45.81	1.63	1.27	17.35
NA2-206	38.61	41.66	10.87	102.71	48.26	1.98	1.55	27.58
NA2-206	39.12	42.16	11.89	102.71	48.26	1.98	1.57	27.58
NA2-212	40.13	43.18	11.68	105.64	50.48	1.98	1.57	27.58
NA2-218	40.89	44.20	11.15	108.80	53.60	1.98	1.57	27.58
NA2-218	41.66	44.96	12.42	108.80	53.60	1.98	1.57	27.58
NA2-225	42.93	46.23	12.14	112.19	56.04	1.98	1.57	27.58
NA2-231	44.45	47.75	12.34	114.90	60.27	1.98	1.57	27.58
NA2-237	45.97	49.53	12.80	118.06	63.61	1.98	1.57	27.58
NA2-244	47.24	50.80	13.16	121.45	66.28	1.98	1.57	27.58
NA2-250	48.51	52.07	13.51	124.61	69.61	1.98	1.57	27.58
NA2-250	49.28	53.09	15.16	124.61	69.61	1.98	1.57	27.58
NA2-256	49.53	53.34	13.72	152.15	73.39	2.24	1.78	40.03
NA2-262	51.31	55.12	14.17	155.98	77.17	2.24	1.78	40.03
NA2-268	52.07	56.13	13.69	159.82	81.18	2.29	1.83	40.03
NA2-268	52.32	56.39	14.43	159.82	81.18	2.29	1.83	40.03
NA2-275	53.85	57.91	14.99	162.98	85.40	2.34	1.88	40.03
NA2-281	55.37	59.44	15.62	166.82	89.18	2.24	1.78	40.03
NA2-281	56.13	60.45	17.17	166.82	89.18	2.24	1.78	40.03

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TABLE D TYPE NA2 REFERENCE METRIC VALUES (SUPPLEMENTARY INFORMATION) (CONT'D)

Ring Series and Size No.	Clearance Diameter		Gaging Diameter	Allowable Trust Loads Sharp Corner Abutment		Maximum Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.
	Ring Compressed in Housing	Ring Seated in Groove	For Checking Ring When Seated in Groove	UNS G10600–G10900 and Stainless Steel Rings Used in Hardened Housing (50 HRc, Min.)	All Standard Rings Used in Low Carbon Steel Housing			
	C1	C2	*A*, Min.	*Pr* (kN) [Note (1)]	*Pg* (kN)	*R*, Max.	*Ch*, Max.	*P'r* (kN)
NA2-287	56.39	60.71	15.90	170.66	95.63	2.34	1.88	40.03
NA2-295	58.42	62.99	15.72	178.33	102.97	2.34	1.88	40.03
NA2-300	59.69	64.26	18.75	178.33	102.97	2.34	1.88	40.03
NA2-306	61.21	65.79	16.54	212.65	107.20	2.46	1.98	53.38
NA2-312	62.74	67.56	16.64	217.16	112.09	2.51	2.01	53.38
NA2-315	63.25	68.07	16.51	219.42	114.31	2.54	2.03	53.38
NA2-315	63.50	68.33	16.99	219.42	114.31	2.54	2.03	53.38
NA2-325	64.52	69.34	17.73	225.74	120.10	2.64	2.11	53.38
NA2-334	66.80	71.88	17.91	232.96	125.88	2.74	2.18	53.38
NA2-347	70.10	75.18	19.38	241.09	134.33	2.74	2.18	53.38
NA2-350	70.87	76.20	19.66	243.35	138.78	2.79	2.24	53.38
NA2-354	72.39	77.72	21.39	246.50	141.45	2.79	2.24	53.38
NA2-362	73.91	79.25	21.16	252.38	147.67	2.95	2.36	53.38
NA2-375	76.71	82.30	21.44	260.50	158.35	3.05	2.44	53.38
NA2-375	76.96	82.55	22.12	260.50	158.35	3.05	2.44	53.38
NA2-387	78.99	84.84	22.63	269.08	169.02	3.12	2.49	53.38
NA2-393	80.52	86.36	22.99	274.05	174.81	3.15	2.51	53.38
NA2-400	82.04	88.14	23.32	278.56	181.03	3.25	2.59	53.38
NA2-412	85.34	91.44	23.88	287.14	186.82	3.30	2.64	53.38
NA2-425	88.39	94.49	24.38	295.72	192.15	3.51	2.79	53.38
NA2-433	88.90	95.00	25.40	300.68	197.94	3.61	2.90	53.38
NA2-450	92.96	99.06	24.89	312.87	203.72	3.71	2.97	53.38
NA2-462	96.27	102.36	25.40	321.90	209.06	3.84	3.07	53.38
NA2-475	98.55	104.65	24.38	330.48	217.95	3.91	3.12	53.38
NA2-475	99.06	105.16	26.16	330.48	217.95	3.91	3.12	53.38
NA2-500	103.63	110.24	24.64	347.63	244.64	4.01	3.20	53.38
NA2-525	109.47	116.33	27.94	418.52	266.88	4.27	3.40	66.72
NA2-537	112.01	118.87	28.45	428.45	273.55	4.27	3.40	66.72
NA2-550	115.06	121.92	27.69	438.83	281.56	4.27	3.40	66.72
NA2-575	121.41	128.27	28.19	458.70	293.12	4.27	3.40	66.72

(continued)

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TABLE D TYPE NA2 REFERENCE METRIC VALUES (SUPPLEMENTARY INFORMATION) (CONT'D)

Ring Series and Size No.	Clearance Diameter		Gaging Diameter	Allowable Trust Loads Sharp Corner Abutment		Maximum Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.
	Ring Compressed in Housing	Ring Seated in Groove	For Checking Ring When Seated in Groove	UNS G10600–G10900 and Stainless Steel Rings Used in Hardened Housing (50 HRc, Min.)	All Standard Rings Used in Low Carbon Steel Housing			
	C1	C2	*A*, Min.	*Pr* (kN) [Note (1)]	*Pg* (kN)	*R*, Max.	*Ch*, Max.	*P'r* (kN)
NA2-600	127.76	134.62	28.70	478.11	305.13	4.27	3.40	66.72
NA2-625	133.10	140.21	29.46	621.68	329.60	4.50	3.61	102.30
NA2-650	139.45	146.81	31.75	646.96	355.40	4.60	3.68	102.30
NA2-662	142.24	149.86	32.51	659.15	374.52	4.65	3.71	102.30
NA2-675	143.51	151.13	30.73	671.79	386.98	4.78	3.81	102.30
NA2-700	149.35	157.23	32.00	696.62	414.11	4.98	3.99	102.30
NA2-725	154.43	162.56	33.53	864.57	443.02	5.13	4.11	151.23
NA2-750	160.78	169.42	35.31	894.82	480.83	5.28	4.22	151.23
NA2-775	167.13	176.02	36.58	924.61	511.52	5.44	4.34	151.23
NA2-800	171.45	180.59	38.10	954.41	542.66	5.59	4.47	151.23
NA2-825	177.80	187.20	38.86	984.21	575.13	5.82	4.65	151.23
NA2-850	181.10	190.75	43.43	1014.01	608.93	5.97	4.78	151.23
NA2-875	187.45	197.36	44.96	1040.19	647.18	6.12	4.90	151.23
NA2-900	193.80	203.96	46.48	1073.60	685.44	6.32	5.05	151.23
NA2-925	200.15	210.82	47.50	1103.40	727.69	6.43	5.13	151.23
NA2-950	202.69	213.61	48.51	1133.19	769.95	6.55	5.23	151.23
NA2-975	209.04	220.22	50.80	1162.99	809.09	6.68	5.33	151.23
NA2-1000	215.39	226.82	51.05	1192.79	848.23	6.86	5.49	151.23

GENERAL NOTES:
(a) For reference see Mandatory Appendix II illustrations.
(b) The values listed above apply to rings made from UNS G10600–G10900 and UNS S15700 stainless steel.
(c) *Safety Factors Pr and Pg*: the allowable thrust load values listed include the following safety factors: *Pr*: 4 *Pg*: 2.

NOTE:
(1) *Pr* values for rings made from beryllium copper can be calculated by multiplying listed values by 0.75.

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NONMANDATORY APPENDIX E
TYPE NA3 REFERENCE METRIC VALUES (DIMENSIONS)

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TABLE E TYPE NA3 REFERENCE METRIC VALUES (DIMENSIONS)

Ring Series and Size No.	Shaft Diameter	Ring Size and Weight						Groove Size					Edge Margin
		Free Diameter		Thickness [Note (1)]		Free Outside Dia. Nom.	Approx. Mass per 1000 Pcs.	Diameter		Width		Depth	
	S, mm	*D*	Tol.	*T*	Tol.	*Y*	kg	*G*	Tol.	*W*	Tol.	*(d)*	*Z*
NA3-4 (2)	1	0.64		0.25	±0.03	2.01	0.004	0.66		0.30		0.18	0.36
NA3-S6	1.6	1.30	+0.03	0.25		3.56	0.01	1.32		0.30		0.13	0.25
NA3-Y6	1.6	1.30	−0.08	0.51	±0.05	4.75	0.04	1.32		0.58		0.13	0.25
NA3-6	1.6	1.30		0.25	±0.03	3.96	0.01	1.32		0.30		0.13	0.25
NA3-9	2.4	1.75	+0.05/−0.08	0.38		5.84	0.05	1.88	+0.05	0.51	+0.05	0.25	0.51
NA3-S9	2.4	1.85		0.38		4.75	0.03	1.88	0	0.51	0	0.25	0.51
NA3-S11	2.8	1.93		0.38		9.53	0.14	2.01	0.038 (3)	0.51		0.38	0.76
NA3-S12	3.2	2.39		0.64		5.44	0.05	2.41		0.74		0.38	0.76
NA3-12	3.2	2.39		0.38		5.84	0.04	2.41		0.51		0.38	0.76
NA3-S14	3.6	2.54		0.38		5.16	0.03	2.59		0.51		0.48	0.97
NA3-Y14	3.6	2.74		0.38		6.35	0.05	2.79		0.51		0.38	0.76
NA3-14	3.6	2.59	+0.03	0.64	±0.05	6.86	0.10	2.67		0.74		0.43	0.86
NA3-S15	4	2.95	−0.08	1.07		9.53	0.34	3.00		1.17		0.48	0.97
NA3-15	4	2.90		0.64		7.16	0.10	2.95	+0.05	0.74		0.51	1.02
NA3-S17	4.4	3.18		0.64		7.92	0.11	3.23	0	0.74		0.56	1.12
NA3-S18	4.8	3.10		0.64		9.53	0.20	3.18	0.05 (3)	0.74		0.79	1.57
NA3-Y18	4.8	3.68		0.64		11.94	0.32	3.73		0.74		0.51	1.02
NA3-18	4.8	3.68		0.64		8.51	0.13	3.73		0.74		0.51	1.02
NA3-S21	5.6	4.70		0.64		11.10	0.21	4.78		0.74		0.38	0.76
NA3-25	6.3	5.26		0.64		13.39	0.34	5.33		0.74		0.51	1.02
NA3-S31	7.9	6.17		0.64		12.70	0.26	6.35		0.74	+0.08	0.79	1.57
NA3-Y31	7.9	6.17		0.64		17.02	0.55	6.35		0.74	0	0.79	1.57
NA3-S37	9.5	7.70	+0.05	0.89		14.40	0.48	7.77		0.99		0.86	1.73
NA3-37	9.5	7.62	−0.10	0.89		16.76	0.68	7.70		0.99		0.91	1.83
NA3-43	11.1	8.56		0.89		17.45	0.68	8.71	+0.08	0.99		1.19	2.39
NA3-S43	11.1	9.53		0.89		15.24	0.45	9.65	0	0.99		0.74	1.47
NA3-50	12.7	9.96		1.07		20.32	1.13	10.06	0.10 (3)	1.17		1.32	2.64
NA3-62	15.9	12.19		1.07		23.88	1.45	12.32		1.17		1.78	3.56
NA3-S74	19.0	15.65		1.27		25.40	1.95	15.88		1.42		1.57	3.15
NA3-75	19.0	14.58	+0.08	1.27		28.45	2.63	14.73		1.42		2.16	4.32
NA3-87	22.2	16.97	−0.13	1.27		33.02	3.45	17.15		1.42		2.54	5.08
NA3-S98	25.0	20.88		1.27		38.10	4.17	21.21		1.42		1.88	3.76
NA3-S98	25.4	20.88		1.27		38.10	4.17	21.21		1.42		2.08	4.17
NA3-S118	30.2	27.08	+0.15	1.57	±0.08	41.30	5.13	27.41	+0.13/0	1.73	+0.10	1.37	2.74
NA3-S137	34.9	30.81	−0.25	1.57		47.63	6.99	31.24	0.13 (3)	1.73	0	1.83	3.66

GENERAL NOTE: See Table 8 for illustrations.

NOTES:

(1) For plated rings, add 0.05 mm to the listed maximum thickness except that maximum thickness after plating will be a minimum of 0.005 mm less than the listed groove width (*W*) minimum.

(2) Available in beryllium copper only.

(3) *F.I.M. (Full Indicator Movement)*: maximum circular run out of groove to shaft.

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NONMANDATORY APPENDIX F
TYPE NA3 REFERENCE METRIC VALUES
(SUPPLEMENTARY INFORMATION)

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TABLE F TYPE NA3 REFERENCE METRIC VALUES (SUPPLEMENTARY INFORMATION)

Ring Series and Size No.	Clearance Diameter	Allowable Thrust Load Sharp Corner Abutment		Maximum Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.	Calculated Allowable Assembly [Note (1)]
	Ring Seated in Groove	UNS G10600–G10900 and Stainless Steel Rings Used on Hardened Shafts (50 HRc, Min.)	All Standard Rings Used on Low Carbon Steel Shafts				
	C2	*Pr* (kN) [Note (1)]	*Pg* (kN)	*R*, Max.	*Ch*, Max.	*P'r* (kN)	RPM
NA3-4 [Note (1)]	2.29	0.06	0.03	0.38	0.25	0.06	40000
NA3-S6	3.81	0.09	0.03	0.76	0.51	0.09	40000
NA3-Y6	5.08	0.18	0.03	0.89	0.64	0.18	40000
NA3-6	4.19	0.09	0.03	0.76	0.51	0.09	40000
NA3-9	6.22	0.20	0.09	1.35	1.02	0.20	36000
NA3-S9	5.08	0.20	0.09	1.02	0.76	0.20	36000
NA3-S11	9.91	0.27	0.18	2.03	1.52	0.27	35000
NA3-S12	5.72	0.49	0.20	1.02	0.76	0.48	35000
NA3-12	6.10	0.29	0.20	1.02	0.76	0.29	35000
NA3-S14	5.46	0.34	0.27	0.74	0.56	0.33	32000
NA3-Y14	6.73	0.34	0.20	1.02	0.76	0.33	32000
NA3-14	7.24	0.77	0.27	1.52	1.14	0.76	32000
NA3-S15	9.91	1.33	0.31	2.03	1.52	1.11	31000
NA3-15	7.49	0.79	0.33	1.52	1.14	0.78	31000
NA3-S17	8.26	0.81	0.40	1.52	1.14	0.80	30000
NA3-S18	9.91	0.90	0.60	1.52	1.14	0.89	30000
NA3-Y18	12.32	0.86	0.40	1.52	1.14	0.85	25000
NA3-18	8.89	0.86	0.40	1.52	1.14	0.85	30000
NA-S21	11.43	1.01	0.33	1.52	1.14	1.00	26000
NA3-25	13.72	1.15	0.51	1.52	1.14	1.13	25000
NA3-S31	13.21	1.47	1.00	1.52	1.14	1.45	22000
NA3-Y31	17.40	1.45	0.98	1.52	1.14	1.42	15000
NA3-S37	14.91	3.02	1.33	1.52	1.14	3.02	20000
NA3-37	17.27	3.11	1.40	1.65	1.27	3.07	20000
NA3-43	18.03	3.75	2.14	1.65	1.27	3.69	16500
NA3-S43	15.75	3.61	1.25	1.27	0.89	3.56	16500
NA3-50	20.83	5.01	2.67	2.03	1.52	4.94	14000
NA3-62	24.38	6.41	4.67	2.03	1.52	6.32	12000
NA3-S74	25.91	8.80	4.89	1.45	1.07	8.45	11000
NA3-75	28.96	9.03	6.67	2.16	1.65	8.90	10500
NA3-87	33.53	10.61	9.12	2.16	1.65	10.45	9000
NA3-S98	38.86	11.74	7.78	2.16	1.65	12.01	6500
NA3-S98	38.86	11.97	8.45	1.96	1.45	12.01	6500
NA3-S118	42.42	15.57	6.67	2.29	1.78	15.35	5500
NA3-S137	48.77	18.51	10.45	2.29	1.78	18.24	4000

GENERAL NOTES:

(a) For reference, see Mandatory Appendix III illustrations.

(b) The values listed above apply to rings made from UNS G10600–G10900 and UNS S15700 stainless steel except Size -4, which is supplied in beryllium copper only.

(c) *Safety Factors Pr and Pg:* the allowable thrust load values listed include the following safety factors: *Pr*: 3 *Pg*: 2.

NOTE:

(1) *Pr* values for other sizes made from beryllium copper can be calculated by multiplying listed values by 0.75.

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HEAVY DUTY EXTERNAL TYPE NA4, REINFORCED E-RINGS NA5, C-RINGS TYPE NA6

1 INTRODUCTORY NOTES

1.1 Scope

This Standard covers complete general and dimensional data for three series of general purpose tapered and reduced cross section retaining rings, which may be used with the nominal size shafts and in grooves of the recommended dimensions listed. Also included are formulas and tolerances on which dimensional data are based. Three appendices include guidance for assembly and recommended standard drawing formats.

The inclusion of dimension data in this Standard is not intended to imply that all of the products described are stock production sizes. Consumers should consult with suppliers concerning lists of stock production sizes.

1.2 ISO Standard

There are no existing ISO standards for these products.

1.3 Ring Types

1.3.1 Heavy Duty External Rings Type NA4. Dimensions of retaining rings and grooves for various shaft sizes are given in Table 6. See Nonmandatory Appendix A for equivalent metric data.

1.3.2 Reinforced E-Rings Type NA5. Dimensions for retaining rings and grooves for various shaft sizes are given in Table 7. See Nonmandatory Appendix C for equivalent metric data.

1.3.3 External C-Rings Type NA6. Dimensions of C-Type external retaining rings and grooves for various shaft sizes are given in Table 8. See Nonmandatory Appendix E for equivalent metric data.

1.4 Designations

Retaining rings in this Standard shall be designated by the following data in the sequence shown: ring series type number; size; material; protective finish, if required; or by, optionally, ASME B18.24.3 PIN Code. See examples below:

NA4-50, Carbon spring steel, phosphate
R272NAA0050NN056NNAA1

NA5-37, Corrosion resistant steel
R272NAB0037NN519NNAB1

NA6-62, Beryllium copper
R272NAC0062NN643NNAA1

1.5 Applicability

The rings covered by this Standard are intended primarily for use with the shaft and groove sizes recommended; however, in certain cases these diameters may be altered somewhat to suit the requirements of a particular design. When such changes are made, care should be taken to not alter the shaft size to such an extent that the ring will take enough permanent set to allow a loose fit after the ring has been assembled into the groove. Neither should the groove diameter be altered to the extent to permit the ring to fit loosely.

1.6 Dimensions

All dimensions in this Standard are in inches unless otherwise stated.

1.7 Supplementary Information

Allowable loads, maximum radii and chamfers, clearance dimensions, gauging diameters, and RPM limits for all three ring series are included in Mandatory Appendices I, II, and III.

1.8 Reference Standards

Unless otherwise specified, the referenced standard shall be the most recent issue at the time of order placement.

ASTM E 18, Standard Test Method for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials

ASTM B 117, Standard Practice for Operating Salt Spray (Fog) Testing Apparatus

ASTM A 380, Standard Practice for Cleaning and Descaling Stainless Steel Parts, Equipment, and Systems

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ASTM B 695, Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel

ASTM DS-56F/SAE HS-1086, Unified Numbering System (UNS) for Metals and Alloys

Publisher: The American Society for Testing and Materials (ASTM), 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959

2 GENERAL DATA

2.1 Heavy Duty External Retaining Rings

2.1.1 The NA4 heavy duty basic type retaining rings covered by this Standard are spread over a shaft by means of a pliers or special tool and allowed to relax and seat in a circumferential groove, thereby providing an external protruding shoulder that can be used for locating and retaining a part on the shaft.

By virtue of their greater thickness and larger section height, these rings are more resistant to shearing and coming out of their grooves than Type NA1 rings.

2.1.2 The NA5 reinforced E-Type retaining rings covered by this Standard contain three prongs connected by a reduced tapered section bridge to provide greater resilience during installation. The rings are installed radially, usually by means of an applicator and provide a high shoulder for abutment by a retained part.

These rings, by virtue of their design, are substantially stiffer and more resistant to coming out of their grooves under centrifugal forces than Type NA3 rings.

2.2 C-Type Retaining Rings

The NA6 C-Type retaining rings covered by this Standard have a tapered section with the taper on the inner surface of the ring facing the groove. The rings are installed radially, usually by means of an applicator, and provide a narrow, uniform shoulder for abutment by a retained part.

3 MATERIAL

3.1 Carbon Spring Steel

Retaining rings made from carbon spring steel shall conform to the chemical composition of UNS G10600 to G10900 and have the following physical properties.

3.1.1 Heat Treatment. The retaining rings shall be heat treated by austempering to the hardness values as specified in Table 1.

3.1.2 Finishes. The following finishes are available.

3.1.2.1 Phosphate Coating. Finish shall consist of basic zinc phosphate treatment and subsequent supplementary treatment to enhance shelf life (example of supplementary treatment: *wax, light drying oil*).

3.1.2.2 Zinc Plating. Finish shall consist of mechanically applied zinc with a dichromate conversion treatment similar to ASTM B 695 Type II, Class 8. The resulting treatment shall be capable of withstanding 72 hours to white corrosion or red rust. Salt spray corrosion resistance test method shall be similar to ASTM B 117.

NOTE: Electroplating is not allowed for the plating of retaining rings.

3.1.2.3 Oil Finish. To extend Shelf Life, rings shall be coated with a thin film of non-tacky water displacing rust preventative oil.

3.2 Corrosion-Resistant Steel

Retaining rings made from corrosion-resistant steel shall conform to the chemical composition of UNS S15700 and have the following physical properties.

3.2.1 Heat Treatment. The retaining rings shall be heat treated to the hardness values specified in Table 2.

3.2.2 Surface Treatment. Retaining rings shall be cleaned free of scale, grease, oil, and other foreign material in conformance to ASTM A 380.

3.3 Beryllium Copper

Retaining rings made from beryllium copper shall conform to the chemical composition of UNS C17200 and have the following physical properties.

3.3.1 Heat Treatment. The retaining rings shall be heat treated to the hardness values specified in Table 3.

3.3.2 Surface Treatment. Retaining rings shall be cleaned to remove oxide formed as a result of the heat treating process. Since these rings have extremely high resistance to most types of atmospheric corrosion, further protective finishes are usually not required.

4 HARDNESS TESTING PROCEDURE

The surfaces of both sides of each sample retaining ring shall be prepared for hardness testing by removal of all plating and other surface conditions that may

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TABLE 1 HARDNESS RANGES FOR TAPERED AND REDUCED CROSS SECTION RETAINING RINGS (CARBON SPRING STEEL)

NA4		NA5	
Ring Size	**Hardness**	**Ring Size**	**Hardness**
39 through 62	67.5–72 HR30N (49–54 HRC)	9 and 12	84.5–87 HR15N (48–53 HRC)
66 and over	47–52 HRC	15 through 31	66.5–71 HR30N (48–53 HRC)
		37 and over	47–52 HRC

NA6	
Ring Size	**Hardness**
12 through 18 [Note (1)]	86–88.5 HR15N (51–56 HRC)
21 through 43	67.5–72 HR30N (49–54 HRC)
50 through 81	66–71 HR30N (47–53 HRC)
87 and over	47–52 HRC

NOTE:
(1) These parts can only be checked by mounting for microhardness testing.

TABLE 2 HARDNESS RANGES FOR TAPERED AND REDUCED CROSS SECTION RETAINING RINGS (CORROSION-RESISTANT STEEL)

NA4		NA5	
Ring Size	**Hardness**	**Ring Size**	**Hardness**
39 and 42	63–69.5 HR30N (44–51 HRC)	9 and 12	82.5–86 HR15N (44–51 HRC)
47 and over	44–51 HRC	15 through 31	63–69.5 HR30N (44–51 HRC)
		37 and over	44–51 HRC

NA6	
Ring Size	**Hardness**
12 through 18 [Note (1)]	82.5–86 HR15N (44–51 HRC)
21 through 81	63–69.5 HR30N (44–51 HRC)
87 and over	44–51 HRC

NOTE:
(1) These parts can only be checked by mounting for microhardness testing.

affect the hardness reading. Hardness testing procedure shall be in conformance to ASTM E 18.

5 PERMANENT SET LIMITS

The following procedures shall be used for determining if the permanent set of the ring is within the allowable limits.

5.1 NA4 Heavy Duty External Retaining Rings

Step 1. Expand the ring with a plier until it just fits over a shaft 1% larger than the nominal shaft diameter. Repeat this procedure 4 more times with the same ring. The ring shall not crack during this procedure.

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TABLE 3 HARDNESS RANGES FOR TAPERED AND REDUCED CROSS SECTION RETAINING RINGS (BERYLLIUM COPPER)

NA4		NA5	
Ring Size	**Hardness**	**Ring Size**	**Hardness**
39 and 42	54–62 HR30N (34–43 HRC)	9 and 12	77–82 HR15N (34–43 HRC)
47 and over	34–43 HRC	15 through 31	54–62 HR30N (34–43 HRC)
		37 and over	34–43 HRC

NA6	
Ring Size	**Hardness**
12 through 62 [Note (1)]	77–82 HR15N (34–43 HRC)
68 through 81	54–62 HR30N (34–43 HRC)
87 and over	34–43 HRC

NOTE:
(1) These parts can only be checked by mounting for microhardness testing.

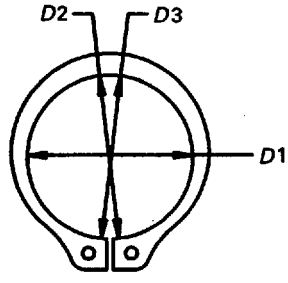


FIG. 1 PERMANENT SET MEASUREMENTS FOR TYPE NA4 RINGS

Step 2. Measure the ring diameter (D) in the three places shown in Fig. 1.

Step 3. Compute the average of the 3 diameters and compare it to the minimum groove diameter listed in the Table 6 for that ring. In all cases, the average diameter after permanent set shall be less than the groove diameter to insure that the ring will seat tightly.

5.2 NA5 (Reinforced E-Type) and NA6 (C-Type) External Retaining Rings

The rings shall, upon being installed in the minimum groove diameter by an applicator or similar tool, grip the minimum groove diameter and shall have no less than 3 point contact.

6 IRREGULARITY LIMITATIONS

6.1 Dish

Dish measurements of tapered and reduced section retaining rings as shown in Fig. 2 shall not exceed the limitations specified in Table 4 for the applicableum ring series thickness.

6.2 Pitch

Pitch measurements of tapered and reduced section retaining rings as shown in Fig. 3 shall not exceed the limitations specified in Table 5 for the applicable ring series thickness.

7 WORKMANSHIP

Workmanship shall be in accordance with high grade commercial practice. Rings shall be free from rust, loose scale, hanging burrs, cracks, and any other defects that might affect their functioning.

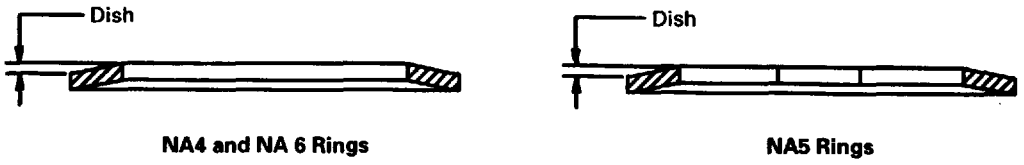
8 ADDITIONAL DATA

8.1 Dimensional Data

Dimensional data and performance information on rings and grooves for tapered and reduced cross section

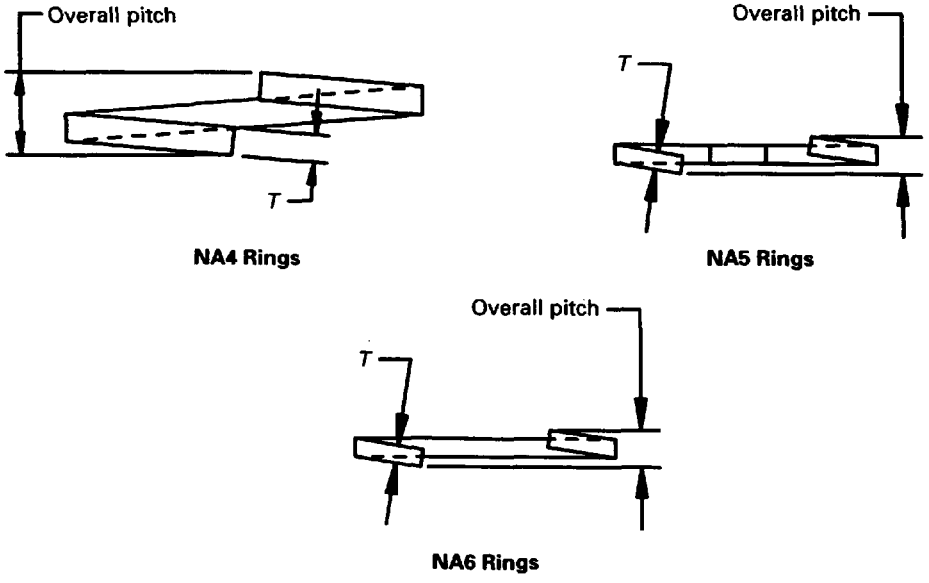
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NA4 and NA 6 Rings NA5 Rings

FIG. 2 DISH FOR TYPE NA4, TYPE NA5, AND TYPE NA6 RINGS



NA4 Rings NA5 Rings

NA6 Rings

FIG. 3 PITCH FOR TYPE NA4, TYPE NA5, AND TYPE NA6 RINGS

retaining rings are tabulated in Tables 6, 7, and 8 and Mandatory Appendices I, II, and III.

8.2 Metric Values

For reference purposes only, metric values are shown in Nonmandatory Appendices A, B, C, D, E, and F.

8.3 Additional Information

Consult with suppliers for additional information not included in this Standard.

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TABLE 4 DISH LIMITATIONS FOR TAPERED AND REDUCED SECTION RETAINING RINGS

NA4 [Note (1)]		NA5 [Note (2)]	
Ring Thickness	Max. Dish	Ring Thickness	Max. Dish
0.035	0.003	0.015	0.002
0.042–0.093	0.005	0.025–0.035	0.003
0.109–0.125	0.010	0.042	0.005

NA6 [Note (3)]	
Ring Thickness	Max. Dish
0.015	0.002
0.025–0.035	0.003
0.042–0.062	0.005

NOTES:
(1) See Table 6 for ring sizes.
(2) See Table 7 for ring sizes.
(3) See Table 8 for ring sizes.

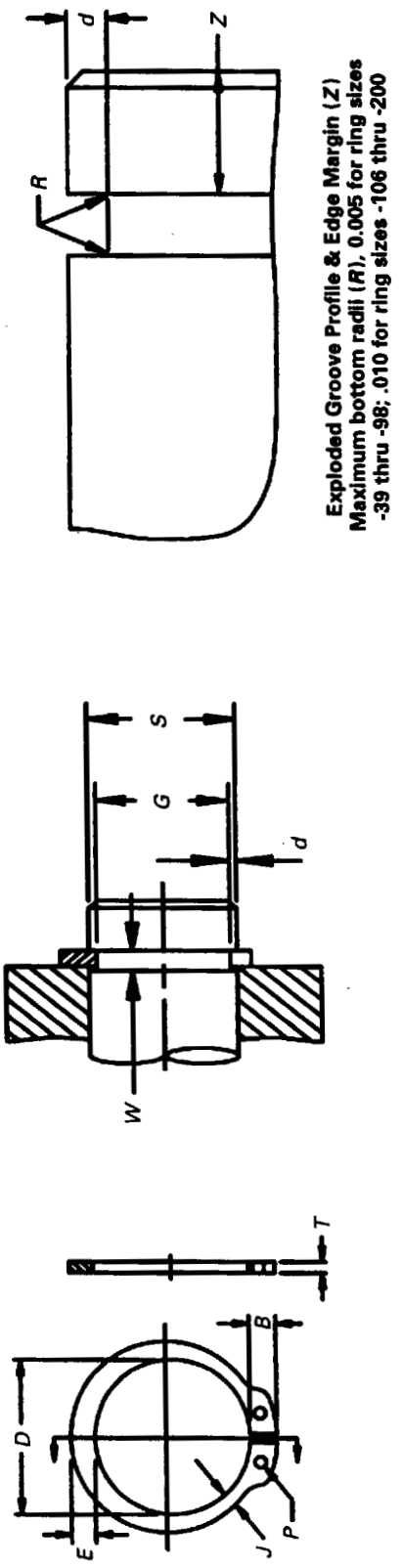
TABLE 5 PITCH LIMITATIONS FOR TAPERED AND REDUCED SECTION RETAINING RINGS

NA4		NA5	
Ring Size	Overall Pitch, Max.	Ring Size	Overall Pitch, Max.
All sizes	3T	9 through 50	1.5T
...	...	56	2T

NA6	
Ring Size	Overall Pitch, Max.
12 through 50	1.5T
56 through 200	2T

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TABLE 6 ILLUSTRATION



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TABLE 6 NA4 HEAVY DUTY EXTERNAL RETAINING RINGS

Ring Series and Size No.	Shaft Diameter			Free Diameter		Thickness [Note (1)]		Hole Diameter		Lug Height (Max.)	Large Section		Small Section		Approx. Mass per 1000 Pcs.	Groove Dimensions					Edge Margin
																Diameter		Width		Depth	
	S, Dec.	*S*, Frac.	*S*, mm	*D*	Tol.	*T*	Tol.	*P*	Tol.	*B*	*E*	Tol.	*J*	Tol.	lb	*G*	Tol.	*W*	Tol.	(*d*)	*Z*
NA4-39	0.394	...	10.0	0.362	+0.003	0.035		0.042		0.105	0.068		0.039		0.70	0.368	+0.001	0.039		0.013	0.039
NA4-42	0.428	...	10.9	0.394	−0.006	0.035		0.042		0.105	0.076	±0.004	0.043	±0.004	0.86	0.402	−0.002	0.039	+0.003	0.013	0.039
NA4-47	0.473	...	12.0	0.435		0.042		0.042	+0.010	0.105	0.088		0.053		1.4	0.444	0.002 (2)	0.046	−0.000	0.015	0.045
NA4-50	0.500	1/2	12.7	0.460		0.050	±0.002	0.050	−0.002	0.124	0.090		0.050		1.6	0.468		0.056		0.016	0.048
NA4-59	0.591	...	15.0	0.543		0.050		0.050		0.134	0.102		0.057		2.2	0.555		0.056	+0.004	0.018	0.054
NA4-62	0.625	5/8	15.9	0.575		0.050		0.050		0.134	0.108	±0.005	0.059	±0.005	2.3	0.588		0.056	−0.000	0.019	0.057
NA4-66	0.669	...	17.0	0.616	+0.005	0.050		0.050		0.134	0.112		0.062		2.6	0.629		0.056		0.020	0.060
NA4-75	0.750	3/4	19.0	0.689	−0.010	0.078		0.078		0.185	0.127		0.077		5.6	0.704	+0.001	0.086		0.023	0.069
NA4-75	0.787	...	20.0	0.689		0.078		0.078		0.185	0.127		0.077		5.6	0.740	−0.003	0.086		0.024	0.072
NA4-87	0.875	7/8	22.2	0.804		0.078		0.078		0.185	0.148	±0.006	0.083	±0.006	7.5	0.821	0.002 (2)	0.086		0.027	0.081
NA4-98	0.984	63/64	25.0	0.906		0.078		0.078		0.185	0.151		0.084		7.8	0.925		0.086		0.030	0.090
NA4-98	1.000	1	25.4	0.906		0.078		0.078		0.185	0.151		0.084		7.8	0.938		0.086		0.031	0.093
NA4-106	1.062	1 1/16	27.0	0.976		0.093		0.093		0.225	0.161		0.090		11.5	0.958		0.103		0.032	0.096
NA4-112	1.125	1 1/8	28.6	1.036		0.093		0.093		0.225	0.169		0.095		12.5	1.059		0.103		0.033	0.099
NA4-118	1.181	...	30.0	1.087	+0.010	0.093		0.093		0.225	0.176		0.098		13.5	1.111		0.103		0.035	0.105
NA4-118	1.188	1 3/16	30.2	1.087	−0.015	0.093	±0.003	0.093		0.225	0.176	±0.007	0.098	±0.007	13.5	1.111	+0.002	0.103	+0.005	0.038	0.114
NA4-125	1.250	1 1/4	31.7	1.150		0.093		0.093	+0.015	0.225	0.185		0.103		14.9	1.174	−0.004	0.103	−0.000	0.038	0.114
NA4-131	1.312	1 5/16	33.3	1.208		0.093		0.093	−0.002	0.225	0.192		0.106		16.0	1.234	0.004 (2)	0.103		0.039	0.117
NA4-137	1.375	1 3/8	34.9	1.268		0.093		0.093		0.225	0.200		0.110		17.8	1.291		0.103		0.042	0.126
NA4-137	1.378	...	35.0	1.288		0.093		0.093		0.225	0.200		0.110		17.8	1.291		0.103		0.044	0.132
NA4-150	1.500	1 1/2	38.1	1.380		0.109		0.109		0.285	0.218		0.123		27.0	1.406		0.120		0.047	0.141
NA4-156	1.562	1 9/16	39.7	1.437		0.109		0.109		0.285	0.228		0.127		31.0	1.468		0.120		0.047	0.141
NA4-156	1.575	...	40.0	1.437		0.109		0.109		0.285	0.228		0.127		31.0	1.480		0.120		0.048	0.144
NA4-175	1.750	1 3/4	44.4	1.608		0.109		0.109		0.295	0.254	±0.008	0.140	±0.008	33.4	1.650		0.120		0.050	0.150
NA4-175	1.772	...	45.0	1.608	+0.013	0.109		0.109		0.295	0.254		0.140		33.4	1.669	+0.003	0.120		0.062	0.156
NA4-193	1.938	1 15/16	49.2	1.782	−0.020	0.125		0.125		0.320	0.280		0.154		48.0	1.826	−0.004	0.139		0.056	0.168
NA4-193	1.969	1 31/32	50.0	1.782		0.125	±0.004	0.125		0.320	0.280		0.154		48.0	1.850	0.004 (2)	0.139	+0.006	0.060	0.180
NA4-200	2.000	2	50.8	1.840		0.125		0.125		0.320	0.290		0.160		50.6	1.880		0.139	−0.000	0.060	0.180

GENERAL NOTE: For reference, see Table 6 Illustration on previous page.

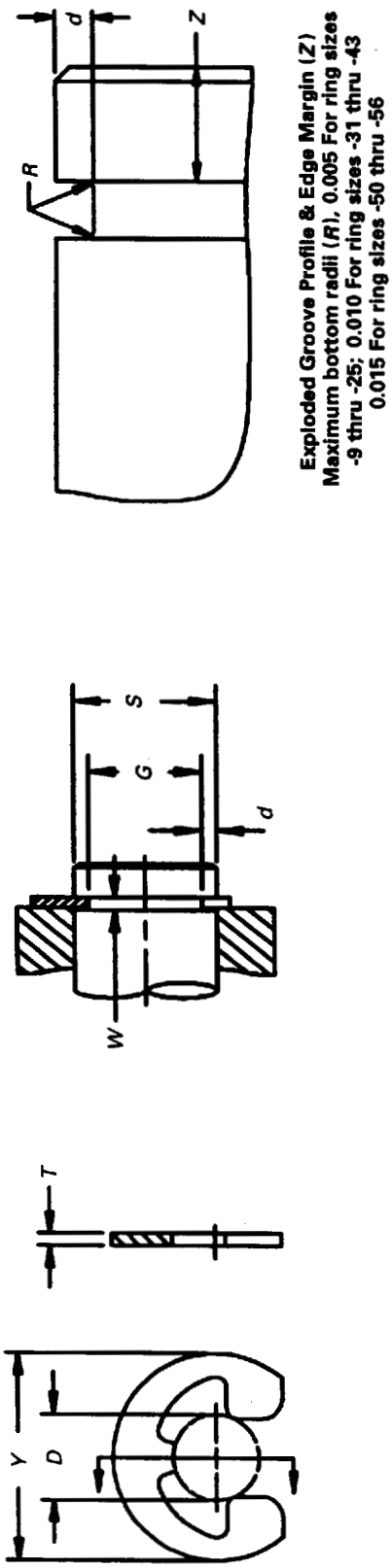
NOTES:

(1) For plated rings, add 0.002 in. to the listed maximum thickness except that maximum ring thickness after plating will be a minimum of 0.0002 in. less than the listed groove width (*W*) minimum.

(2) *F.I.M. (Full Indicator Movement)*: maximum circular run out of groove to shaft.

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TABLE 7 ILLUSTRATION



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TABLE 7 NA5 (REINFORCED E-TYPE) EXTERNAL RETAINING RINGS

Ring Series and Size No.	Shaft Diameter			Ring Size and Weight						Groove Size						Edge Margin
				Free Diameter			Thickness [Note (1)]		Free Outside Dia. Nom.	Approx. Mass per 1000 Pcs.	Diameter		Width		Depth	
	S, Dec.	S, Frac.	S, mm	D	Tol.		T	Tol.	Y	lb	G	Tol.	W	Tol.	(d)	Z
NA5-9	0.094	3/32	2.4	0.072	+0.001		0.015		0.206	0.07	0.074	+0.002	0.020	+0.002	0.010	0.020
NA5-12	0.125	1/8	3.2	0.093	−0.003		0.015		0.270	0.13	0.095	−0.000	0.020	−0.000	0.015	0.030
NA5-15	0.156	5/32	4.0	0.113	+0.002/−0.003		0.025		0.335	0.31	0.116	0.0015 (2)	0.029		0.020	0.040
NA5-18	0.188	3/16	4.8	0.143			0.025		0.375	0.39	0.147		0.029		0.020	0.040
NA5-21	0.219	7/32	5.6	0.182	±0.003		0.025	±0.002	0.446	0.54	0.188	±0.002	0.029		0.015	0.031
NA5-25	0.250	1/4	6.3	0.204			0.025		0.516	0.71	0.210	0.002 (2)	0.029		0.020	0.040
NA5-31	0.312	5/16	7.9	0.242			0.025		0.588	0.85	0.250	±0.003	0.029	+0.003	0.031	0.062
NA5-37	0.375	3/8	9.5	0.292			0.035		0.660	1.5	0.303	0.003 (2)	0.039	−0.000	0.036	0.072
NA5-43	0.438	7/16	11.1	0.332			0.035		0.745	1.9	0.343		0.039		0.047	0.094
NA5-50	0.500	1/2	12.7	0.385	±0.004		0.042		0.810	3.2	0.396	±0.003	0.046		0.052	0.104
NA5-56	0.562	9/16	14.3	0.430			0.042		0.870	3.5	0.437	0.004 (2)	0.046		0.062	0.124

GENERAL NOTE: For reference, see Table 7 Illustration on previous page.

NOTES:

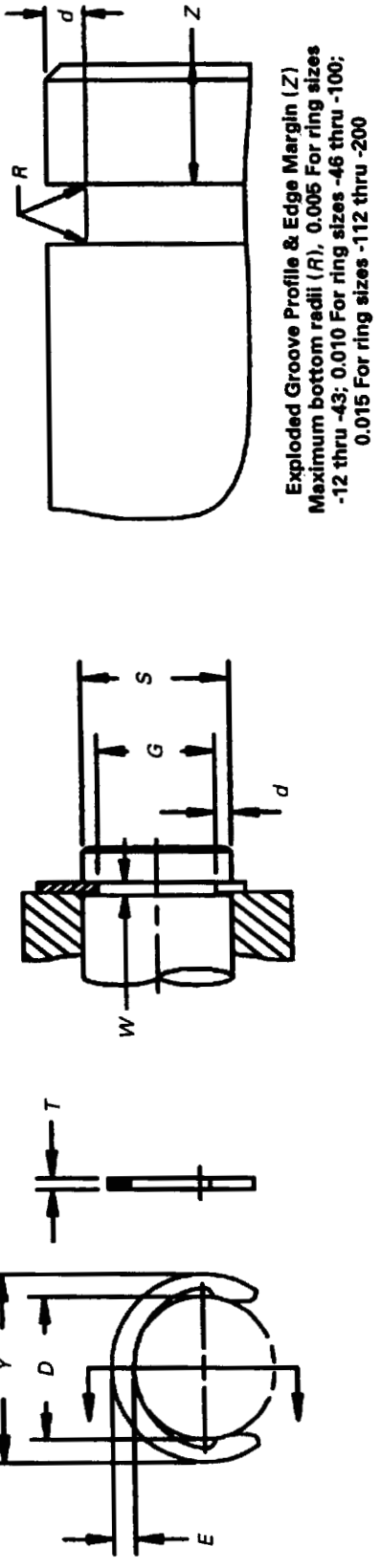
(1) For plated rings, add 0.002 in. to the listed maximum thickness except that maximum ring thickness after plating will be a minimum of 0.0002 in. less than the listed groove width (*W*) minimum.

(2) *F.I.M. (Full Indicator Movement)*: maximum circular run out of groove to shaft.

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TABLE 8 ILLUSTRATION



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TABLE 8 NA6 (C-TYPE) EXTERNAL RETAINING RINGS

Ring Series and Size No.	Shaft Diameter			Ring Size and Weight								Groove Size					Edge Margin
				Free Diameter		Thickness [Note (1)]		Free Outside Dia. Nom.	Large Section		Approx. Mass per 1000 Pcs.	Diameter		Width		Depth	
	S, Dec.	*S*, Frac.	*S*, mm	*D*	Tol.	*T*	Tol.	*Y*	*E*	Tol.	lb	*G*	Tol.	*W*	Tol.	(*d*)	*Z*
NA6-12	0.125	1/8	3.2	0.102	+0.002	0.015		0.165	0.031		0.030	0.106	±0.0015	0.020	+0.002	0.0095	0.020
NA6-15	0.156	5/32	4.0	0.131	−0.004	0.015		0.205	0.037	±0.003	0.052	0.135	0.0015 (2)	0.020	−0.000	0.0105	0.020
NA6-18	0.188	3/16	4.8	0.161		0.015		0.244	0.042		0.062	0.165		0.020		0.011	0.022
NA6-21	0.219	7/32	5.6	0.187		0.025		0.275	0.044		0.120	0.193	±0.002	0.029		0.013	0.026
NA6-23	0.236	15/64	6.0	0.203		0.025		0.295	0.046		0.15	0.208	0.0015 (2)	0.029		0.014	0.028
NA6-25	0.250	1/4	6.4	0.211	+0.003	0.025		0.311	0.050		0.157	0.220		0.029		0.015	0.030
NA5-28	0.281	9/32	7.1	0.242	−0.005	0.025		0.346	0.051		0.19	0.247		0.029		0.017	0.034
NA6-31	0.312	5/16	7.9	0.270		0.025		0.376	0.053	±0.004	0.226	0.276	±0.002	0.029		0.018	0.035
NA6-37	0.375	3/8	9.5	0.328		0.025		0.448	0.060		0.300	0.335	0.002 (2)	0.029		0.020	0.040
NA6-40	0.406	13/32	10.3	0.359		0.025		0.486	0.063		0.352	0.364		0.029		0.021	0.042
NA6-43	0.438	7/16	11.1	0.386		0.025		0.517	0.065		0.359	0.393		0.029		0.022	0.044
NA6-50	0.500	1/2	12.7	0.441		0.035	±0.002	0.581	0.070		0.671	0.450		0.039	+0.003	0.025	0.050
NA6-56	0.562	9/16	14.3	0.497	±0.006	0.035		0.653	0.078		0.710	0.507		0.039	−0.000	0.028	0.056
NA6-62	0.625	5/8	15.9	0.553		0.035		0.715	0.081		0.937	0.563		0.039		0.031	0.062
NA6-68	0.688	11/16	17.5	0.606		0.042		0.784	0.086	±0.005	1.3	0.619		0.046		0.034	0.068
NA6-75	0.750	3/4	19.0	0.665		0.042		0.845	0.090		1.5	0.676	±0.003	0.046		0.037	0.074
NA6-81	0.812	13/16	20.6	0.721	±0.007	0.042		0.915	0.097		1.7	0.732	0.004 (2)	0.046		0.040	0.080
NA6-87	0.875	7/8	22.2	0.777		0.042		0.991	0.105		2.0	0.789		0.046		0.043	0.086
NA6-93	0.938	15/16	23.8	0.830		0.042		1.058	0.112		2.3	0.843		0.046		0.047	0.094
NA6-100	1.000	1	25.4	0.887		0.042		1.130	0.120		2.7	0.900		0.046		0.050	0.100
NA6-112	1.125	1 1/8	28.6	0.997		0.050		1.267	0.135		4.0	1.013		0.056		0.056	0.112
NA6-125	1.250	1 1/4	31.7	1.110	±0.008	0.050		1.415	0.150		5.1	1.126	±0.004	0.056	+0.004	0.062	0.124
NA6-137	1.375	1 3/8	34.9	1.220		0.050		1.555	0.165		6.1	1.237	0.005 (2)	0.056	−0.000	0.069	0.138
NA6-150	1.500	1 1/2	38.1	1.331		0.050		1.691	0.180	±0.007	7.6	1.350		0.056		0.075	0.150
NA6-162	1.625	1 5/8	41.3	1.563		0.062		1.853	0.195		11.0	1.483		0.068		0.071	0.162
NA6-175	1.750	1 3/4	44.4	1.565	±0.010	0.062	±0.003	1.975	0.210		12.9	1.576	±0.005	0.068		0.087	0.174
NA6-200	2.000	2	50.8	1.777		0.062		2.257	0.240		16.2	1.800	0.005 (2)	0.066		0.100	0.200

GENERAL NOTE: For reference, see Table 8 Illustration on previous page.

NOTES:

(1) For plated rings, add 0.002 in. to the listed maximum thickness except that maximum ring thickness after plating will be a minimum of 0.0002 in. less than the listed groove width (*W*) minimum.

(2) F.I.M. (Full Indicator Movement): maximum circular run out of groove to shaft.

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MANDATORY APPENDIX I
HEAVY DUTY EXTERNAL SERIES NA4

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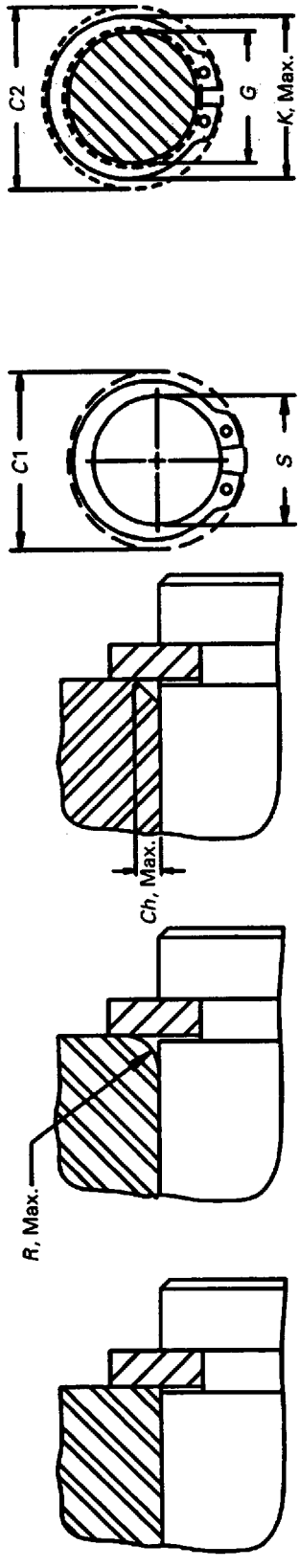


TABLE I ILLUSTRATION

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TABLE I NA4 HEAVY DUTY EXTERNAL RETAINING RINGS

Ring Series and Size No.	Clearance Diameter		Gaging Diameter	Allowable Thrust Loads [Note (1)] Square Corner Abutment		Maximum Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.	Calculated Allowable Assembly (Steel Rings)
	Ring Expanded Over Shaft	Ring Seated in Groove	For Checking Ring When Seated in Groove	UNS G10600–G10900 and Stainless Steel Rings Used on Hardened Shafts (50 HRC, Min.)	All Standard Rings Used on Low Carbon Steel Shafts				
	C1	C2	*K*, Max.	*Pr* (lb) [Note (2)]	*Pg* (lb)	*R*, Max.	*Ch*, Max.	*P'r* (lb)	RPM
NA4-39	0.61	0.58	0.479	2030	700	0.047	0.039	450	80000
NA4-42	0.65	0.62	0.525	2335	800	0.057	0.046	530	72000
NA4-47	0.69	0.66	0.589	3045	1000	0.070	0.058	550	69000
NA4-50	0.75	0.72	0.613	3959	1100	0.070	0.058	650	65000
NA4-59	0.86	0.83	0.719	4568	1500	0.070	0.058	750	52500
NA4-62	0.90	0.86	0.758	4872	1600	0.074	0.062	750	49000
NA4-66	0.94	0.90	0.808	5278	1900	0.077	0.064	900	45000
NA4-75	1.12	1.08	0.913	9135	2400	0.089	0.074	2500	40500
NA4-75	1.16	1.12	0.949	9135	2400	0.089	0.074	2500	38000
NA4-87	1.25	1.20	1.056	10556	3300	0.100	0.083	2500	34000
NA4-98	1.36	1.30	1.164	11673	4000	0.100	0.083	2500	30000
NA4-98	1.37	1.31	1.177	11673	4000	0.100	0.083	2500	30000
NA4-106	1.52	1.46	1.256	15225	4800	0.106	0.088	4000	27000
NA4-112	1.58	1.52	1.329	16240	5200	0.112	0.093	4000	26000
NA4-118	1.64	1.57	1.391	16748	5600	0.112	0.093	4000	24000
NA4-118	1.54	1.57	1.391	16748	5600	0.112	0.093	4000	24000
NA4-125	1.70	1.63	1.468	17763	6500	0.112	0.093	4000	23000
NA4-131	1.77	1.69	1.538	18270	7400	0.128	0.107	4000	21500
NA4-137	1.83	1.75	1.607	19793	8200	0.128	0.107	4000	20500
NA4-137	1.83	1.75	1.607	19793	8200	0.128	0.107	4000	20500
NA4-150	2.08	1.98	1.752	24868	10000	0.128	0.107	5000	18500
NA4-156	2.14	2.05	1.829	26390	10400	0.128	0.107	5000	17000
NA4-156	2.15	2.06	1.841	26930	10400	0.128	0.107	5000	17000
NA4-175	2.34	2.25	2.050	29435	12400	0.128	0.107	5000	15500
NA4-175	2.37	2.27	2.069	29435	12400	0.128	0.107	5000	15500
NA4-193	2.58	2.48	2.265	37555	15300	0.153	0.128	6000	14300
NA4-193	2.61	2.50	2.289	37555	15300	0.153	0.128	6000	14100
NA4-200	2.64	2.53	2.334	38570	17000	0.153	0.128	6000	14000

GENERAL NOTE: For reference, see Table I Illustration on previous page.

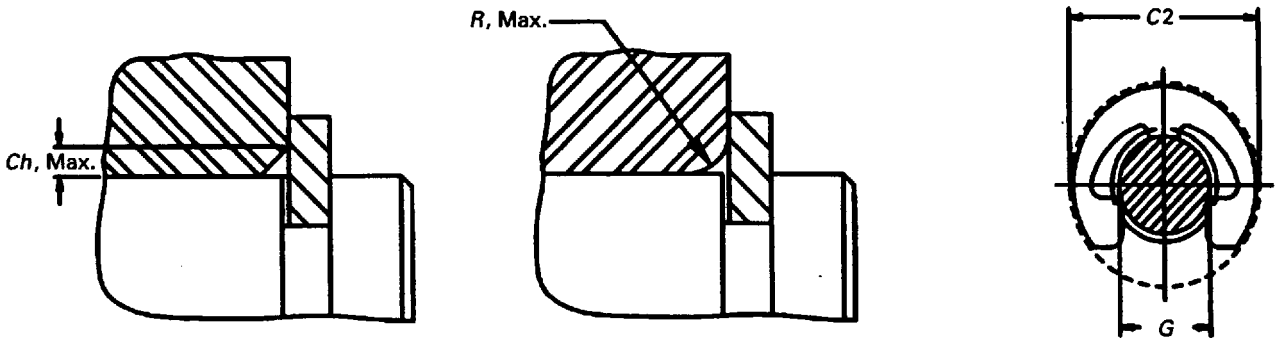
NOTES:

(1) *Safety factors for Pr and Pg*: The allowable thrust load values include the following safety factors: *Pr*: 4, *Pg*: 2.

(2) *Pr* values listed apply to rings made from UNS G10600-G10900 and UNS S15700 stainless steel. *Pr* values for rings made from beryllium copper can be calculated by multiplying listed values by 0.75.

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MANDATORY APPENDIX II
REINFORCED E-RING SERIES NA5



Maximum Corner Radius & Chamfer

TABLE II NA5 (REINFORCED E-TYPE) EXTERNAL RETAINING RINGS

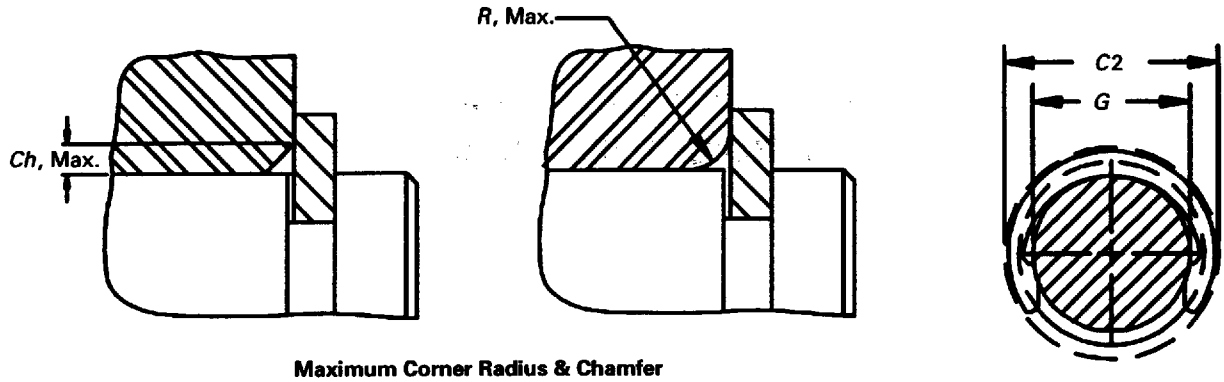
Ring Series and Size No.	Clearance Diameter	Allowable Thrust Load [Note (1)] Sharp Corner Abutment		Maximum Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.	Calculated Allowable Assembly (Steel Rings)
	Ring Seated in Groove	UNS G10600–G10900 and Stainless Steel Rings Used on Hardened Shafts 50 HRC, Min.	All Standard Rings Used on Low Carbon Steel Shafts				
	C2	*Pr* (lb) [Note (2)]	*Pg* (lb)	*R*, Max.	*Ch*, Max.	*P'r* (lb)	RPM
NA5-9	0.22	51	13	0.045	0.033	50	90000
NA5-12	0.29	76	25	0.045	0.033	75	70000
NA5-15	0.35	152	40	0.065	0.050	150	60000
NA5-18	0.39	183	50	0.065	0.050	180	50000
NA5-21	0.46	223	50	0.065	0.050	220	43000
NA5-25	0.53	254	75	0.065	0.050	250	38000
NA5-31	0.61	305	135	0.070	0.055	300	32000
NA5-37	0.68	528	190	0.070	0.055	520	28000
NA5-43	0.77	609	285	0.070	0.055	600	24000
NA5-50	0.83	832	360	0.080	0.060	820	20000
NA5-56	0.89	944	480	0.080	0.060	930	17000

NOTES:
(1) *Safety factors for Pr and Pg*: The allowable thrust load values include the following safety factors: *Pr*: 3, *Pg*: 2.
(2) *Pr* values listed apply to rings made from UNS G10600–G10900 and UNS S15700 stainless steel. *Pr* values for rings made from beryllium copper can be calculated by multiplying listed values by 0.75.

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MANDATORY APPENDIX III
C-RING SERIES NA6

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Maximum Corner Radius & Chamfer

TABLE III NA6 (C-TYPE) EXTERNAL RETAINING RINGS

Ring Series and Size No.	Clearance Diameter	Allowable Thrust Load [Note (1)] Sharp Corner Abutment		Maximum Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.	Calculated Allowable Assembly (Steel Rings)
	Ring Seated in Groove	UNS G10600–G10900 and Stainless Steel Rings Used on Hardened Shafts 50 HRC, Min.	All Standard Rings Used on Low Carbon Steel Shafts				
	C2	*Pr* (lb) [Note (2)]	*Pg* (lb)	*R*, Max.	*Ch*, Max.	*P'r* (lb)	RPM
NA6-12	0.18	86	45	0.014	0.011	85	80000
NA6-15	0.22	102	55	0.018	0.014	100	75000
NA6-18	0.25	132	70	0.021	0.016	110	73000
NA6-21	0.29	264	100	0.021	0.016	260	71000
NA6-23	0.31	284	115	0.022	0.017	275	62000
NA6-25	0.33	294	130	0.023	0.018	290	60000
NA6-28	0.36	335	165	0.021	0.016	310	56000
NA6-31	0.39	376	200	0.024	0.018	310	52000
NA6-37	0.47	447	270	0.026	0.020	310	43000
NA6-40	0.50	487	300	0.027	0.021	310	40000
NA6-43	0.53	528	350	0.029	0.022	310	31000
NA6-50	0.60	842	450	0.030	0.023	610	25000
NA6-56	0.67	944	550	0.033	0.025	610	22000
NA6-62	0.74	1045	700	0.033	0.025	610	20000
NA6-68	0.80	1725	800	0.034	0.026	880	18500
NA6-75	0.87	1878	1000	0.036	0.027	880	17500
NA6-81	0.94	2040	1150	0.038	0.029	880	16000
NA6-87	1.01	2202	1300	0.040	0.031	880	15000
NA6-93	1.08	2355	1550	0.043	0.033	880	14000
NA6-100	1.15	2517	1800	0.046	0.035	880	12500
NA6-112	1.30	3370	2200	0.052	0.040	1250	11500
NA6-125	1.44	3735	2700	0.057	0.044	1250	10500
NA6-137	1.58	4111	3350	0.062	0.048	1250	9500
NA6-150	1.72	4486	4000	0.069	0.053	1250	8500
NA6-162	1.88	5506	4650	0.075	0.058	1920	8000
NA6-175	2.01	6526	5300	0.081	0.062	1920	7500
NA6-200	2.30	7410	7000	0.091	0.070	1920	6000

NOTES:
(1) *Safety Factors for Pr and Pg*: The allowable thrust load values include the following safety factors: *Pr*: 4, *Pg*: 2.
(2) *Pr* values listed apply to rings made from UNS G10600-G10900 and UNS S15700 stainless steel. *Pr* values for rings made from beryllium copper can be calculated by multiplying listed values by 0.75.

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NONMANDATORY APPENDIX A
TYPE NA4 REFERENCE METRIC VALUES (DIMENSIONS)

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TABLE A TYPE NA4 REFERENCE METRIC VALUES (DIMENSIONS)

Ring Series and Size No.	Shaft Diameter	Free Diameter		Thickness [Note (1)]		Hole Diameter		Lug Height (Max.)	Large Section		Small Section		Approx. Mass per 1000 Pcs.	Groove Dimensions				Edge Margin
														Diameter		Width		Depth	
	S, mm	*D*	Tol.	*T*	Tol.	*P*	Tol.	*B*	*E*	Tol.	*J*	Tol.	kg	*G*	Tol.	*W*	Tol.	(*d*)	*Z*
NA4-39	10.0	9.19	+0.08	0.89		1.07		2.7	1.73		0.99		0.3	9.35	+0.03	0.99		0.33	0.99
NA4-42	10.9	10.01	−0.20	0.89		1.07		2.7	1.93	±0.10	1.09	±0.10	0.4	10.21	−0.05	0.99	+0.08	0.33	0.99
NA4-47	12.0	11.05		1.07		1.07	+0.25	2.7	2.24		1.35		0.6	11.28	0.05 (2)	1.17	0	0.38	1.14
NA4-50	12.7	11.68		1.27	±0.05	1.27	−0.05	3.1	2.29		1.27		0.7	11.89		1.42		0.41	1.22
NA4-59	15.0	13.79		1.27		1.27		3.4	2.59		1.45		1.0	14.10		1.42	+0.10	0.46	1.37
NA4-62	15.9	14.61		1.27		1.27		3.4	2.69	+0.13	1.50	±0.13	1.0	14.94		1.42	0	0.48	1.45
NA4-66	17.0	15.85	+0.13	1.27		1.27		3.4	2.84		1.57		1.2	15.98		1.42		0.51	1.52
NA4-75	19.0	17.50	−0.25	1.98		1.98		4.7	3.23		1.96		2.5	17.88	+0.03	2.18		0.58	1.75
NA4-75	20.0	17.50		1.98		1.98		4.7	3.23		1.96		2.5	18.80	−0.08	2.18		0.61	1.83
NA4-87	22.2	20.42		1.98		1.98		4.7	3.76	±0.15	2.11	±0.15	3.4	20.85	0.05 (2)	2.18		0.69	2.06
NA4-98	25.0	23.01		1.98		1.98		4.7	3.84		2.13		3.5	23.50		2.18		0.76	2.29
NA4-98	25.4	23.01		1.98		1.98		4.7	3.84		2.13		3.5	23.83		2.18		0.79	2.36
NA4-106	27.0	24.84		2.36		2.36		5.7	4.09		2.29		5.2	25.35		2.62		0.81	2.44
NA4-112	28.6	26.31		2.36	±0.08	2.36		5.7	4.29		2.41		5.7	26.90		2.62	+0.13	0.84	2.51
NA4-118	30.0	27.61		2.36		2.36		5.7	4.47		2.49		6.1	28.22		2.62	0	0.89	2.67
NA4-118	30.2	27.61	+0.25	2.36		2.36	+0.38	5.7	4.47	±0.18	2.49	±0.18	6.1	28.22	+0.05	2.62		0.97	2.90
NA4-125	31.7	29.21	−0.38	2.36		2.36	−0.05	5.7	4.70		2.62		6.8	29.82	−0.10	2.62		0.97	2.90
NA4-131	33.3	30.68		2.36		2.36		5.7	4.88		2.69		7.3	31.34	0.10 (2)	2.62		0.99	2.97
NA4-137	34.9	32.21		2.36		2.36		5.7	5.08		2.79		8.1	32.79		2.62		1.07	3.20
NA4-137	35.0	32.21		2.36		2.36		5.7	5.08		2.79		8.1	32.79		2.62		1.12	3.35
NA4-150	38.1	35.05		2.77		2.77		7.2	5.54		3.12		12.2	35.71		3.05		1.19	3.58
NA4-156	39.7	36.50		2.77		2.77		7.2	5.79		3.23		14.1	37.29		3.05		1.19	3.58
NA4-156	40.0	36.50		2.77		2.77		7.2	5.79		3.23		14.1	37.59		3.05		1.22	3.66
NA4-175	44.4	40.84		2.77		2.77		7.5	6.45	±0.20	3.56	±0.20	15.2	41.91	+0.08	3.05		1.27	3.81
NA4-175	45.0	40.84	+0.33	2.77		2.77		7.5	6.45		3.56		15.2	42.38	−0.10	3.05		1.32	3.96
NA4-193	49.2	45.26	−0.51	3.18		3.18		8.1	7.11		3.91		21.8	46.38	0.10 (2)	3.53		1.42	4.27
NA4-193	50.0	45.26		3.18	±0.10	3.18		8.1	7.11		3.91		21.8	46.99		3.53	+0.15	1.52	4.57
NA4-200	50.8	46.74		3.18		3.18		8.1	7.37		4.06		23.0	47.75		3.53	0	1.52	4.57

GENERAL NOTE: See Table 6 for illustrations.

NOTES:

(1) For plated rings, add 0.05 mm to the listed maximum thickness except that maximum thickness after plating will be a minimum of 0.005 mm less than the listed groove width (*W*) minimum.

(2) *F.I.M. (Full Indicator Movement)*: maximum circular run out of groove to shaft.

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NONMANDATORY APPENDIX B
TYPE NA4 REFERENCE METRIC VALUES
(SUPPLEMENTARY INFORMATION)

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TABLE B TYPE NA4 REFERENCE METRIC VALUES (SUPPLEMENTARY INFORMATION)

Ring Series and Size No.	Clearance Diameter		Gaging Diameter	Allowable Thrust Loads [Note (1)] Square Corner Abutment		Maximum Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.	Calculated Allowable Assembly (Steel Rings)
	Ring Expanded Over Shaft	Ring Seated in Groove	For Checking Ring When Seated in Groove	UNS G10600–G10900 and Stainless Steel Rings Used on Hardened Shafts 50 HRC, Min.	All Standard Rings Used on Low Carbon Steel Shafts				
	C1	C2	*K*, Max.	*Pr* (kN) [Note (2)]	*Pg* (kN)	*R*, Max.	*Ch*, Max.	*P'r* (kN)	RPM
NA4-39	15.5	14.7	12.17	9.0	3.1	1.19	0.99	2.0	80000
NA4-42	16.5	15.7	13.34	10.4	3.6	1.45	1.17	2.4	72000
NA4-47	17.5	16.8	14.96	13.5	4.4	1.78	1.47	2.4	69000
NA4-50	19.1	18.3	15.57	17.6	4.9	1.78	1.47	2.9	65000
NA4-59	21.8	21.1	18.26	20.3	6.7	1.78	1.47	3.3	52500
NA4-62	22.9	21.8	19.25	21.7	7.1	1.86	1.57	3.3	49000
NA4-66	23.9	22.9	20.52	23.5	8.5	1.96	1.63	4.0	45000
NA4-75	28.4	27.4	23.19	40.6	10.7	2.26	1.88	11.1	40500
NA4-75	29.5	28.4	24.10	40.6	10.7	2.26	1.88	11.1	38000
NA4-87	31.8	30.5	26.82	47.0	14.7	2.54	2.11	11.1	34000
NA4-98	34.5	33.0	29.57	51.9	17.8	2.54	2.11	11.1	30000
NA4-98	34.8	33.3	29.90	51.9	17.8	2.54	2.11	11.1	30000
NA4-106	38.6	37.1	31.90	67.7	21.4	2.69	2.24	17.8	27000
NA4-112	40.1	38.6	33.76	72.2	23.1	2.84	2.36	17.8	26000
NA4-118	41.7	39.9	35.33	74.5	24.9	2.84	2.36	17.8	24000
NA4-118	41.7	39.9	35.33	74.5	24.9	2.84	2.36	17.8	24000
NA4-125	43.2	41.4	37.29	79.0	28.9	2.84	2.36	17.8	23000
NA4-131	45.0	42.9	39.07	81.3	32.9	3.25	2.72	17.8	21500
NA4-137	46.5	44.5	40.82	88.0	36.5	3.25	2.72	17.8	20500
NA4-137	46.5	44.5	40.82	88.0	36.5	3.25	2.72	17.8	20500
NA4-150	52.8	50.3	44.50	110.6	44.5	3.25	2.72	22.2	18500
NA4-156	54.4	52.1	46.46	117.4	46.3	3.25	2.72	22.2	17000
NA4-156	54.6	52.3	46.76	119.8	46.3	3.25	2.72	22.2	17000
NA4-175	59.4	57.2	52.07	130.9	55.2	3.25	2.72	22.2	15500
NA4-175	60.2	57.7	52.55	130.9	55.2	3.25	2.72	22.2	15500
NA4-193	65.5	63.0	57.53	167.0	68.1	3.89	3.25	26.7	14300
NA4-193	66.3	63.5	58.14	167.0	68.1	3.89	3.25	26.7	14100
NA4-200	67.1	64.3	59.28	171.6	75.6	3.89	3.25	26.7	14000

GENERAL NOTE: See Mandatory Appendix I for illustrations.

NOTES:

(1) *Safety factors for Pr and Pg*: The allowable thrust load values include the following safety factors: *Pr*: 4, *Pg*: 2.

(2) *Pr* values listed apply to rings made from UNS G10600–G10900 and UNS S15700 stainless steel. *Pr* values for rings made from beryllium copper can be calculated by multiplying listed values by 0.75.

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NONMANDATORY APPENDIX C
TYPE NA5 REFERENCE METRIC VALUES (DIMENSIONS)

TABLE C TYPE NA5 REFERENCE METRIC VALUES (DIMENSIONS)

Ring Series and Size No.	Shaft Diameter	Ring Size and Weight						Groove Size					Edge Margin
		Free Diameter		Thickness [Note (1)]		Free Outside Diameter Nom.	Approx. Mass per 1000 Pcs.	Diameter		Width		Depth	
	S, mm	*D*	Tol.	*T*	Tol.	*Y*	kg	*G*	Tol.	*W*	Tol.	*(d)*	*Z*
NA5-9	2.4	1.83	+0.03	0.38		5.23	0.03	1.88	+0.05	0.51	+0.05	0.25	0.51
NA5-12	3.2	2.36	−0.08	0.38		6.86	0.06	2.41	−0.00	0.51	0	0.38	0.76
NA5-15	4.0	2.87	+0.05/−0.08	0.64		8.51	0.14	2.95	0.04 (2)	0.74		0.51	1.02
NA5-18	4.8	3.63		0.64		9.53	0.18	3.73		0.74		0.51	1.02
NA5-21	5.6	4.62	±0.08	0.64	±0.05	11.33	0.24	4.78	±0.05	0.74		0.38	0.79
NA5-25	6.3	5.18		0.64		13.11	0.32	5.33	0.05 (2)	0.74		0.51	1.02
NA5-31	7.9	6.15		0.64		14.94	0.39	6.36	±0.08	0.74	+0.08	0.79	1.57
NA5-37	9.5	7.42		0.89		16.76	0.68	7.70	0.08 (2)	0.99	0	0.91	1.83
NA5-43	11.1	8.43		0.89		18.95	0.88	8.71		0.99		1.19	2.39
NA5-50	12.7	9.78	±0.10	1.07		20.57	1.45	10.06	±0.08	1.17		1.32	2.64
NA5-56	14.3	10.92		1.07		22.10	1.59	11.10	0.10 (2)	1.17		1.57	3.15

GENERAL NOTE: See Table 7 for illustrations.

NOTES:

(1) For plated rings, add 0.05 mm to the listed maximum thickness except that maximum thickness after plating will be a minimum of 0.005 mm less than the listed groove width (*W*) minimum.

(2) *F.I.M. (Full Indicator Movement)*: maximum circular run out of groove to shaft.

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NONMANDATORY APPENDIX D
TYPE NA5 REFERENCE METRIC VALUES
(SUPPLEMENTARY INFORMATION)

TABLE D TYPE NA5 REFERENCE METRIC VALUES (SUPPLEMENTARY INFORMATION)

Ring Series and Size No.	Clearance Diameter	Allowable Thrust Load [Note (1)] Square Corner Abutment		Maximum Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.	Calculated Allowable Assembly (Steel Rings)
	Ring Seated in Groove	UNS G10600–G10900 and Stainless Steel Rings Used on Hardened Shafts 50 HRC, Min.	All Standard Rings Used on Low Carbon Steel Shafts				
	C2	*Pr* (kN) [Note (2)]	*Pg* (kN)	*R*, Max.	*Ch*, Max.	*P'r* (kN)	RPM
NA5-9	5.6	0.2	0.1	1.1	0.8	0.2	90000
NA5-12	7.2	0.3	0.1	1.1	0.8	0.3	70000
NA5-15	8.9	0.7	0.2	1.7	1.3	0.7	60000
NA5-18	9.9	0.8	0.2	1.7	1.3	0.8	50000
NA5-21	11.7	1.0	0.2	1.7	1.3	1.0	43000
NA5-25	13.5	1.1	0.3	1.7	1.3	1.1	38000
NA5-31	15.5	1.4	0.6	1.8	1.4	1.3	32000
NA5-37	17.3	2.3	0.8	1.8	1.4	2.3	28000
NA5-43	19.6	2.7	1.3	1.8	1.4	2.7	24000
NA5-50	21.1	3.7	1.6	2.0	1.5	3.6	20000
NA5-56	22.6	4.2	2.1	2.0	1.5	4.1	17000

GENERAL NOTE: See Mandatory Appendix II for illustrations.

NOTES:

(1) *Safety factors for Pr and Pg*: The allowable thrust load values include the following safety factors: *Pr*: 3, *Pg*: 2.

(2) *Pr* values listed apply to rings made from UNS G10600-G10900 and UNS S15700 stainless steel. *Pr* values for rings made from beryllium copper can be calculated by multiplying listed values by 0.75.

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NONMANDATORY APPENDIX E
TYPE NA6 REFERENCE METRIC VALUES (DIMENSIONS)

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STD·ASME B18·27-ENGL 1998 ■ 0759670 0613118 161 ■

TABLE E TYPE NA6 REFERENCE METRIC VALUES (DIMENSIONS)

Ring Series and Size No.	Shaft Diameter	Ring Size and Weight								Groove Size					Edge Margin
		Free Diameter		Thickness [Note (1)]		Free Outside Dia. Nom.	Large Section		Approx. Mass per 1000 Pcs.	Diameter		Width		Depth	
	S, mm	*D*	Tol.	*T*	Tol.	*Y*	*E*	Tol.	kg	*G*	Tol.	*W*	Tol.	(*d*)	*Z*
NA6-12	3.2	2.59	+0.05	0.38		4.19	0.79		0.01	2.69	±0.04	0.51	+0.05	0.24	0.51
NA6-15	4.0	3.33	−0.10	0.38		5.21	0.94	±0.08	0.02	3.43	0.04 (2)	0.51	0	0.27	0.51
NA6-18	4.8	4.09		0.38		6.20	1.07		0.03	4.19		0.51		0.28	0.56
NA6-21	5.6	4.75		0.64		6.99	1.12		0.05	4.90	±0.05	0.74		0.33	0.66
NA6-23	6.0	5.16		0.64		7.49	1.17		0.07	5.28	0.04 (2)	0.74		0.36	0.71
NA6-25	6.4	5.38		0.64		7.90	1.27		0.07	5.59		0.74		0.38	0.76
NA6-28	7.1	6.15	+0.08	0.64		8.79	1.30		0.09	6.27		0.74		0.43	0.86
NA6-31	7.9	6.86	−0.13	0.64		9.55	1.35	±0.10	0.10	7.01	±0.05	0.74		0.46	0.91
NA6-37	8.5	8.33		0.64		11.38	1.52		0.14	8.51	0.05 (2)	0.74		0.51	1.02
NA6-40	10.3	9.12		0.64		12.34	1.60		0.16	9.25		0.74		0.53	1.07
NA6-43	11.1	9.80		0.64		13.13	1.65		0.16	9.98		0.74		0.56	1.12
NA6-50	12.7	11.20		0.89	±0.05	14.76	1.78		0.30	11.43		0.99	+0.08	0.64	1.27
NA6-56	14.3	12.62	±0.15	0.89		16.59	1.98		0.32	12.88		0.99	0	0.71	1.42
NA6-62	15.9	14.05		0.89		18.16	2.06		0.43	14.30		0.99		0.79	1.57
NA6-68	17.5	15.44		1.07		19.91	2.18	±0.13	0.59	15.72	±0.08	1.17		0.86	1.73
NA6-75	19.0	16.89		1.07		21.46	2.29		0.68	17.17	0.10 (2)	1.17		0.94	1.88
NA6-81	20.6	18.31	±0.18	1.07		23.24	2.46		0.77	18.59		1.17		1.02	2.03
NA6-87	22.2	19.74		1.07		25.17	2.67		0.91	20.04		1.17		1.09	2.18
NA6-93	23.6	21.08		1.07		26.87	2.84		1.04	21.41		1.17		1.19	2.39
NA6-100	25.4	22.53		1.07		28.70	3.05		1.22	22.86		1.17		1.27	2.54
NA6-112	28.6	25.32		1.27		32.18	3.43		1.81	25.73		1.42		1.42	2.84
NA6-125	31.7	28.19	±0.20	1.27		35.94	3.81		2.31	28.60	±0.10	1.42		1.57	3.15
NA6-137	34.9	30.99		1.27		39.50	4.19		2.77	31.42	0.13 (2)	1.42	+0.10	1.75	3.51
NA6-150	38.1	33.81		1.27		42.95	4.57	±0.18	3.45	34.29		1.42	0	1.91	3.81
NA6-162	41.3	39.70		1.57		47.07	4.95		4.99	37.16		1.73		1.80	4.11
NA6-175	44.4	39.50	±0.25	1.57	±0.08	50.17	5.33		5.85	40.03	±0.13	1.73		2.21	4.42
NA6-200	50.8	45.14		1.57		57.33	6.10		7.35	45.72	0.13 (2)	1.73		2.54	5.08

GENERAL NOTE: See Table 8 for illustrations.

NOTES:

(1) For plated rings, add 0.05 mm to the listed maximum thickness except that maximum thickness after plating will be a minimum of 0.005 mm less than the listed groove width (*W*) minimum.

(2) *F.I.M. (Full Indicator Movement)*: maximum allowable deviation of concentricity between groove and shaft.

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NONMANDATORY APPENDIX F
TYPE NA6 REFERENCE METRIC VALUES (SUPPLEMENTARY INFORMATION)

TABLE F TYPE NA6 REFERENCE METRIC VALUES (SUPPLEMENTARY INFORMATION)

Ring Series and Size No.	Clearance Diameter	Allowable Thrust Load [Note (1)] Sharp Corner Abutment		Maximum Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.	Calculated Allowable Assembly (Steel Rings)
	Ring Seated in Groove	UNS G106000–G10900 and Stainless Steel Rings Used on Hardened Shafts 50 HRC, Min.	All Standard Rings Used on Low Carbon Steel Shafts				
	C2	*Pr* (kN) [Note (2)]	*Pg* (kN)	*R*, Max.	*Ch*, Max.	*P'r* (kN)	RPM
NA6-12	4.57	0.38	0.20	0.36	0.28	0.38	80000
NA6-15	5.59	0.45	0.24	0.46	0.36	0.44	75000
NA6-18	6.35	0.59	0.31	0.53	0.41	0.49	73000
NA6-21	7.37	1.17	0.44	0.53	0.41	1.16	71000
NA6-23	7.87	1.26	0.51	0.56	0.43	1.22	62000
NA6-25	8.38	1.31	0.58	0.58	0.46	1.29	60000
NA6-28	9.14	1.49	0.73	0.53	0.41	1.38	56000
NA6-31	9.91	1.67	0.89	0.61	0.46	1.38	52000
NA6-37	11.94	1.99	1.20	0.66	0.51	1.38	43000
NA6-40	12.70	2.17	1.33	0.69	0.53	1.38	40000
NA6-43	13.46	2.35	1.56	0.74	0.56	1.38	31000
NA6-50	15.24	3.75	2.00	0.76	0.58	2.71	25000
NA6-56	17.02	4.20	2.45	0.84	0.64	2.71	22000
NA6-62	18.80	4.65	3.11	0.84	0.64	2.71	20000
NA6-68	20.32	7.68	3.56	0.86	0.66	3.91	18500
NA6-75	22.10	8.35	4.45	0.91	0.69	3.91	17500
NA6-81	23.88	9.07	5.12	0.97	0.74	3.91	16000
NA6-87	25.65	9.79	5.78	1.02	0.79	3.91	15000
NA6-93	27.43	10.48	6.89	1.09	0.84	3.91	14000
NA6-100	29.21	11.20	8.01	1.17	0.89	3.91	12500
NA6-112	33.02	14.99	9.79	1.32	1.02	5.56	11500
NA6-125	36.58	16.61	12.01	1.45	1.12	5.56	10500
NA6-137	40.13	18.29	14.90	1.57	1.22	5.56	9500
NA6-150	43.69	19.95	17.79	1.75	1.35	5.58	8500
NA6-162	47.75	24.49	20.68	1.91	1.47	8.54	8000
NA6-175	51.05	29.03	23.57	2.06	1.57	8.54	7500
NA6-200	58.42	32.96	31.14	2.31	1.78	8.54	6000

GENERAL NOTE: See Mandatory Appendix III for illustrations.

NOTES:

(1) *Safety factors for Pr and Pg*: the allowable thrust load values include the following safety factors: *Pr*: 4, *Pg*: 2.

(2) *Pr* values listed apply to rings made from UNS G10600–G10900 and UNS S15700 stainless steel. *Pr* values for rings made from beryllium copper can be calculated by multiplying listed values by 0.75.

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BOWED EXTERNAL RINGS NA7, BOWED INTERNAL RINGS NA8, BOWED EXTERNAL E-RINGS NA9

1 INTRODUCTORY NOTES

1.1 Scope

This Standard covers complete general and dimensional data for three series of general purpose bowed, tapered, and reduced cross section retaining rings that may be used with the nominal size shafts and housings listed and in grooves of the recommended dimensions listed. Also included are formulas and tolerances on which dimensional data are based. Three appendices include guidance for assembly and recommended standard drawing formats.

The inclusion of dimensional data in this Standard is not intended to imply that all of the products described are stock production sizes. Consumers should consult with suppliers concerning lists of stock production sizes.

1.2 ISO Standard

There are no existing ISO standards for these products.

1.3 Ring Types

1.3.1 Bowed External Rings. Dimensions of basic bowed external retaining rings and grooves for various shaft sizes are given in Table 4. See Nonmandatory Appendix A for equivalent metric data.

1.3.2 Bowed Internal Rings. Dimensions for basic bowed internal retaining rings and grooves for various housing sizes are given in Table 5. See Nonmandatory Appendix B for equivalent metric data.

1.3.3 Bowed External E-Rings. Dimensions of bowed E-Type external retaining rings and grooves for various shaft sizes are given in Table 6. See Nonmandatory Appendix E for equivalent metric data.

1.4 Designations

Retaining rings in this standard shall be designated by the following data in the sequence shown: ring series type number; size; material; protective finish, if required; or by optionally, ASME B18.24.3 PIN Code. See examples below:

NA7-125 Carbon Spring Steel, Phosphate
R273NAA0125NN056NNAA1

NA8-75 Corrosion Resistant Steel
R273NAB0075NN519NNAB1

NA9-37 Beryllium Copper
R273NAC0037NN643NNAA1

1.5 Applicability

The rings in this Standard are intended primarily for use with the shaft, housing, and groove sizes recommended; however, in certain cases these diameters may be altered somewhat to suit the requirements of a particular design. When such changes are made, care should be taken to not alter the shaft or housing size to such an extent that the ring will take enough permanent set to allow a loose fit after the ring has been assembled into the groove. Neither should the groove diameter be altered to the extent to permit the ring to fit loosely, nor should the groove location parameters (x_{max} and x_{min}) be altered to the extent the take-up is adversely affected.

1.6 Dimensions

All dimensions in this Standard are in inches unless otherwise stated.

1.7 Supplementary Information

Allowable loads, maximum radii and chamfers, groove location parameters, clearance dimensions, and gaging diameters for all three ring series are included in Mandatory Appendices I, II, and III. RPM limits for bowed external basic and bowed external E-rings are included in Mandatory Appendices I and III.

1.8 Reference Standards

Unless otherwise specified, the referenced standards shall be the most recent issue at the time of

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order placement.

ASTM E 18, Standard Test Method for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials

ASTM B 117, Standard Practice for Operating Salt Spray (Fog) Testing Apparatus

ASTM A 380, Standard Practice for Cleaning and Descaling Stainless Steel Parts, Equipment, and Systems

ASTM B 695, Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel

ASTM DS-56F/SAE HS-1086, Unified Numbering System (UNS) for Metals and Alloys

Publisher: The American Society for Testing and Materials (ASTM), 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959

2 GENERAL DATA

2.1 Bowed Basic Retaining Rings

Type NA7 rings are similar in configuration to the NA1 basic external rings and also are spread over a shaft by means of pliers or special tool and allowed to relax and seat in a circumferential groove. The main difference is that the body of the NA7 ring is bowed around an axis normal to the diameter bisecting the ring gap. This bowed construction makes it possible for the rings to take up end-play caused by tolerances in groove location and retained part dimensions.

Type NA8 rings are similar in configuration to NA2 basic internal rings and also are compressed into a housing by means of a pliers or special tool and allowed to relax and seat in a circumferential groove. Once again, the ring is bowed around an axis normal to the diameter bisecting the ring gap that provides for end-play take up caused by tolerances in groove location and retained part dimensions.

2.2 Bowed External E-Type Retaining Rings

Type NA9 rings are similar in configuration to the NA3 E-Type rings, and also are installed radially, usually by means of an applicator, and provide a high shoulder for abutment by a retained part. They differ from the NA3 flat E-rings in that they are bowed around an axis normal to the diameter bisecting the ring gap. This bowed construction makes it possible for the rings to take up end-play caused by tolerances in groove location and the dimensions of the retained parts.

3 MATERIAL

3.1 Carbon Spring Steel

Retaining ring made from carbon spring steel shall conform to the chemical composition of UNS G10600 to G10900 and have the following physical properties.

3.1.1 Heat Treatment. The retaining rings shall be heat treated by austempering to the hardness values specified in Table 1.

3.1.2 Finishes. The following finishes are available.

3.1.2.1 Phosphate Coating. Finish shall consist of basic zinc phosphate treatment, and subsequent supplementary treatment to enhance shelf life (example of supplementary treatment: *wax, light drying oil*).

3.1.2.2 Zinc Plating. Finish shall consist of mechanically applied zinc with a dichromate conversion treatment similar to ASTM B 695 Type II, Class 8. The resulting treatment shall be capable of withstanding 72 hours to white corrosion or red rust. Salt spray corrosion resistance test method shall be similar to ASTM B 117.

NOTE: Electroplating is not allowed for the plating of retaining rings.

3.1.2.3 Oil Finish. To extend Shelf Life, rings shall be coated with a thin film of non-tacky water displacing rust preventative oil.

3.2 Corrosion-Resistant Steel

Retaining rings made from corrosion-resistant steel shall conform to the chemical composition of UNS S15700 and have the following physical properties.

3.2.1 Heat Treatment. The retaining rings shall be heat treated to the hardness values specified in Table 2.

3.2.2 Surface Treatment. Retaining rings shall be cleaned free of scale, grease, oil and other foreign material in conformance to ASTM A 380.

3.3 Beryllium Copper

Retaining rings made from beryllium copper shall conform to the chemical composition of UNS C17200 and have the following physical properties.

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TABLE 1 HARDNESS RANGES FOR TAPERED AND REDUCED CROSS SECTION RETAINING RINGS (CARBON SPRING STEEL)

NA7		NA8	
Ring Size	**Hardness**	**Ring Size**	**Hardness**
25 through 46	69.5–73 HR30N (51–55 HRC)	25 and 31	86–88 HR15N (51–55 HRC)
50 through 81	66–71 HR30N (47–53 HRC)	37 through 51	69.5–73 HR30N (51–55 HRC)
87 through 102	47–53 HRC	56 through 77	67.5–72 HR30N (49–54 HRC)
106 and over	47–52 HRC	81 through 102	66–71 HR30N (47–53 HRC)
		106 and over	47–52 HRC

NA9	
Ring Size	**Hardness**
12 and S14 [Note (1)]	84.5–87 HR15N (48–53 HRC)
S11, 14 through S21	84.5–87 HR15N (48–53 HRC)
25 and S31	66.5–71 HR30N (48–53 HRC)
37 and over	47–52 HRC

NOTE:
(1) These parts can only be checked by mounting for microhardness testing.

3.3.1 Heat Treatment. The retaining rings shall be heat treated to the hardness values specified in Table 3.

3.3.2 Surface Treatment. Retaining rings shall be cleaned to remove oxide formed as a result of the heat treating process. Since these rings have extremely high resistance to most types of atmospheric corrosion, further protective finishes are usually not required.

4 HARDNESS TESTING PROCEDURE

The surfaces of both sides of each sample retaining ring shall be prepared for hardness testing by removal of all plating and other surface conditions which may affect the hardness reading. Hardness testing procedure shall be in conformance to ASTM E 18.

5 PERMANENT SET LIMITS

The following procedures shall be used for determining if the permanent set of the ring is within the allowable limits.

5.1 NA7 Bowed Basic External Retaining Rings

Step 1. Expand the ring with pliers until it just fits over a shaft 1% larger than the nominal shaft diameter. Repeat this procedure 4 more

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TABLE 2 HARDNESS RANGES FOR TAPERED AND REDUCED CROSS SECTION RETAINING RINGS (CORROSION-RESISTANT STEEL)

NA7		NA8	
Ring Size	**Hardness**	**Ring Size**	**Hardness**
25 through 81	63–69.5 HR30N (44–51 HRC)	25 and 31	82.5–86 HR15N (44–51 HRC)
87 and over	44–51 HRC	37 through 102	63–69.5 HR30N (44–51 HRC)
		106 and over	44–51 HRC

NA9	
Ring Size	**Hardness**
12 and S14 [Note (1)]	82.5–86 HR15N (44–51 HRC)
S11, 14 through S21	82.5–86 HR15N (44–51 HRC)
25 and S31	63–69.5 HR30N (44–51 HRC)
37 and over	44–51 HRC

NOTE:
(1) These parts can only be checked by mounting for microhardness testing.

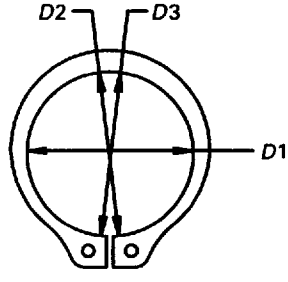


FIG. 1 PERMANENT SET MEASUREMENTS FOR TYPE NA7 RINGS

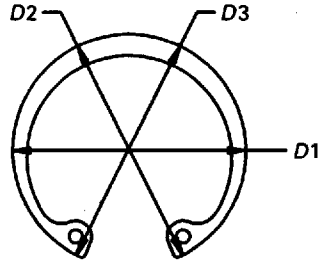


FIG. 2 PERMANENT SET MEASUREMENTS FOR TYPE NA8 RINGS

times with the same ring. The ring shall not crack during this procedure.

Step 2. Measure the ring diameter (D) in the three places shown in Fig. 1.

Step 3. Compute the average of the 3 diameters and compare it to the minimum groove diameter listed in the Table 4 for that ring. In all cases, the average diameter after permanent set shall be less than the minimum groove diameter to insure that the ring will seat tightly.

5.2 NA8 Bowed Basic Internal Retaining Rings

Step 1. Compress the ring with pliers until the lugs abut each other. Repeat this procedure 4 more times.

Step 2. Measure the ring diameter (D) in the three places shown in Fig. 2.

Step 3. Compute the average of the 3 diameters and compare it to the maximum groove diameter listed in Table 5 for the ring. In all cases, the average diameter after permanent set shall be greater than the maximum groove

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TABLE 3 HARDNESS RANGES FOR TAPERED AND REDUCED CROSS SECTION RETAINING RINGS (BERYLLIUM COPPER)

NA7		NA8	
Ring Size	**Hardness**	**Ring Size**	**Hardness**
18 through 23 [Note (1)]	77–82 HR15N (34–43 HRC)	25 and 31	77–82 HR15N (34–43 HRC)
25 through 102	54–62 HR30N (34–43 HRC)	37 through 102	54–62 HR30N (34–43 HRC)
106 and over	34–43 HRC	106 and over	34–43 HRC

NA9	
Ring Size	**Hardness**
12 and S14 [Note (1)]	77–82 HR15N (34–43 HRC)
S11, 14 through S21	77–82 HR15N (34–43 HRC)
25 and S31	54–62 HR30N (34–43 HRC)
37 and over	34–43 HRC

NOTE:
(1) These parts can only be checked by mounting for microhardness testing.

diameter to insure that the ring will seat tightly.

5.3 NA9 Bowed (E-Type) External Retaining Rings

The rings shall, upon being installed in the minimum groove diameter by an applicator or similar tool, grip the minimum groove diameter and shall have no less than 3 point contact.

6 WORKMANSHIP

Workmanship shall be in accordance with high grade commercial practice. Rings shall be free from rust, loose scale, hanging burrs, cracks, and any other defects that might affect their functioning.

7 ADDITIONAL DATA

7.1 Dimensional Data

Dimensional data and performance information on rings and grooves for tapered and reduced cross section retaining rings are shown in Tables 4, 5, and 6 and Mandatory Appendices I, II, and III.

7.2 Metric Values

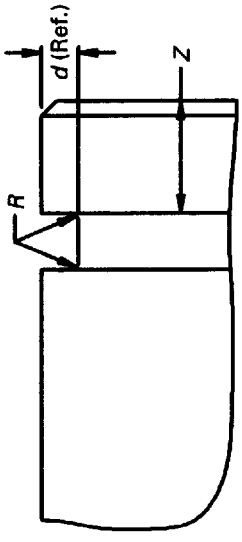
For reference purposes only, metric values are shown in Nonmandatory Appendices A, B, C, D, E, and F.

7.3 Additional Information

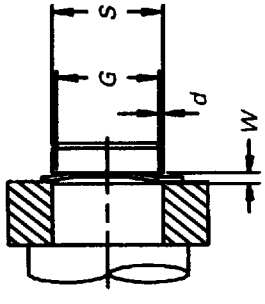
Consult with suppliers for additional information not included in this Standard.

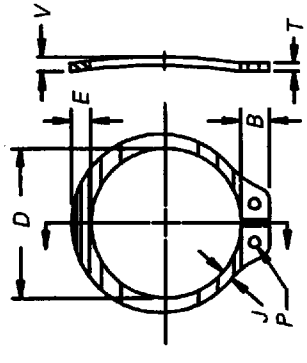
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TABLE 4 ILLUSTRATION



Exploded Groove Profile & Edge Margin (*Z*)
Maximum bottom radii (*R*), square corners For ring sizes -18 thru -23; 0.003 For ring sizes -25 thru -35; 0.005 For ring sizes -37 thru -100; 0.010 For ring sizes -102 and over.





Free Diameter & Ring Measurements with Section B-B

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TABLE 4 NA7 BOWED BASIC EXTERNAL RETAINING RINGS

Ring Series and Size No.	Shaft Diameter			Ring Size and Weight													Groove Dimensions					Edge Margin
				Free Diameter		Thickness [Note (1)]		Bow Height		Hole Diameter		Lug Height (Max.)	Large Section		Small Section		Approx. Mass per 1000 Pcs.	Diameter		Width		Depth	
	S, Dec.	*S*, Frac.	*S*, mm	*D*	Tol.	*T*	Tol.	*V*	Tol.	*P*	Tol.	*B*	*E*	Tol.	*J*	Tol.	lb	*G*	Tol.	*W*	Tol.	(*d*)	*Z*
NA7-18 (2)	0.188	3/16	4.8	0.168		0.015		0.036		0.025		0.052	0.025		0.016		0.059	0.175		0.030		0.006	0.018
NA7-19 (2)	0.197	...	5.0	0.179	+0.002	0.015		0.036		0.026		0.058	0.026	±0.002	0.016	±0.002	0.063	0.185	±0.0015	0.030	+0.003	0.006	0.018
NA7-21 (2)	0.219	7/32	5.6	0.196	−0.004	0.015		0.036		0.026		0.058	0.028		0.017		0.074	0.205	0.0015 (3)	0.030	−0.000	0.007	0.021
NA7-23 (2)	0.236	15/64	6.0	0.215		0.015		0.036		0.026		0.058	0.030		0.019		0.086	0.222		0.030		0.007	0.021
NA7-25	0.250	1/4	6.4	0.225		0.025		0.047		0.041		0.083	0.035		0.025		0.21	0.230		0.040		0.010	0.030
NA7-27	0.276	...	7.0	0.250		0.025		0.047		0.041		0.084	0.035		0.024		0.23	0.255		0.040		0.010	0.031
NA7-28	0.281	9/32	7.1	0.256		0.025		0.047	±0.006	0.041		0.083	0.038		0.025		0.24	0.261		0.040		0.010	0.030
NA7-31	0.312	5/16	7.9	0.281		0.025		0.047		0.041		0.090	0.040		0.026		0.27	0.290		0.040		0.011	0.033
NA7-34	0.344	11/32	8.7	0.309		0.025		0.047		0.041		0.090	0.042		0.026		0.31	0.321		0.040		0.011	0.033
NA7-35	0.354	...	9.0	0.320	+0.002	0.025	±0.002	0.047		0.041	+0.010	0.090	0.046	±0.003	0.029	±0.003	0.35	0.330	±0.002	0.040	+0.005	0.012	0.036
NA7-37	0.375	3/8	9.5	0.338	−0.005	0.025		0.047		0.041	−0.002	0.091	0.050		0.030		0.39	0.352	0.002 (3)	0.040	−0.000	0.012	0.036
NA7-39	0.394	...	10.0	0.354		0.025		0.047		0.041		0.090	0.052		0.031		0.42	0.369		0.040		0.012	0.037
NA7-40	0.406	13/32	10.3	0.366		0.025		0.047		0.041		0.090	0.054		0.033		0.43	0.382		0.040		0.012	0.036
NA7-43	0.438	7/16	11.1	0.395		0.025		0.047		0.041		0.091	0.055		0.033		0.50	0.412		0.040		0.013	0.039
NA7-46	0.469	15/32	11.9	0.428		0.025		0.047		0.041		0.091	0.060		0.035		0.54	0.443		0.040		0.013	0.039
NA7-50	0.500	1/2	12.7	0.461		0.035		0.063		0.047		0.111	0.065		0.040		0.91	0.468		0.055		0.016	0.048
NA7-55	0.551	...	14.0	0.509		0.035		0.063		0.047		0.111	0.053		0.036		0.90	0.519	±0.002	0.055		0.016	0.048
NA7-56	0.562	9/16	14.3	0.521		0.035		0.063		0.047		0.111	0.072	±0.004	0.041	±0.004	1.1	0.530	0.004 (3)	0.055		0.016	0.048
NA7-59	0.594	19/32	15.1	0.550		0.035		0.063	±0.007	0.047		0.112	0.076		0.043		1.2	0.559		0.055		0.017	0.052
NA7-62	0.625	5/8	15.9	0.579	+0.005	0.035		0.063		0.047		0.113	0.080		0.045		1.3	0.588		0.055		0.018	0.055
NA7-66	0.669	...	17.0	0.621	−0.010	0.035		0.063		0.047		0.113	0.082		0.043		1.4	0.629	±0.003	0.055		0.020	0.060
NA7-66	0.672	43/64	17.1	0.621		0.035		0.063		0.047		0.113	0.082		0.043		1.4	0.631	0.004 (3)	0.055		0.020	0.060
NA7-68	0.688	11/16	17.5	0.635		0.042		0.073		0.052		0.140	0.084		0.048		1.8	0.646		0.062		0.021	0.063
NA7-75	0.750	3/4	19.0	0.693		0.042		0.073	±0.008	0.052		0.140	0.092	±0.005	0.051	±0.005	2.1	0.704		0.062		0.023	0.069
NA7-78	0.781	25/32	19.8	0.722		0.042		0.073		0.052		0.140	0.094		0.052		2.2	0.733		0.062		0.024	0.072

(continued)

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TABLE 4 NA7 BOWED BASIC EXTERNAL RETAINING RINGS (CONT'D)

Ring Series and Size No.	Shaft Diameter			Ring Size and Weight													Groove Dimensions					Edge Margin
				Free Diameter		Thickness [Note (1)]		Bow Height		Hole Diameter		Lug Height (Max.)	Large Section		Small Section		Approx. Mass per 1000 Pcs.	Diameter		Width		Depth	
	S, Dec.	*S*, Frac.	*S*, mm	*D*	Tol.	*T*	Tol.	*V*	Tol.	*P*	Tol.	*B*	*E*	Tol.	*J*	Tol.	lb	*G*	Tol.	*W*	Tol.	(*d*)	*Z*
NA7-81	0.812	13/16	20.6	0.751		0.042		0.073		0.052	+0.010	0.140	0.096		0.054		2.5	0.762		0.062		0.025	0.075
NA7-87	0.875	7/8	22.2	0.810		0.042		0.073		0.052	−0.002	0.141	0.104	±0.005	0.057	±0.005	2.8	0.821		0.062		0.027	0.081
NA7-93	0.938	15/16	23.8	0.867	+0.005	0.042		0.073	±0.008	0.078		0.170	0.110		0.063		3.1	0.882	±0.003	0.062		0.028	0.084
NA7-98	0.984	63/64	25.0	0.910	−0.010	0.042		0.073		0.078		0.171	0.114		0.064		3.5	0.926	0.004 (3)	0.062		0.029	0.087
NA7-100	1.000	1	25.4	0.925		0.042		0.073		0.078		0.171	0.116		0.065		3.6	0.940		0.062		0.030	0.090
NA7-102	1.023	...	26.0	0.946		0.042		0.073		0.078		0.172	0.118		0.066		3.9	0.961		0.062		0.031	0.093
NA7-106	1.062	1 1/16	27.0	0.982		0.050	±0.002	0.085		0.078		0.185	0.122		0.069		4.8	0.998		0.070		0.032	0.096
NA7-112	1.125	1 1/8	28.6	1.041		0.050		0.085		0.078		0.186	0.128		0.071		5.1	1.059		0.070	+0.005	0.033	0.099
NA7-118	1.188	1 3/16	30.2	1.098		0.050		0.085		0.078	+0.015	0.186	0.132		0.072		5.6	1.118		0.070	−0.000	0.035	0.105
NA7-125	1.250	1 1/4	31.7	1.156		0.050		0.085		0.078	−0.002	0.187	0.140		0.076		5.9	1.176		0.070		0.037	0.111
NA7-131	1.312	1 5/16	33.3	1.214	+0.010	0.050		0.085	±0.012	0.078		0.187	0.146	±0.006	0.076	±0.006	6.8	1.232	±0.004	0.070		0.040	0.120
NA7-137	1.375	1 3/8	34.9	1.272	−0.015	0.050		0.085		0.078		0.188	0.152		0.082		7.2	1.291	0.005 (3)	0.070		0.042	0.126
NA7-143	1.438	1 7/16	36.5	1.333		0.050		0.085		0.078		0.188	0.160		0.086		8.1	1.350		0.070		0.044	0.132
NA7-150	1.500	1 1/2	38.1	1.387		0.050		0.085		0.120		0.218	0.168		0.091		9.0	1.406		0.070		0.047	0.141
NA7-162	1.625	1 5/8	41.3	1.503	+0.013	0.062	±0.003	0.115	±0.015	0.125		0.239	0.180		0.097		13.2	1.529	±0.005	0.096		0.048	0.144
NA7-175	1.750	1 3/4	44.4	1.618	−0.020	0.062		0.115		0.125		0.241	0.188		0.101		15.3	1.650	0.005 (3)	0.096		0.050	0.150

GENERAL NOTE: For reference, see Table 4 Illustration beginning on page 100.

NOTES:

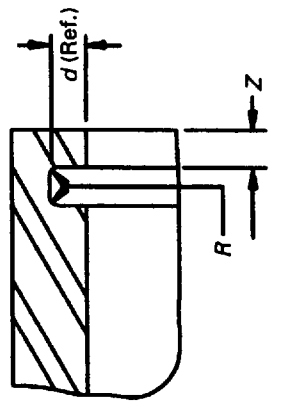
(1) For plated rings, add 0.002 in. to the listed maximum thickness.

(2) Sizes -18 through -23 available in beryllium copper only.

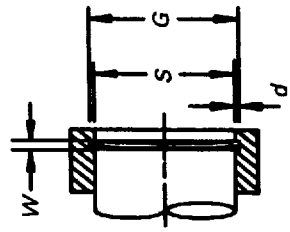
(3) *F.I.M. (Full Indicator Movement)*: maximum circular run out of groove to shaft.

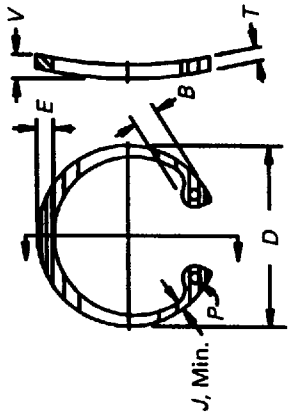
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TABLE 5 ILLUSTRATION



Exploded Groove Profile & Edge Margin (Z)
Maximum bottom radii (R), 0.005 for ring sizes -25 thru -100; 0.010 for ring sizes -102 and over





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TABLE 5 NA8 BOWED BASIC INTERNAL RETAINING RINGS

Ring Series and Size No.	Housing Diameter			Ring Size and Weight														Groove Dimensions						Edge Margin
				Free Diameter		Thickness [Note (1)]		Bow Height		Hole Diameter		Lug Height (Max.)	Large Section		Small Section		Approx. Mass per 1000 Pcs.	Diameter		Width		Depth		
	S, Dec.	*S*, Frac.	*S*, mm	*D*	Tol.	*T*	Tol.	*V*	Tol.	*P*	Tol.	*B*	*E*	Tol.	*J*	Tol.	lb	*G*	Tol.	*W*	Tol.	(*d*)		*Z*
NA8-25	0.250	1/4	6.4	0.280		0.015		0.036		0.031		0.068	0.025	±0.002	0.015	±0.002	0.08	0.268	±0.001	0.030	+0.002	0.009		0.027
NA8-31	0.312	5/16	7.9	0.346		0.015		0.036		0.031		0.069	0.033		0.018		0.11	0.330	0.0015 (2)	0.030	−0.000	0.009		0.027
NA8-37	0.375	3/8	9.5	0.415		0.025		0.047	±0.006	0.041		0.085	0.040		0.028		0.25	0.397		0.040		0.011		0.033
NA8-43	0.438	7/16	11.1	0.482		0.025		0.047		0.041		0.101	0.049	±0.003	0.029	±0.003	0.37	0.461	±0.002	0.040		0.012		0.036
NA8-45	0.453	29/64	11.5	0.498		0.025		0.047		0.047		0.101	0.050		0.030		0.43	0.477	0.002 (2)	0.040		0.012		0.036
NA8-50	0.500	1/2	12.7	0.548	±0.010	0.035		0.063		0.047		0.117	0.053		0.035		0.70	0.530		0.055		0.015		0.045
NA8-51	0.512	...	13.0	0.560		0.035		0.063		0.047		0.119	0.053		0.035		0.77	0.542		0.055		0.015		0.045
NA8-56	0.562	9/16	14.3	0.620		0.035		0.063	±0.007	0.047		0.137	0.053		0.035		0.86	0.596	±0.002	0.055		0.017		0.051
NA8-62	0.625	5/8	15.9	0.694		0.035		0.063		0.062	+0.010	0.137	0.060	±0.004	0.035	±0.004	1.0	0.665	0.004 (2)	0.055		0.020		0.060
NA8-68	0.688	11/16	17.5	0.763		0.035		0.063		0.062	−0.002	0.137	0.063		0.036		1.2	0.732		0.055		0.022		0.066
NA8-75	0.750	3/4	19.0	0.831		0.035		0.063		0.062		0.147	0.070		0.040		1.3	0.796		0.055		0.023		0.069
NA8-77	0.777	...	19.7	0.859		0.042		0.073		0.062		0.151	0.074		0.044		1.7	0.825		0.062		0.024		0.072
NA8-81	0.812	13/16	20.6	0.901		0.042		0.073		0.062		0.160	0.077		0.044		1.9	0.862		0.062		0.025		0.075
NA8-86	0.866	...	22.0	0.961		0.042		0.073		0.062		0.160	0.081		0.045		2.0	0.920		0.062		0.027		0.081
NA8-87	0.875	7/8	22.2	0.971		0.042		0.073		0.062		0.160	0.084		0.045		2.1	0.931		0.062		0.028		0.084
NA8-90	0.901	...	22.9	1.000	±0.015	0.042	±0.002	0.073	±0.008	0.062		0.160	0.087	±0.005	0.047	±0.005	2.2	0.959	±0.003	0.062	+0.003	0.029		0.087
NA8-93	0.938	15/16	23.8	1.041		0.042		0.073		0.062		0.160	0.091		0.050		2.4	1.000	0.004 (2)	0.062	−0.000	0.031		0.093
NA8-100	1.000	1	25.4	1.111		0.042		0.073		0.062		0.160	0.104		0.052		2.7	1.066		0.062		0.033		0.099
NA8-102	1.023	...	26.0	1.136		0.042		0.073		0.062		0.160	0.106		0.054		2.8	1.091		0.062		0.034		0.102
NA8-106	1.062	1 1/16	27.0	1.180		0.050		0.085		0.078		0.185	0.110		0.055		3.7	1.130		0.070		0.034		0.102
NA8-112	1.125	1 1/8	28.6	1.249		0.050		0.085		0.078		0.185	0.116		0.057		4.0	1.197		0.070		0.036		0.108
NA8-118	1.181	...	30.0	1.319		0.050		0.085		0.078		0.185	0.120		0.058		4.3	1.255		0.070		0.037		0.111
NA8-118	1.188	1 3/16	30.2	1.319		0.050		0.085		0.078		0.185	0.120		0.058		4.3	1.262		0.070		0.037		0.111
NA8-125	1.250	1 1/4	31.7	1.388		0.050		0.085		0.078		0.185	0.124		0.062		4.8	1.330		0.070		0.040		0.120
NA8-125	1.259	...	32.0	1.388	±0.025	0.050		0.085	±0.012	0.078		0.185	0.124	±0.006	0.062	±0.006	4.8	1.339	±0.004	0.070		0.040		0.120
NA8-131	1.312	1 5/16	33.3	1.456		0.050		0.085		0.078		0.185	0.130		0.062		5.0	1.396	0.005 (2)	0.070		0.042		0.126
NA8-137	1.375	1 3/8	34.9	1.526		0.050		0.085		0.078		0.185	0.130		0.063		5.1	1.461		0.070		0.043		0.129
NA8-137	1.378	...	35.0	1.526		0.050		0.085		0.078	+0.015	0.185	0.130		0.063		5.1	1.464		0.070		0.043		0.129
NA8-143	1.438	1 7/16	36.5	1.596		0.050		0.085		0.078	−0.002	0.185	0.133		0.065		5.8	1.528		0.070		0.045		0.135
NA8-145	1.456	...	37.0	1.616		0.050		0.085		0.078		0.185	0.133		0.065		6.4	1.548		0.070		0.046		0.138
NA8-150	1.500	1 1/2	38.1	1.660		0.050		0.085		0.078		0.185	0.133		0.066		6.5	1.594		0.070		0.047		0.141
NA8-156	1.562	1 9/16	39.7	1.734		0.062		0.115		0.078		0.207	0.157		0.078		8.9	1.658		0.100		0.048		0.144
NA8-156	1.575	...	40.0	1.734	+0.035	0.062	±0.003	0.115	±0.015	0.078		0.207	0.157	±0.007	0.078	±0.007	8.9	1.671	±0.005	0.100	+0.005	0.048		0.144
NA8-162	1.625	1 5/8	41.3	1.804	−0.025	0.062		0.115		0.078		0.232	0.164		0.082		10.0	1.725	0.005 (2)	0.100	−0.000	0.050		0.150
NA8-175	1.750	1 3/4	44.4	1.942		0.062		0.115		0.078		0.239	0.171		0.083		10.3	1.858		0.100		0.054		0.162

GENERAL NOTE: For reference, see Table 5 Illustration on previous page.

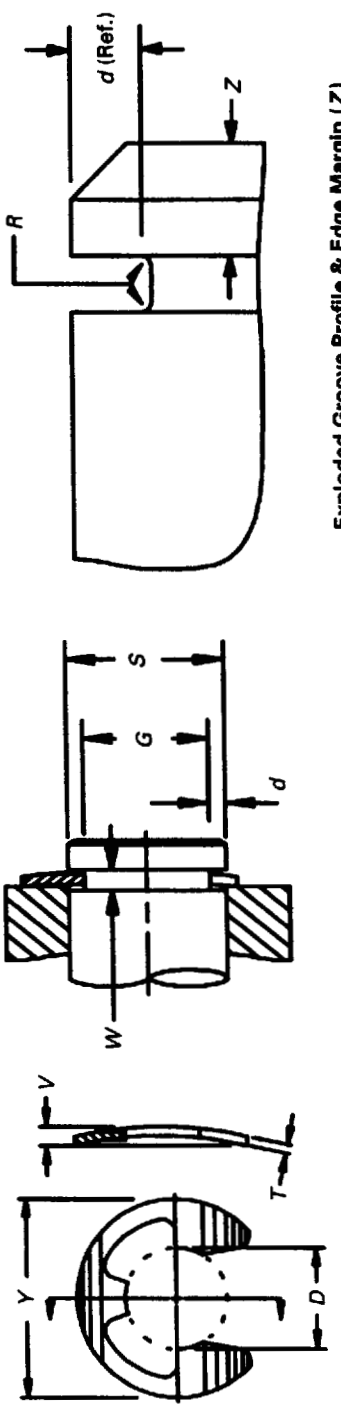
NOTES:

(1) For plated rings, add 0.002 in. to the listed maximum thickness.

(2) *F.I.M. (Full Indicator Movement)*: maximum circular run out of groove diameter to housing.

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TABLE 6 ILLUSTRATION



Exploded Groove Profile & Edge Margin (Z)
Maximum bottom radii (R), 0.005 For ring sizes S-11 Thru -25; 0.010 For ring sizes S-31 Thru S-43; 0.015 ring sizes -50 and over.

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TABLE 6 NA9 BOWED (E-TYPE) EXTERNAL RETAINING RINGS

Ring Series and Size No.	Shaft Diameter			Ring Size and Weight							Groove Dimensions						Edge Margin
				Free Diameter		Thickness [Note (1)]		Bow Height		Outside Diameter (ref)	Approx. Mass per 1000 Pcs.	Diameter		Width		Depth	
	S_1 Dec.	S_1 Frac.	S_1 mm	D	Tol.	T	Tol.	V_1 Min.	V_1 Max.	Y	lb	G	Tol.	W	Tol.	(d)	Z
NA9-S11	0.110	7/64	2.8	0.076		0.010		0.025	0.035	0.375	0.20	0.079	+0.002	0.022		0.015	0.030
NA9-12	0.125	1/8	3.2	0.094		0.010	±0.001	0.025	0.035	0.230	0.06	0.095	−0.000	0.022		0.015	0.030
NA9-S14	0.140	9/64	3.6	0.100		0.010		0.022	0.032	0.203	0.040	0.102	0.0015 (2)	0.019		0.019	0.038
NA9-14	0.140	9/64	3.6	0.102		0.015		0.028	0.038	0.270	0.13	0.105		0.025		0.017	0.034
NA9-15	0.156	5/32	4.0	0.114	+0.001	0.015		0.030	0.040	0.282	0.13	0.116		0.027		0.020	0.040
NA9-S17	0.172	11/64	4.4	0.125	−0.003	0.015		0.032	0.042	0.312	0.16	0.127	+0.002	0.029		0.022	0.044
NA9-18	0.188	3/16	4.8	0.145		0.015		0.033	0.043	0.335	0.17	0.147	−0.000	0.030		0.020	0.040
NA9-S18	0.188	3/16	4.8	0.122		0.015		0.038	0.048	0.375	0.27	0.125	0.002 (2)	0.035	+0.005	0.031	0.062
NA9-S21	0.219	7/32	5.6	0.185		0.015		0.043	0.058	0.437	0.28	0.188		0.040	−0.000	0.015	0.030
NA9-25	0.250	1/4	6.3	0.207		0.025		0.050	0.065	0.527	0.76	0.210		0.047		0.020	0.040
NA9-S31	0.312	5/16	7.9	0.243		0.025	±0.002	0.050	0.065	0.500	0.57	0.250		0.047		0.031	0.062
NA9-37	0.375	3/8	9.5	0.300	+0.002	0.035		0.060	0.076	0.660	1.5	0.303		0.060		0.036	0.072
NA9-43	0.438	7/16	11.1	0.337	−0.004	0.035		0.060	0.076	0.687	1.5	0.343		0.060		0.047	0.094
NA9-S43	0.438	7/16	11.1	0.375		0.035		0.060	0.076	0.600	1.0	0.380	+0.003	0.057		0.029	0.058
NA9-50	0.500	1/2	12.7	0.392		0.042		0.075	0.093	0.800	2.5	0.396	−0.000	0.073		0.052	0.104
NA9-62	0.625	5/8	15.9	0.480		0.042		0.080	0.098	0.940	3.2	0.485	0.004 (2)	0.077		0.070	0.140
NA9-S74	0.744	...	18.9	0.616		0.050		0.090	0.110	1.000	4.3	0.625		0.085		0.060	0.118
NA9-S74	0.750	3/4	19.0	0.616		0.050		0.090	0.110	1.000	4.3	0.625		0.085		0.062	0.124
NA9-75	0.750	3/4	19.0	0.574	+0.003	0.050		0.090	0.110	1.120	5.8	0.580		0.085		0.085	0.170
NA9-87	0.875	7/8	22.2	0.668	−0.005	0.050		0.090	0.110	1.300	7.6	0.675		0.085		0.100	0.200
NA9-S98	0.984	63/64	25.0	0.822		0.050		0.088	0.112	1.500	9.38	0.835		0.085		0.074	0.148

GENERAL NOTE: For reference, see Table 6 Illustration on previous page.

NOTES:
(1) For plated rings, add 0.002 in. to the listed maximum thickness.
(2) *F.I.M. (Full Indicator Movement)*: maximum circular run out of groove to shaft.

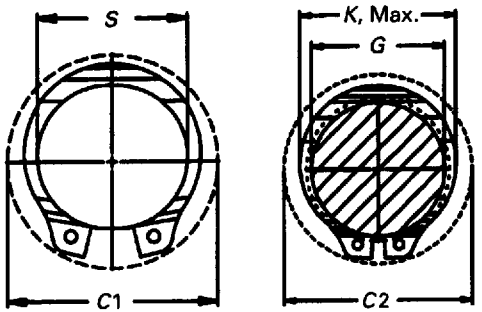
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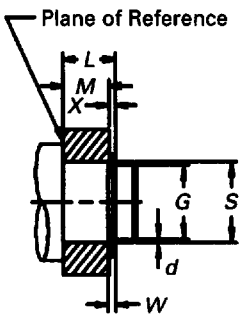
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MANDATORY APPENDIX I
BOWED EXTERNAL SERIES NA7

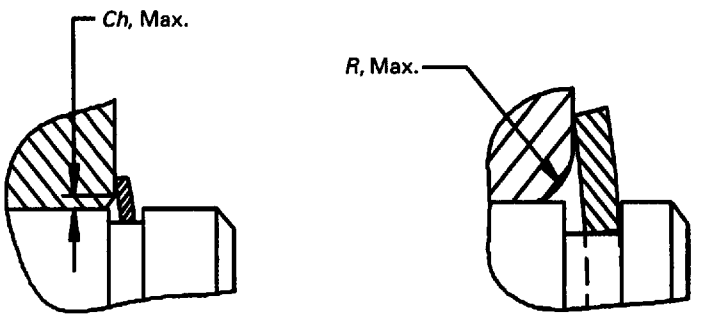
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Outer Groove Wall Locations
L, Max. = *M*, Min. + *X*, Max.
L, Min. = *M*, Max. + *X*, Min.



Maximum Corner Radius & Chamfer

TABLE I NA7 BOWED BASIC EXTERNAL RETAINING RINGS

Ring Series and Size No.	Application Data												
	Clearance		Gaging Diameter Ring Installed in Groove	Allowable Thrust Load Square Corner Abutment		Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.	Distance, Outer Groove Wall to Face of Retained Part		Resilient Take Up of Tolerence L and M	Approx. Force Needed to Flatten Rings	Calculated Allowable Assembly [Note (1)]
	Expanded Over Shaft	Released in Groove		UNS G10600–G10900 and Stainless Steel Rings Used on Hardened Shafts 50 HRC, Min.	All Standard Rings Used on Low Carbon Steel Shafts								
	C1	C2	*K*, Max.	*Pr* (lb) [Note (1)]	*Pg* (lb)	*R*, Max.	*Ch*, Max.	*P'r* (lb)	*X*, Min.	*X*, Max.	*X*, Max.–*X*, Min.	lb	RPM
NA7-18 (1)	0.298	0.288	0.218	240	80	0.014	0.0085	105	0.020	0.028		20	80000
NA7-19 (1)	0.319	0.307	0.228	250	85	0.0145	0.009	105	0.020	0.028		20	80000
NA7-21 (1)	0.338	0.324	0.252	280	110	0.015	0.009	105	0.020	0.028		15	80000
NA7-23 (1)	0.355	0.341	0.272	310	120	0.0185	0.010	105	0.020	0.028		15	80000
NA7-25	0.45	0.43	0.290	500	175	0.018	0.011	470	0.030	0.038		50	80000
NA7-27	0.48	0.46	0.315	660	195	0.0175	0.0105	470	0.030	0.038		50	76000
NA7-28	0.49	0.47	0.326	670	200	0.020	0.012	470	0.030	0.038	0.008	60	74000
NA7-31	0.54	0.52	0.357	751	240	0.020	0.012	470	0.030	0.038		50	70000
NA7-34	0.57	0.55	0.390	812	265	0.021	0.0125	470	0.030	0.038		45	64000
NA7-35	0.59	0.57	0.405	832	300	0.023	0.014	470	0.030	0.038		45	62000
NA7-37	0.61	0.59	0.433	883	225	0.025	0.0155	470	0.030	0.038		45	60000
NA7-39	0.62	0.60	0.452	964	335	0.027	0.016	470	0.030	0.038		40	56500
NA7-40	0.63	0.61	0.468	984	350	0.0285	0.017	470	0.030	0.038		40	55000
NA7-43	0.66	0.64	0.501	1035	400	0.023	0.0175	470	0.030	0.038		35	50000
NA7-48	0.68	0.66	0.540	1117	450	0.031	0.018	470	0.030	0.038		35	42000

(continued)

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TABLE I NA7 BOWED BASIC EXTERNAL RETAINING RINGS (CONT'D)

Ring Series and Size No.	Application Data												
	Clearance		Gaging Diameter Ring Installed in Groove	Allowable Thrust Load Square Corner Abutment		Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.	Distance, Outer Groove Wall to Face of Retained Part		Resilient Take Up of Tolerence L and M	Approx. Force Needed to Flatten Rings	Calculated Allowable Assembly [Note (1)]
	Expanded Over Shaft	Released in Groove		UNS G10600–G10900 and Stainless Steel Rings Used on Hardened Shafts 50 HRC, Min.	All Standard Rings Used on Low Carbon Steel Shafts								
	C1	C2	*K*, Max.	*Pr* (lb) [Note (1)]	*Pg* (lb)	*R*, Max.	*Ch*, Max.	*P'r* (lb)	*X*, Min.	*X*, Max.	*X*, Max.–*X*, Min.	lb	RPM
NA7-50	0.77	0.74	0.574	1675	550	0.034	0.020	910	0.042	0.053		90	40000
NA7-55	0.81	0.78	0.611	1827	600	0.027	0.0165	910	0.042	0.053		85	36000
NA7-56	0.82	0.79	0.644	1878	650	0.038	0.023	910	0.042	0.053		80	35000
NA7-59	0.86	0.83	0.680	1978	750	0.0395	0.0235	910	0.042	0.053		70	32000
NA7-62	0.90	0.87	0.715	2091	800	0.0415	0.025	910	0.042	0.053		80	30000
NA7-66	0.93	0.90	0.758	2233	960	0.040	0.024	910	0.042	0.053		50	29000
NA7-66	0.93	0.89	0.758	2233	950	0.040	0.024	910	0.042	0.053		50	29000
NA7-68	1.01	0.97	0.779	3451	1000	0.042	0.025	1340	0.049	0.060		70	28000
NA7-75	1.09	1.05	0.860	3756	1200	0.048	0.0275	1340	0.049	0.060		65	26500
NA7-78	1.12	1.08	0.883	3959	1300	0.047	0.028	1340	0.049	0.060		60	25500
NA7-81	1.15	1.10	0.914	4060	1450	0.047	0.028	1340	0.049	0.060		55	24500
NA7-87	1.21	1.16	0.987	4365	1650	0.051	0.035	1340	0.049	0.060	0.011	45	23000
NA7-93	1.34	1.29	1.034	4720	1850	0.055	0.033	1340	0.049	0.060		40	21500
NA7-98	1.39	1.34	1.106	4823	2000	0.056	0.0335	1340	0.049	0.060		40	20500
NA7-100	1.41	1.35	1.122	5024	2100	0.057	0.034	1340	0.049	0.060		35	20000
NA7-102	1.43	1.37	1.147	5128	2250	0.058	0.035	1340	0.049	0.060		35	19500
NA7-106	1.50	1.44	1.192	5293	2400	0.080	0.036	1950	0.057	0.068		60	19000
NA7-112	1.65	1.49	1.261	6699	2600	0.063	0.038	1950	0.057	0.068		55	18800
NA7-118	1.61	1.54	1.325	7105	2950	0.064	0.0385	1850	0.057	0.068		50	18000
NA7-125	1.69	1.62	1.396	7460	3250	0.068	0.041	1950	0.057	0.068		45	17000
NA7-131	1.75	1.67	1.458	7866	3700	0.068	0.041	1950	0.057	0.068		40	16500
NA7-137	1.80	1.72	1.529	8222	4100	0.072	0.043	1950	0.057	0.068		35	18000
NA7-143	1.87	1.79	1.600	8628	4500	0.076	0.045	1950	0.057	0.068		30	15000
NA7-150	1.99	1.90	1.668	8932	5000	0.079	0.047	1950	0.057	0.068		30	14800
NA7-162	2.17	2.06	1.812	12028	5500	0.067	0.052	3000	0.069	0.094	0.025	55	13200
NA7-175	2.31	2.21	1.945	12982	6200	0.091	0.064	3000	0.069	0.094		50	12200

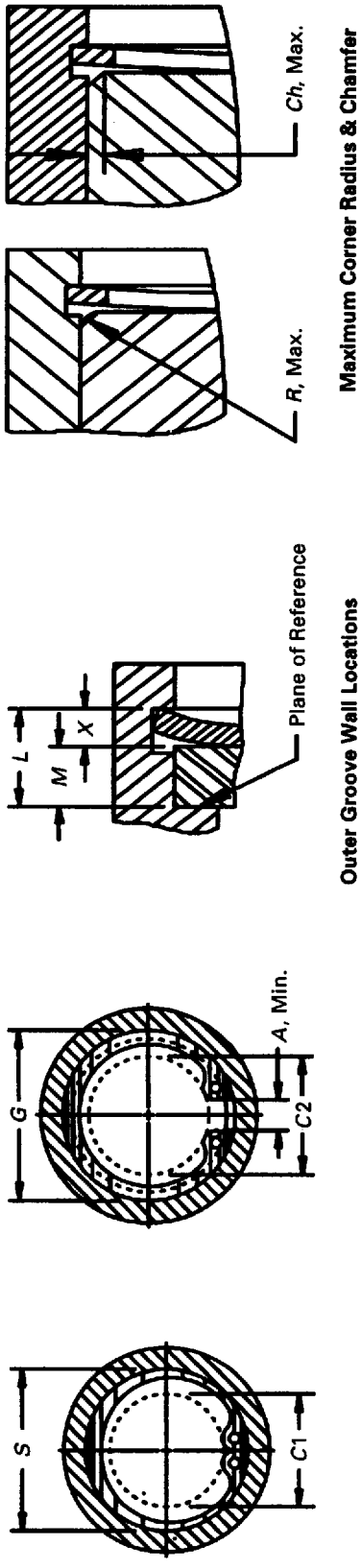
NOTES:
(1) (a) The values listed above apply to rings made from UNS G10600–G10900 and UNS S15700 stainless steel except sizes -18 through -23, which are supplied in beryllium copper only.
(b) *Pr* values for other sizes made from beryllium copper can be calculated by multiplying listed values by 0.75.
(2) *Safety Factors Pr and Pg:* the allowable thrust load values listed include the following safety factors: *Pr*: 4 *Pg*: 2.

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MANDATORY APPENDIX II
BOWED INTERNAL SERIES NA8

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TABLE II ILLUSTRATION



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TABLE II NA8 BOWED BASIC INTERNAL RETAINING RINGS

Ring Series and Size No.	Application Data											
	Clearance		Gap Width	Allowable Thrust Load Square Corner Abutment		Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.	Distance, Outer Groove Wall to Face of Retained Part		Resilient Take Up of Tolerances L and M	Approx. Force Needed to Flatten Rings
	Compressed in Housing	Released in Groove	Ring in Groove	UNS G10600–G10900 and Stainless Steel Rings Used in Hardened Housing 50 HRC, Min.	All Standard Rings Used in Low Carbon Steel Housing							
	C1	C2	*A*, Min.	*Pr* (lb) [Note (1)]	*Pg* (lb)	*R*, Max.	*Ch*, Max.	*P'r* (lb)	*X*, Min.	*X*, Max.	*X*, Max.–*X*, Min.	lb
NA8-25	0.115	0.133	0.047	426	190	0.011	0.0085	190	0.020	0.028		20
NA8-31	0.173	0.191	0.055	538	240	0.016	0.013	190	0.020	0.028		20
NA8-37	0.204	0.226	0.063	1066	350	0.023	0.018	530	0.030	0.038	0.008	45
NA8-43	0.23	0.254	0.063	1238	440	0.027	0.021	530	0.030	0.038		40
NA8-45	0.25	0.274	0.071	1299	460	0.027	0.021	530	0.030	0.038		40
NA8-50	0.26	0.29	0.090	2010	510	0.027	0.021	1100	0.042	0.053		120
NA8-51	0.27	0.30	0.092	2060	520	0.027	0.021	1100	0.042	0.053		115
NA8-56	0.275	0.305	0.095	2253	710	0.027	0.021	1100	0.042	0.053		100
NA8-62	0.34	0.38	0.104	2507	1050	0.027	0.021	1100	0.042	0.053		85
NA8-68	0.40	0.44	0.118	2741	1280	0.027	0.021	1100	0.042	0.053		65
NA8-75	0.45	0.49	0.143	3045	1460	0.032	0.025	1100	0.042	0.053		45
NA8-77	0.475	0.52	0.145	4618	1580	0.035	0.028	1650	0.049	0.060		80
NA8-81	0.49	0.54	0.153	4872	1710	0.035	0.028	1650	0.049	0.060		75
NA8-86	0.54	0.59	0.172	5177	1980	0.035	0.028	1650	0.049	0.060		70
NA8-87	0.545	0.60	0.179	5227	2080	0.035	0.028	1650	0.049	0.060		70
NA8-90	0.585	0.62	0.188	5430	2200	0.038	0.030	1650	0.049	0.060		65
NA8-93	0.61	0.67	0.200	5684	2450	0.038	0.030	1650	0.049	0.060		60
NA8-100	0.665	0.73	0.212	6039	2600	0.042	0.034	1650	0.049	0.060	0.011	55
NA8-102	0.69	0.755	0.220	6141	3000	0.042	0.034	1650	0.049	0.060		50
NA8-106	0.685	0.75	0.213	7562	3050	0.044	0.035	2400	0.057	0.068		70
NA8-112	0.745	0.815	0.232	8019	3400	0.047	0.035	2400	0.057	0.068		65
NA8-118	0.79	0.86	0.226	8526	3700	0.047	0.036	2400	0.057	0.068		60
NA8-118	0.80	0.87	0.245	8626	3700	0.047	0.036	2400	0.057	0.068		60
NA8-125	0.875	0.955	0.266	8932	4250	0.048	0.038	2400	0.057	0.068		55
NA8-125	0.885	0.965	0.290	8932	4250	0.048	0.038	2400	0.057	0.068		55
NA8-131	0.93	1.01	0.284	9440	4700	0.048	0.038	2400	0.057	0.068		50
NA8-137	0.99	1.07	0.297	9846	5050	0.048	0.038	2400	0.057	0.068		45
NA8-137	0.99	1.07	0.305	9846	5050	0.048	0.038	2400	0.057	0.068		45
NA8-143	1.06	1.15	0.313	10353	5500	0.048	0.038	2400	0.057	0.068		40
NA8-145	1.08	1.17	0.320	10455	5700	0.048	0.038	2400	0.057	0.068		35
NA8-150	1.12	1.21	0.340	10708	6000	0.048	0.038	2400	0.057	0.068		35
NA8-154	1.14	1.23	0.338	13908	6350	0.064	0.050	3900	0.075	0.095		40
NA8-156	1.15	1.24	0.374	13906	6350	0.064	0.050	3900	0.075	0.095	0.020	40
NA8-162	1.15	1.25	0.339	14413	6900	0.064	0.050	3900	0.075	0.095		40
NA8-175	1.26	1.36	0.372	15580	8050	0.064	0.050	3900	0.075	0.095		35

GENERAL NOTE: For reference, see Table II Illustration on previous page.

NOTES:

(1) The *Pr* values listed apply to rings made from UNS G10600–G10900 and UNS S15700 stainless steel. *Pr* values for rings made from beryllium copper can be calculated by multiplying listed values by 0.75.

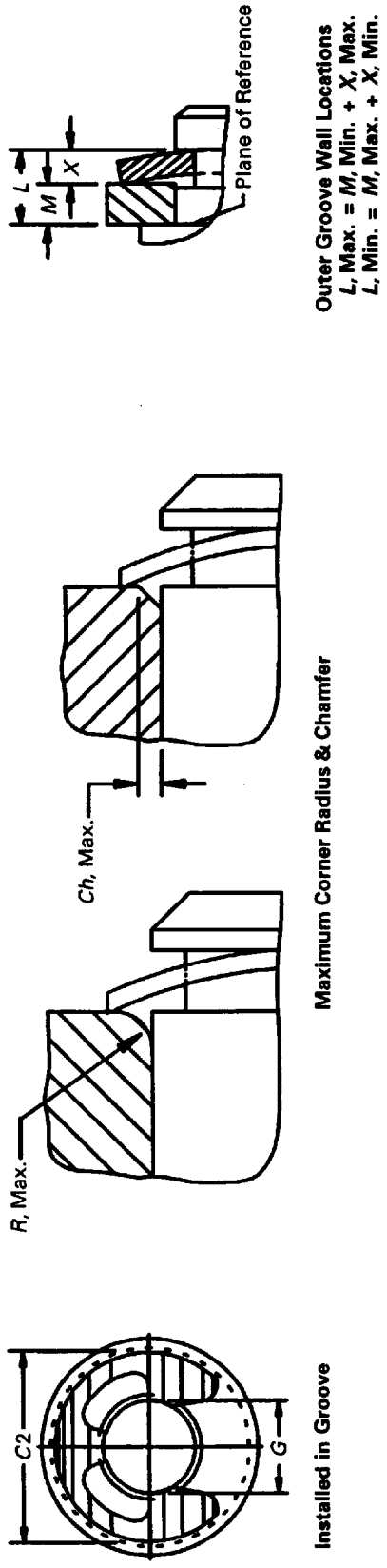
(2) *Safety Factors Pr and Pg*: the allowable thrust load values listed include the following safety factors: *Pr*: 4; *Pg*: 2.

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MANDATORY APPENDIX III
BOWED E-RING EXTERNAL SERIES NA9

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TABLE III ILLUSTRATION



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TABLE III NA9 BOWED (E-TYPE) EXTERNAL RETAINING RINGS

Ring Series and Size No.	Application Data										
	Clearance	Allowable Thrust Load Square Corner Abutment		Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.	Distance, Outer Groove Wall to Face of Retained Part		Resilient Take Up of Tolerence L and M	Approx. Force Needed to Flatten Rings	Calculated Allowable Assembly (Steel Rings)
	Released in Groove	UNS G10600–G10900 and Stainless Steel Rings Used on Hardened Shafts 50 HRC, Min.	All Standard Rings Used on Low Carbon Steel Shafts								
	C2	*Pr* (lb) [Note (1)]	*Pg* (lb)	*R*, Max.	*Ch*, Max.	*P'r* (lb)	*X*, Min.	*X*, Max.	*X*, Max.–*X*, Min.	lb	RPM
NA9-S11	0.390	61	40	0.080	0.060	60	0.017	0.022	0.005	19	35000
NA9-12	0.240	44	45	0.040	0.030	43	0.017	0.022	0.005	8	35000
NA9-S14	0.215	51	60	0.029	0.022	50	0.014	0.018	0.004	6	32000
NA9-14	0.285	76	60	0.060	0.045	75	0.020	0.023	0.003	16	32000
NA9-15	0.295	81	75	0.060	0.045	80	0.022	0.027	0.005	15	31000
NA9-S17	0.325	91	90	0.060	0.045	90	0.023	0.029	0.006	14	30000
NA9-18	0.35	96	90	0.060	0.045	95	0.023	0.030	0.007	12	30000
NA9-S18	0.39	102	135	0.060	0.045	100	0.026	0.034	0.008	16	30000
NA9-S21	0.45	117	75	0.060	0.045	115	0.029	0.039	0.010	12	26000
NA9-25	0.54	259	115	0.060	0.045	255	0.036	0.046	0.010	35	25000
NA9-S31	0.52	330	225	0.060	0.045	325	0.036	0.046	0.010	30	22000
NA9-37	0.68	700	315	0.065	0.050	690	0.045	0.055	0.010	55	20000
NA9-43	0.71	842	480	0.065	0.050	830	0.045	0.055	0.010	50	16500
NA9-S43	0.62	812	280	0.050	0.035	800	0.045	0.055	0.010	65	16500
NA9-50	0.82	1127	600	0.080	0.060	1110	0.056	0.070	0.014	90	14000
NA9-62	0.96	1441	1050	0.080	0.060	1420	0.061	0.075	0.014	85	12000
NA9-S74	1.02	1940	1050	0.057	0.062	1900	0.069	0.085	0.016	110	11000
NA9-S74	1.02	1979	1100	0.042	0.062	1900	0.069	0.085	0.016	110	11000
NA9-75	1.14	2030	1500	0.085	0.065	2000	0.069	0.085	0.016	110	10500
NA9-87	1.32	2385	2050	0.085	0.065	2350	0.069	0.085	0.016	120	9000
NA9-S98	1.530	2600	1750	0.085	0.065	2700	0.067	0.083	0.016	110	6500

GENERAL NOTE: For reference, see Table III Illustration on previous page.

NOTES:

(1) The values listed apply to rings made from UNS G10600–G10900 and UNS S15700 stainless steel. *Pr* values for rings made from beryllium copper can be calculated by multiplying listed values by 0.75.

(2) *Safety Factors for Pr and Pg*: the allowable thrust load values listed include the following safety factors: *Pr*: 3; *Pg*: 2.

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NONMANDATORY APPENDIX A
TYPE NA7 REFERENCE METRIC VALUES (DIMENSIONS)

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STD.ASME B18.27-ENGL 1998 ■ 0759670 0613143 317 ■

TABLE A TYPE NA7 REFERENCE METRIC VALUES (DIMENSIONS)

Ring Series and Size No.	Shaft Diameter	Ring Size and Weight													Groove Dimensions					Edge Margin
		Free Diameter		Thickness [Note (1)]		Bow Height		Hole Diameter		Lug Height (Max.)	Large Section		Small Section		Approx. Mass per 1000 Pcs.	Diameter		Width		Depth	
	S, mm	*D*	Tol.	*T*	Tol.	*V*	Tol.	*P*	Tol.	*B*	*E*	Tol.	*J*	Tol.	kg	*G*	Tol.	*W*	Tol.	(*d*)	*Z*
NA7-18 (2)	4.8	4.27		0.38		0.91		0.64		1.32	0.64		0.41		0.03	4.45		0.76		0.15	0.46
NA7-19 (2)	5.0	4.55	+0.05	0.38		0.91		0.66		1.47	0.66	±0.05	0.41	±0.05	0.03	4.70	±0.04	0.76	+0.08	0.15	0.46
NA7-21 (2)	5.6	4.98	−0.10	0.38		0.91		0.66		1.47	0.71		0.43		0.03	5.21	0.04 (3)	0.76	0	0.18	0.53
NA7-23 (2)	6.0	5.46		0.38		0.91		0.66		1.47	0.76		0.48		0.04	5.64		0.76		0.18	0.53
NA7-25	6.4	5.72		0.64		1.19		1.04		2.11	0.89		0.64		0.10	5.84		1.02		0.25	0.76
NA7-27	7.0	6.35		0.64		1.19		1.04		2.13	0.89		0.61		0.10	6.48		1.02		0.25	0.79
NA7-28	7.1	6.50		0.64		1.19	±0.15	1.04		2.11	0.97		0.64		0.11	6.63		1.02		0.25	0.76
NA7-31	7.9	7.14		0.64		1.19		1.04		2.29	1.02		0.66		0.12	7.37		1.02		0.28	0.84
NA7-34	8.7	7.85		0.64		1.19		1.04		2.29	1.07		0.66		0.14	8.15		1.02		0.28	0.84
NA7-35	9.0	8.13	+0.05	0.64		1.19		1.04	+0.25	2.29	1.17	±0.08	0.74	±0.08	0.16	8.38	±0.05	1.02		0.30	0.91
NA7-37	9.5	8.59	−0.13	0.64		1.19		1.04	−0.05	2.31	1.27		0.76		0.18	8.94	0.05 (3)	1.02		0.30	0.91
NA7-39	10.0	8.99		0.64		1.19		1.04		2.29	1.32		0.79		0.19	9.37		1.02		0.30	0.94
NA7-40	10.3	9.30		0.64		1.19		1.04		2.29	1.37		0.84		0.20	9.70		1.02		0.30	0.91
NA7-43	11.1	10.03		0.64		1.19		1.04		2.31	1.40		0.84		0.23	10.46		1.02		0.33	0.99
NA7-46	11.9	10.87		0.64		1.19		1.04		2.31	1.52		0.89		0.25	11.25		1.02		0.33	0.99
NA7-50	12.7	11.71		0.89		1.60		1.19		2.82	1.65		1.02		0.41	11.89		1.40		0.41	1.22
NA7-55	14.0	12.93		0.89		1.60		1.19		2.82	1.35		0.91		0.41	13.18	±0.05	1.40		0.41	1.22
NA7-56	14.3	13.23		0.89		1.60		1.19		2.82	1.83	±0.10	1.04	±0.10	0.50	13.46	0.10 (3)	1.40		0.41	1.22
NA7-59	15.1	13.97		0.89		1.60	±0.18	1.19		2.84	1.93		1.09		0.54	14.20		1.40		0.43	1.32
NA7-62	15.9	14.71		0.89		1.60		1.19		2.87	2.03		1.14		0.59	14.94		1.40		0.46	1.40
NA7-66	17.0	15.77		0.89	±0.05	1.60		1.19		2.87	2.08		1.09		0.64	15.98		1.40	+0.13	0.51	1.52
NA7-66	17.1	15.77		0.89		1.60		1.19		2.87	2.08		1.09		0.64	16.03		1.40	0	0.51	1.52
NA7-68	17.5	16.13	+0.13	1.07		1.85		1.32		3.56	2.13		1.22		0.82	16.41		1.57		0.53	1.60
NA7-75	19.0	17.60	−0.25	1.07		1.85		1.32		3.56	2.34		1.30		0.95	17.88	±0.08	1.57		0.58	1.75
NA7-78	19.8	18.34		1.07		1.85		1.32		3.56	2.39		1.32		1.00	18.62	0.10 (3)	1.57		0.61	1.83
NA7-81	20.6	19.08		1.07		1.85		1.32		3.56	2.44		1.37		1.14	19.35		1.57		0.64	1.91
NA7-87	22.2	20.57		1.07		1.85	±0.20	1.32		3.58	2.64	±0.13	1.45	±0.13	1.27	20.85		1.57		0.69	2.06
NA7-93	23.8	22.02		1.07		1.85		1.98		4.32	2.79		1.60		1.41	22.40		1.57		0.71	2.13
NA7-98	25.0	23.11		1.07		1.85		1.98	+0.38	4.34	2.90		1.62		1.59	23.52		1.57		0.74	2.21
NA7-100	25.4	23.50		1.07		1.85		1.98	−0.05	4.34	2.95		1.65		1.63	23.88		1.57		0.76	2.29
NA7-102	26.0	24.03		1.07		1.85		1.98		4.37	3.00		1.68		1.77	24.41		1.57		0.79	2.36

(continued)

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TABLE A TYPE NA7 REFERENCE METRIC VALUES (DIMENSIONS) (CONT'D)

Ring Series and Size No.	Ring Size and Weight													Groove Dimensions					Edge Margin
	Shaft Diameter	Free Diameter		Thickness (Note (1))		Bow Height		Hole Diameter		Lug Height (Max.)	Large Section		Small Section		Approx. Mass per 1000 Pcs.	Diameter		Width		Depth	
	S, mm	D	Tol.	T	Tol.	V	Tol.	P	Tol.	B	E	Tol.	J	Tol.	kg	G	Tol.	W	Tol.	(d)	Z
NA7-106	27.0	24.94		1.27		2.16		1.98		4.70	3.10		1.75		2.18	25.35		1.78		0.81	2.44
NA7-112	28.6	26.44		1.27	±0.05	2.16		1.98	+0.38	4.72	3.25		1.80		2.32	26.90		1.78		0.84	2.51
NA7-118	30.2	27.89		1.27		2.16		1.98	−0.05	4.72	3.35		1.83		2.54	28.40		1.78		0.89	2.67
NA7-125	31.7	29.36	+0.25	1.27		2.16		1.98		4.75	3.56		1.93		2.68	29.87		1.78		0.94	2.82
NA7-131	33.3	30.84	−0.38	1.27		2.16	±0.30	1.98		4.75	3.71	±0.15	1.93	±0.15	3.09	31.29	±0.10	1.78	+0.13	1.02	3.06
NA7-137	34.9	32.31		1.27		2.16		1.98		4.78	3.86		2.08		3.27	32.79	0.13 (3)	1.78	0	1.07	3.20
NA7-143	36.5	33.86		1.27		2.16		1.98		4.78	4.06		2.18		3.68	34.29		1.78		1.12	3.35
NA7-150	38.1	35.23		1.27		2.16		3.05		5.54	4.27		2.31		4.09	35.71		1.78		1.19	3.58
NA7-162	41.3	38.18	+0.33	1.57	±0.08	2.92	±0.38	3.18		6.07	4.57		2.46		5.99	38.84	±0.13	2.44		1.22	3.66
NA7-175	44.4	41.10	−0.51	1.57		2.92		3.18		6.12	4.78		2.57		6.95	41.91	0.13 (3)	2.44		1.27	3.81

GENERAL NOTE: See Table 4 for illustrations.

NOTES:
(1) For plated rings, add 0.05 mm to the listed maximum thickness.
(2) Sizes -18 through -23 available in beryllium copper only.
(3) *F.I.M. (Full Indicator Movement)*: maximum circular run out of groove to shaft.

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NONMANDATORY APPENDIX B
TYPE NA7 REFERENCE METRIC VALUES
(SUPPLEMENTARY INFORMATION)

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TABLE B TYPE NA7 REFERENCE METRIC VALUES (SUPPLEMENTARY INFORMATION)

Ring Series and Size No.	Application Data												
	Clearance		Gaging Diameter Ring Installed in Groove	Allowable Thrust Load Square Corner Abutment		Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.	Distance, Outer Groove Wall to Face of Retained Part		Resilient Take Up of Tolerence L and M	Approx. Force Needed to Flatten Rings	Calculated Allowable Assembly [Note (1)]
	Expanded Over Shaft	Released in Groove		UNS G10600–G10900 and Stainless Steel Rings Used on Hardened Shafts 50 HRC, Min.	All Standard Rings Used on Low Carbon Steel Shafts								
	C1	C2	*K*, Max.	*Pr* (kN) [Note (1)]	*Pg* (kN)	*R*, Max.	*Ch*, Max.	*P'r* (kN)	*X*, Min.	*X*, Max.	*X*, Max.–*X*, Min.	kN	RPM
NA7-18 (1)	7.57	7.28	5.54	1.07	0.35	0.36	0.22	0.47	0.51	0.71		0.10	80000
NA7-19 (1)	8.10	7.80	5.82	1.11	0.38	0.37	0.23	0.47	0.51	0.71		0.10	80000
NA7-21 (1)	8.59	8.23	6.40	1.25	0.49	0.38	0.23	0.47	0.51	0.71		0.07	80000
NA7-23 (1)	9.02	8.56	6.91	1.38	0.53	0.42	0.25	0.47	0.51	0.71		0.07	80000
NA7-25	11.43	10.92	7.37	2.66	0.78	0.46	0.26	2.09	0.76	0.96		0.24	80000
NA7-27	12.19	11.68	8.00	2.94	0.87	0.44	0.27	2.09	0.76	0.96		0.24	76000
NA7-28	12.45	11.94	8.28	2.96	0.89	0.51	0.30	2.09	0.76	0.96	0.20	0.24	74000
NA7-31	13.72	13.21	9.07	3.34	1.07	0.51	0.30	2.09	0.76	0.96		0.24	70000
NA7-34	14.48	13.97	9.91	3.61	1.18	0.53	0.32	2.09	0.76	0.96		0.22	64000
NA7-35	14.99	14.48	10.29	3.70	1.33	0.58	0.36	2.09	0.76	0.96		0.22	62000
NA7-37	15.49	14.99	11.00	3.93	1.45	0.66	0.39	2.09	0.76	0.96		0.22	60000
NA7-39	15.75	15.24	11.48	4.24	1.49	0.69	0.41	2.09	0.76	0.96		0.20	56500
NA7-40	16.00	15.49	11.89	4.29	1.56	0.72	0.43	2.09	0.76	0.96		0.20	55000
NA7-43	16.75	16.26	12.73	4.60	1.78	0.74	0.44	2.09	0.76	0.96		0.17	50000
NA7-46	17.27	16.76	13.72	4.97	2.01	0.79	0.46	2.09	0.76	0.96		0.17	42000

(continued)

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TABLE B TYPE NA7 REFERENCE METRIC VALUES (SUPPLEMENTARY INFORMATION) (CONT'D)

Ring Series and Size No.	Application Data												
	Clearance		Gaging Diameter Ring Installed in Groove	Allowable Thrust Load Square Corner Abutment		Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.	Distance, Outer Groove Wall to Face of Retained Part		Resilient Take Up of Tolerence L and M	Approx. Force Needed to Flatten Rings	Calculated Allowable Assembly [Note (1)]
	Expanded Over Shaft	Released in Groove		UNS G10600–G10900 and Stainless Steel Rings Used on Hardened Shafts 50 HRC, Min.	All Standard Rings Used on Low Carbon Steel Shafts								
	C1	C2	*K*, Max.	*Pr* (kN) [Note (1)]	*Pg* (kN)	*R*, Max.	*Ch*, Max.	*P'r* (kN)	*X*, Min.	*X*, Max.	*X*, Max.–*X*, Min.	kN	RPM
NA7-50	19.68	18.80	14.58	7.45	2.45	0.86	0.51	4.05	1.07	1.35		0.44	40000
NA7-55	20.57	19.81	15.52	8.13	2.57	0.69	0.42	4.05	1.07	1.35		0.42	36000
NA7-56	20.83	20.07	16.36	8.35	2.89	0.97	0.68	4.05	1.07	1.35		0.39	35000
NA7-59	21.84	21.08	17.27	8.80	3.37	1.00	0.60	4.05	1.07	1.35		0.34	32000
NA7-62	22.86	22.10	18.16	9.30	3.56	1.05	0.64	4.05	1.07	1.35		0.29	30000
NA7-66	23.62	22.61	19.20	9.93	4.23	1.02	0.61	4.05	1.07	1.35		0.24	29000
NA7-66	23.62	22.61	19.25	9.93	4.23	1.02	0.61	4.05	1.07	1.35		0.24	29000
NA7-68	25.65	24.64	19.79	15.35	4.45	1.07	0.64	5.96	1.24	1.52		0.34	28000
NA7-75	27.69	26.67	21.59	16.71	5.34	1.17	0.70	5.96	1.24	1.52		0.32	26500
NA7-78	28.45	27.43	22.43	17.61	5.78	1.19	0.71	5.96	1.24	1.52		0.29	25500
NA7-81	29.21	27.94	23.22	18.06	6.45	1.19	0.71	5.96	1.24	1.52		0.27	24500
NA7-87	30.73	29.46	25.07	19.42	7.34	1.30	0.89	5.96	1.24	1.52	0.28	0.22	23000
NA7-93	34.04	32.77	26.77	20.99	8.23	1.40	0.84	5.96	1.24	1.52		0.20	21500
NA7-98	35.31	34.04	28.08	21.90	8.90	1.42	0.85	5.96	1.24	1.52		0.20	20500
NA7-100	35.81	34.29	28.50	22.35	9.34	1.45	0.86	5.96	1.24	1.52		0.17	20000
NA7-102	36.32	34.80	29.13	22.80	10.01	1.47	0.89	5.96	1.24	1.52		0.17	19500
NA7-106	38.10	36.58	30.28	27.99	10.66	1.52	0.91	8.67	1.45	1.73		0.29	19000
NA7-112	39.37	37.85	32.03	29.80	11.56	1.60	0.97	8.67	1.45	1.73		0.27	18000
NA7-118	40.89	39.12	33.66	31.60	13.12	1.63	0.98	8.67	1.45	1.73		0.24	18000
NA7-125	42.93	41.15	35.46	33.18	14.46	1.73	1.04	8.67	1.45	1.73		0.22	17000
NA7-131	44.46	42.42	37.03	34.99	16.46	1.73	1.04	8.67	1.45	1.73		0.20	16500
NA7-137	45.72	43.69	38.84	36.57	18.24	1.83	1.09	8.67	1.45	1.73		0.17	16000
NA7-143	47.50	45.47	40.64	38.38	20.01	1.93	1.14	8.67	1.45	1.73		0.15	15000
NA7-150	50.65	48.26	42.37	39.73	22.24	2.01	1.19	8.67	1.45	1.73		0.15	14800
NA7-162	55.12	52.83	46.02	53.50	24.46	2.21	1.32	13.34	1.75	2.39	0.64	0.27	13200
NA7-175	56.67	56.13	49.40	57.79	27.58	2.31	1.37	13.34	1.75	2.39		0.24	12200

NOTES:

(1) (a) The values listed above apply to rings made from UNS G10600–G10900 and UNS S15700 stainless steel except sizes -18 through -23, which are supplied in beryllium copper only.

(b) *Pr* values for other sizes made from beryllium copper can be calculated by multiplying listed values by 0.75.

(2) *Safety Factors Pr and Pg:* the allowable thrust load values listed include the following safety factors: *Pr*: 4 *Pg*: 2.

(3) See Mandatory Appendix I for illustrations.

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NONMANDATORY APPENDIX C
TYPE NA8 REFERENCE METRIC VALUES (DIMENSIONS)

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STD·ASME B18·27-ENGL 1998 ■ 0759670 0613149 835 ■

TABLE C TYPE NA8 REFERENCE METRIC VALUES (DIMENSIONS)

Ring Series and Size No.	Housing Diameter	Free Diameter		Thickness [Note (1)]		Bow Height		Hole Diameter		Lug Height (Max.)	Large Section		Small Section		Approx. Mass per 1000 Pcs.	Groove Dimensions					Edge Margin
																Diameter		Width		Depth	
	S, mm	*D*	Tol.	*T*	Tol.	*V*	Tol.	*P*	Tol.	*B*	*E*	Tol.	*J*	Tol.	kg	*G*	Tol.	*W*	Tol.	(*d*)	*Z*
NA8-25	6.4	7.11		0.38		0.91		0.79		1.73	0.64	±0.05	0.38	±0.05	0.04	6.81	±0.03	0.76	+0.05	0.23	0.69
NA8-31	7.9	8.79		0.38		0.91		0.79		1.75	0.84		0.46		0.05	8.38	0.04 (2)	0.76	0	0.23	0.69
NA8-37	9.5	10.54		0.64		1.19		1.04		2.16	1.02		0.71		0.11	10.08	±0.05	1.02		0.28	0.84
NA8-43	11.1	12.24		0.64		1.19	±0.15	1.04		2.57	1.24	±0.08	0.74	±0.80	0.17	11.71	0.05 (2)	1.02		0.30	0.91
NA8-45	11.5	12.65		0.64		1.19		1.19		2.57	1.27		0.76		0.20	12.12		1.02		0.30	0.91
NA8-50	12.7	13.92	±0.25	0.89		1.60		1.19		2.97	1.35		0.89		0.32	13.46		1.40		0.38	1.14
NA8-51	13.0	14.22		0.89		1.60	±0.18	1.19		3.02	1.35		0.89		0.35	13.77		1.40		0.38	1.14
NA8-56	14.3	15.75		0.89		1.60		1.19	+0.25	3.48	1.35	±0.10	0.89	±0.10	0.39	15.14	±0.05	1.40		0.43	1.30
NA8-62	15.9	17.63		0.89		1.60		1.57	−0.05	3.48	1.52		0.89		0.45	16.89	0.10 (2)	1.40		0.51	1.52
NA8-68	17.5	19.38		0.89		1.60		1.57		3.48	1.60		0.91		0.54	18.59		1.40		0.56	1.68
NA8-75	19.0	21.11		0.89		1.60		1.57		3.73	1.78		1.02		0.59	20.22		1.40	+0.08	0.58	1.75
NA8-77	19.7	21.82		1.07		1.85		1.57		3.84	1.88		1.12		0.77	20.96		1.57	0	0.61	1.83
NA8-81	20.6	22.89		1.07		1.85		1.57		4.06	1.96		1.12		0.86	21.89		1.57		0.64	1.91
NA8-86	22.0	24.41		1.07		1.85		1.57		4.06	2.06		1.14		0.91	23.37		1.57		0.69	2.06
NA8-87	22.2	24.66		1.07	±0.05	1.85		1.57		4.06	2.13		1.14		0.95	23.65	±0.08	1.57		0.71	2.13
NA8-90	22.9	25.40	±0.38	1.07		1.85	±0.20	1.57		4.06	2.21	±0.13	1.19	±0.13	1.00	24.36	0.10 (2)	1.57		0.74	2.21
NA8-93	23.8	26.44		1.07		1.85		1.57		4.06	2.31		1.27		1.09	25.40		1.57		0.79	2.36
NA8-100	25.4	28.22		1.07		1.85		1.57		4.06	2.64		1.32		1.23	27.08		1.57		0.84	2.51
NA8-102	26.0	28.85		1.07		1.85		1.57		4.06	2.69		1.37		1.27	27.71		1.57		0.86	2.59
NA8-106	27.0	29.97		1.27		2.16		1.98		4.70	2.79		1.40		1.68	28.70		1.78		0.86	2.59
NA8-112	28.6	31.72		1.27		2.16		1.98		4.70	2.95		1.45		1.82	30.40		1.78		0.91	2.74
NA8-118	30.0	33.50		1.27		2.16		1.98		4.70	3.05		1.47		1.95	31.88		1.78		0.94	2.82
NA8-118	30.2	33.50		1.27		2.16		1.98		4.70	3.05		1.47		1.95	32.05		1.78		0.94	2.82
NA8-125	31.7	35.26	±0.64	1.27		2.16	±0.30	1.98		4.70	3.15		1.57		2.18	33.78		1.78		1.02	3.05
NA8-125	32.0	35.26		1.27		2.16		1.98		4.70	3.15	±0.15	1.57	±0.15	2.18	34.01	±0.10	1.78		1.02	3.05
NA8-131	33.3	36.98		1.27		2.16		1.98		4.70	3.30		1.57		2.27	35.46	0.13 (2)	1.78		1.07	3.20
NA8-137	34.9	38.76		1.27		2.16		1.98	+0.38	4.70	3.30		1.60		2.32	37.11		1.78		1.09	3.28
NA8-137	35.0	38.76		1.27		2.16		1.98	−0.50	4.70	3.30		1.60		2.32	37.19		1.78		1.09	3.28
NA8-143	36.5	40.54		1.27		2.16		1.98		4.70	3.38		1.65		2.63	38.81		1.78		1.14	3.43
NA8-145	37.0	41.05		1.27		2.16		1.98		4.70	3.38		1.65		2.91	39.32		1.78		1.17	3.51
NA8-150	38.1	42.16		1.27		2.16		1.98		4.70	3.38		1.68		2.95	40.49		1.78		1.19	3.58
NA8-156	39.7	44.04		1.57		2.92		1.98		5.26	3.99		1.98		4.04	42.11		2.54		1.22	3.66
NA8-156	40.0	44.04	+0.89	1.57		2.92	±0.38	1.98		5.26	3.99		1.98		4.04	42.44	±0.13	2.54	+0.13	1.22	3.66
NA8-162	41.3	45.82	−0.64	1.57	±0.08	2.92		1.98		5.89	4.17	±0.18	2.08	±0.18	4.54	43.82	0.13 (2)	2.54	−0	1.27	3.81
NA8-175	44.4	49.33		1.57		2.92		1.98		6.07	4.34		2.11		4.68	47.19		2.54		1.37	4.11

GENERAL NOTE: See Table 5 for Illustrations.

NOTES:

(1) For plated rings, add 0.05 mm to the listed maximum thickness.

(2) *F.I.M. (Full Indicator Movement)*: maximum circular run out of groove dia. to housing.

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NONMANDATORY APPENDIX D
TYPE NA8 REFERENCE METRIC VALUES
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TABLE D TYPE NA8 REFERENCE METRIC VALUES (SUPPLEMENTARY INFORMATION)

Ring Series and Size No.	Application Data											
	Clearance		Gap Width	Allowable Thrust Load Square Corner Abutment		Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.	Distance, Outer Groove Wall to Face of Retained Part		Resilient Take Up of Tolerances L and M	Approx. Force Needed to Flatten Rings
	Compressed in Housing	Released in Groove	Ring in Groove	UNS G10600–G10900 and Stainless Steel Rings Used in Hardened Housing 50 HRC, Min.	All Standard Rings Used in Low Carbon Steel Housing							
	C1	C2	*A*, Min.	*Pr* (kN)	*Pg* (kN)	*R*, Max.	*Ch*, Max.	*P'r* (kN)	*X*, Min.	*X*, Max.	*X*, Max.–*X*, Min.	kN
NA8-25	2.92	3.38	1.19	1.89	0.85	0.28	0.22	0.85	0.51	0.71		0.09
NA8-31	4.39	4.85	1.40	2.39	1.07	0.41	0.33	0.85	0.51	0.71		0.09
NA8-37	5.18	5.74	1.60	4.74	1.56	0.58	0.46	2.35	0.76	0.97	0.20	0.20
NA8-43	5.84	6.45	1.60	5.51	1.96	0.69	0.53	2.36	0.76	0.97		0.18
NA8-45	6.35	6.96	1.80	5.78	2.06	0.69	0.53	2.36	0.76	0.97		0.18
NA8-50	6.60	7.37	2.29	8.94	2.27	0.69	0.53	4.89	1.07	1.35		0.53
NA8-51	6.86	7.62	2.34	9.16	2.31	0.69	0.53	4.89	1.07	1.35		0.51
NA8-56	6.99	7.75	2.41	10.02	3.16	0.69	0.53	4.89	1.07	1.35		0.44
NA8-62	8.64	9.85	2.64	11.15	4.67	0.69	0.53	4.89	1.07	1.35		0.38
NA8-68	10.16	11.18	3.00	12.19	5.69	0.69	0.53	4.89	1.07	1.35		0.29
NA8-75	11.43	12.45	3.63	13.54	6.49	0.81	0.64	4.89	1.07	1.35		0.20
NA8-77	12.07	13.21	3.68	20.54	7.03	0.89	0.71	7.34	1.24	1.52		0.36
NA8-81	12.45	13.72	3.89	21.67	7.51	0.89	0.71	7.34	1.24	1.52		0.33
NA8-86	13.72	14.99	4.37	23.03	8.81	0.89	0.71	7.34	1.24	1.52		0.31
NA8-87	13.84	15.24	4.55	23.25	9.25	0.89	0.71	7.34	1.24	1.52		0.31
NA8-90	14.35	15.75	4.78	24.15	9.79	0.97	0.76	7.34	1.24	1.52	0.28	0.29
NA8-93	15.49	17.02	5.08	25.28	10.90	0.97	0.76	7.34	1.24	1.52		0.27
NA8-100	16.89	18.54	5.38	26.88	12.45	1.07	0.86	7.34	1.24	1.52		0.24
NA8-102	17.53	19.18	5.59	27.32	13.34	1.07	0.86	7.34	1.24	1.52		0.22
NA8-106	17.40	19.05	5.41	33.64	13.57	1.12	0.89	10.68	1.45	1.73		0.31
NA8-112	18.92	20.70	5.89	35.67	15.12	1.19	0.91	10.68	1.45	1.73		0.29
NA8-118	20.07	21.84	5.74	37.92	16.46	1.19	0.91	10.68	1.45	1.73		0.27
NA8-118	20.32	22.10	6.22	37.92	16.48	1.19	0.91	10.68	1.45	1.73		0.27
NA8-125	22.23	24.26	6.73	39.73	18.90	1.22	0.97	10.68	1.45	1.73		0.24
NA8-125	22.48	24.51	7.37	39.73	18.90	1.22	0.97	10.68	1.45	1.73		0.24
NA8-131	23.62	25.65	7.21	41.99	20.91	1.22	0.97	10.68	1.45	1.73		0.22
NA8-137	25.15	27.18	7.54	43.80	22.46	1.22	0.97	10.68	1.45	1.73		0.20
NA8-137	25.15	27.18	7.75	43.80	22.46	1.22	0.97	10.68	1.45	1.73		0.20
NA8-143	26.92	29.21	7.95	46.05	24.46	1.22	0.97	10.68	1.45	1.73		0.18
NA8-145	27.43	29.72	8.13	46.50	25.35	1.22	0.97	10.68	1.45	1.73		0.16
NA8-150	28.45	30.73	8.64	47.65	26.69	1.22	0.97	10.68	1.45	1.73		0.16
NA8-156	28.96	31.24	8.59	61.86	28.24	1.63	1.27	17.35	1.91	2.41		0.18
NA8-156	29.21	31.50	9.50	61.85	28.24	1.63	1.27	17.35	1.91	2.41	0.51	0.18
NA8-162	29.21	31.75	8.61	64.11	30.69	1.63	1.27	17.35	1.91	2.41		0.18
NA8-175	32.00	34.54	9.45	69.30	35.81	1.63	1.27	17.35	1.91	2.41		0.16

GENERAL NOTES:
(a) The *Pr* values listed apply to rings made from UNS G10600–G10900 and UNS S15700 stainless steel. *Pr* values for rings made from beryllium copper can be calculated by multiplying listed values by 0.75.
(b) *Safety Factors Pr and Pg*: the allowable thrust load values listed include the following safety factors: *Pr*: 4; *Pg*: 2.
(c) See Mandatory Appendix II for illustrations.

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NONMANDATORY APPENDIX E
TYPE NA9 REFERENCE METRIC VALUES (DIMENSIONS)

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TABLE E TYPE NA9 REFERENCE METRIC VALUES (DIMENSIONS)

Ring Series and Size No.	Shaft Diameter	Ring Size and Weight								Groove Size					Edge Margin
		Free Diameter		Thickness [Note (1)]		Bow Height		Outside Diameter (Ref.)	Approx. Mass per 1000 Pcs.	Diameter		Width		Depth	
	S, mm	*D*	Tol.	*T*	Tol.	*V*, Min.	*V*, Max.	*Y*	kg	*G*	Tol.	*W*	Tol.	(*d*)	*Z*
NA9-S11	2.8	1.93		0.25		0.64	0.89	9.53	0.09	2.01	+0.05	0.56		0.38	0.76
NA9-12	3.2	2.39		0.25	±0.03	0.64	0.89	5.84	0.03	2.41	0	0.56		0.38	0.76
NA9-S14	3.6	2.54		0.25		0.56	0.81	5.16	0.02	2.59	0.04 (2)	0.48		0.48	0.97
NA9-14	3.6	2.59		0.38		0.71	0.97	6.86	0.06	2.67		0.64		0.43	0.86
NA9-15	4.0	2.90	+0.03	0.38		0.76	1.02	7.16	0.06	2.95		0.69		0.51	1.02
NA9-S17	4.4	3.18	−0.08	0.38		0.81	1.07	7.92	0.07	3.23	+0.05	0.74		0.56	1.12
NA9-18	4.8	3.68		0.38		0.84	1.09	8.51	0.08	3.73	0	0.76		0.51	1.02
NA9-S18	4.8	3.10		0.38		0.97	1.22	9.53	0.12	3.18	0.05 (2)	0.89	+0.13	0.79	1.57
NA9-S21	5.6	4.70		0.38		1.09	1.47	11.10	0.13	4.78		1.02	0	0.38	0.76
NA9-25	6.3	5.26		0.64		1.27	1.65	13.39	0.35	5.33		1.19		0.51	1.02
NA9-S31	7.9	6.17		0.64	±0.05	1.27	1.65	12.70	0.26	6.35		1.19		0.79	1.57
NA9-37	9.5	7.62	+0.05	0.89		1.52	1.93	16.76	0.68	7.70		1.52		0.91	1.83
NA9-43	11.1	8.56	−0.10	0.89		1.52	1.93	17.45	0.68	8.71		1.52		1.19	2.39
NA9-S43	11.1	9.53		0.89		1.52	1.93	15.24	0.45	9.65	+0.08	1.45		0.74	1.47
NA9-50	12.7	9.96		1.07		1.91	2.36	20.32	1.14	10.06	0	1.85		1.32	2.64
NA9-62	15.9	12.19		1.07		2.03	2.49	23.88	1.45	12.32	0.10 (2)	1.96		1.78	3.56
NA9-S74	18.9	15.65		1.27		2.29	2.79	25.40	1.95	15.88		2.16		1.52	3.00
NA9-S74	19.0	15.65	+0.08	1.27		2.29	2.79	25.40	1.95	15.88		2.16		1.57	3.15
NA9-75	19.0	14.58	−0.13	1.27		2.29	2.79	28.45	2.63	14.73		2.16		2.16	4.32
NA9-87	22.2	16.97		1.27		2.29	2.79	33.02	3.45	17.15		2.16		2.54	5.08
NA9-S98	25	20.88		1.27		2.24	2.84	38.10	4.26	21.21		2.16		1.88	3.76

GENERAL NOTE: See Table 6 for illustrations.

NOTES:
(1) For plated rings, add 0.05 mm to the listed maximum thickness.
(2) *F.I.M. (Full Indicator Movement)*: maximum circular run out of grove to shaft.

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NONMANDATORY APPENDIX F
TYPE NA9 REFERENCE METRIC VALUES
(SUPPLEMENTARY INFORMATION)

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TABLE F TYPE NA9 REFERENCE METRIC VALUES (SUPPLEMENTARY INFORMATION)

Ring Series and Size No.	Application Data										
	Clearance	Allowable Thrust Load Square Corner Abutment		Allowable Corner Radii and Chamfers of Retained Parts		Maximum Allowable Assembly Load With *R*, Max. or *Ch*, Max.	Distance, Outer Groove Wall to Face of Retained Part		Resilient Take Up of Tolerence L and M	Approx. Force Needed to Flatten Rings	Calculated Allowable Assembly (Steel Rings)
	Released in Groove	UNS G10600–G10900 and Stainless Steel Rings Used on Hardened Shafts 50 HRC, Min.	All Standard Rings Used on Low Carbon Steel Shafts								
	C2	*Pr* (kN)	*Pg* (kN)	*R*, Max.	*Ch*, Max.	*P'r* (kN)	*X*, Min.	*X*, Max.	*X*, Max.–*X*, Min.	kN	RPM
NA9-S11	9.91	0.27	0.18	2.03	1.52	0.27	0.43	0.56	0.13	0.08	35000
NA9-12	6.10	0.20	0.20	1.02	0.76	0.19	0.43	0.56	0.13	0.04	35000
NA9-S14	5.46	0.23	0.27	0.74	0.66	0.22	0.36	0.46	0.10	0.03	32000
NA9-14	7.24	0.34	0.27	1.62	1.14	0.33	0.51	0.58	0.08	0.07	32000
NA9-15	7.49	0.36	0.33	1.52	1.14	0.36	0.56	0.69	0.13	0.07	31000
NA9-S17	8.26	0.40	0.40	1.52	1.14	0.40	0.58	0.74	0.15	0.06	30000
NA9-18	8.89	0.43	0.40	1.52	1.14	0.42	0.58	0.76	0.18	0.06	30000
NA9-S18	9.91	0.45	0.60	1.52	1.14	0.44	0.66	0.86	0.20	0.07	30000
NA9-S21	11.43	0.52	0.33	1.52	1.14	0.51	0.74	0.99	0.25	0.05	26000
NA9-25	13.72	1.15	0.51	1.52	1.14	1.13	0.91	1.17	0.25	0.16	25000
NA9-S31	13.21	1.47	1.00	1.52	1.14	1.45	0.91	1.17	0.25	0.13	22000
NA9-37	17.27	3.11	1.40	1.65	1.27	3.07	1.14	1.40	0.25	0.24	20000
NA9-43	18.03	3.75	2.14	1.65	1.27	3.69	1.14	1.40	0.25	0.22	16500
NA9-S43	15.75	3.61	1.25	1.27	0.89	3.56	1.14	1.40	0.25	0.28	16500
NA9-50	20.83	5.01	2.67	2.03	1.52	4.94	1.42	1.78	0.36	0.40	14000
NA9-62	24.38	6.41	4.67	2.03	1.52	6.32	1.55	1.91	0.36	0.38	12000
NA9-S74	25.91	8.63	4.67	1.45	1.57	8.45	1.75	2.16	0.41	0.49	11000
NA9-S74	25.91	8.60	4.69	1.07	1.57	8.45	1.75	2.16	0.41	0.49	11000
NA9-75	28.96	9.03	6.67	2.16	1.65	8.90	1.75	2.16	0.41	0.49	10500
NA9-87	33.53	10.61	9.12	2.16	1.65	10.45	1.75	2.16	0.41	0.53	9000
NA9-S98	38.86	11.56	7.78	2.16	1.65	12.01	1.70	2.11	0.41	0.49	6500

GENERAL NOTES:

(a) The values listed apply to rings made from UNS G10600-G10900 and UNS S15700 stainless steel. *Pr* values for rings made from beryllium copper can be calculated by multiplying listed values by 0.75.

(b) *Safety Factors for Pr and Pg*: the allowable thrust load values listed include the following safety factors: *Pr*: 3; *Pg*: 2.

(c) See Mandatory Appendix III for illustrations.

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AMERICAN NATIONAL STANDARDS FOR BOLTS, NUTS, RIVETS, SCREWS WASHERS, AND SIMILAR FASTENERS

Small Solid Rivets ..... B18.1.1-1972(R1995)
Large Rivets ..... B18.1.2-1972(R1995)
Metric Small Solid Rivets ..... B18.1.3M-1983(R1995)
Square and Hex Bolts and Screws (Inch Series) B18.2.1-1996
Square and Hex Nuts (Inch Series) ..... B18.2.2-1987(R1993)
Metric Hex Cap Screws ..... B18.2.3.1M-1979(R1995)
Metric Formed Hex Screws ..... B18.2.3.2M-1979(R1995)
Metric Heavy Hex Screws ..... B18.2.3.3M-1979(R1995)
Metric Hex Flange Screws ..... B18.2.3.4M-1984(R1995)
Metric Hex Bolts ..... B18.2.3.5M-1979(R1995)
Metric Heavy Hex Bolts ..... B18.2.3.6M-1979(R1995)
Metric Heavy Hex Structural Bolts ..... B18.2.3.7M-1979(R1995)
Metric Hex Lag Screws ..... B18.2.3.8M-1981(R1991)
Metric Heavy Hex Flange Screws ..... B18.2.3.9M-1984(R1995)
Square Head Bolts (Metric Series) B18.2.3.10M-1996
Metric Hex Nuts, Style 1 ..... B18.2.4.1M-1996
Metric Hex Nuts, Style 2 ..... B18.2.4.2M-1979(R1995)
Metric Slotted Hex Nuts ..... B18.2.4.3M-1979(R1995)
Metric Hex Flange Nuts ..... B18.4.4.4M-1982(R1993)
Metric Hex Jam Nuts ..... B18.2.4.5M-1979(R1998)
Metric Heavy Hex Nuts ..... B18.2.4.6M-1979(R1998)
Fasteners for Use in Structural Applications B18.2.6-1996
Socket Cap, Shoulder, and Set Screws, Hex and Spline Keys (Inch Series) B18.3-1998
Socket Head Cap Screws (Metric Series) ..... B18.3.1M-1986(R1993)
Metric Series Hexagon Keys and Bits ..... B18.3.2M-1979(R1998)
Hexagon Socket Head Shoulder Screws (Metric Series) ..... B18.3.3M-1986(R1993)
Hexagon Socket Button Head Cap Screws (Metric Series) ..... B18.3.4M-1986(R1993)
Hexagon Socket Flat Countersunk Head Cap Screws (Metric Series) ..... B18.3.5M-1986(R1993)
Metric Series Socket Set Screws ..... B18.3.6M-1986(R1993)
Round Head Bolts (Inch Series) ..... B18.5-1990(R1998)
Metric Round Head Short Square Neck Bolts B18.5.2.1M-1996
Metric Round Head Square Neck Bolts ..... B18.5.2.2M-1982(R1993)
Round Head Square Neck Bolts With Large Head (Metric Series) ..... B18.5.2.3M-1990(R1998)
Wood Screws (Inch Series) ..... B18.6.1-1981(R1997)
Slotted Head Cap Screws, Square Head Set Screws, and Slotted Headless Set Screws B18.6.2-1998
Machine Screws and Machine Screw Nuts ..... B18.6.3-1972(R1997)
Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws (Inch Series) ..... B18.6.4-1981(R1997)
Metric Thread Forming and Thread Cutting Tapping Screws ..... B18.6.5M-1986(R1993)
Metric Machine Screws ..... B18.6.7M-1985(R1993)
General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps ..... B18.7-1972(R1992)
Metric General Purpose Semi-Tubular Rivets ..... B18.7.1M-1984(R1992)
Clevis Pins and Cotter Pins (Inch Series) B18.8.1-1994
Taper Pins, Dowel Pins, Straight Pins, Grooved Pins, and Spring Pins (Inch Series) B18.8.2-1995
Spring Pins — Coiled Type (Metric Series) B18.8.3M-1995
Spring Pins — Slotted (Metric Series) B18.8.4M-1994
Machine Dowel Pins — Hardened Ground (Metric Series) B18.8.5M-1994
Cotter Pins (Metric Series) B18.8.6M-1995
Headless Clevis Pins (Metric Series) B18.8.7M-1994
Headed Clevis Pins (Metric Series) B18.8.8M-1994
Grooved Pins (Metric Series) B18.8.9M-1998
Plow Bolts (Inch Series) B18.9-1996
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Screw and Washer Assemblies — Sems (Inch Series) B18.13-1996
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Mechanical and Performance Requirements for Prevailing-Torque Type Steel Metric Hex Nuts and Hex Flange Nuts ..... B18.16.1M-1979(R1995)
Torque-Tension Test Requirements for Prevailing-Torque Type Steel Metric Hex Nuts and Hex Flange Nuts ..... B18.16.2M-1979(R1995)

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Dimensional Requirements for Prevailing-Torque Type Steel Metric Hex Nuts and Hex Flange Nuts B18.16.3M-1998
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Inspection and Quality Assurance for High-Volume Machine Assembly Fasteners ..... B18.18.2M-1987(R1993)
Inspection and Quality Assurance for Special Purpose Fasteners ..... B18.18.3M-1987(R1993)
Inspection and Quality Assurance for Fasteners for Highly Specialized Engineered Applications ..... B18.18.4M-1987(R1993)
Inspection and Quality Assurance Plan Requiring In-Process Inspection and Controls B18.18.5M-1998
Quality Assurance Plan for Fasteners Produced in a Third Party Accreditation System B18.18.6M-1998
Quality Assurance Plan for Fasteners Produced in a Customer Approved Control Plan B18.18.7M-1998
Lock Washers (Inch Series) B18.21.1-1994
Lock Washers (Metric Series) B18.21.2M-1994
Metric Plain Washers ..... B18.22M-1981(R1990)
Plain Washers ..... B18.22.1-1965(R1998)
Part Identifying Number (PIN) Code System Standard for B18 Externally Threaded Products B18.24.1-1996
Part Identifying Number (PIN) Code System Standard for B18 Internally Threaded Products B18.24.2-1998
Part Identifying Number (PIN) Code System Standard for B18 Nonthreaded Products B18.24.3-1998
Square and Rectangular Keys and Keyways B18.25.1M-1996
Woodruff Keys and Keyways B18.25.2M-1996
Square and Rectangular Keys and Keyways: Width Tolerances and Deviations Greater Than Basic Size B18.25.3M-1998
Tapered and Reduced Cross Section Retaining Rings (Inch Series) B18.27-1998
Helical Coil Screw Thread Inserts (Inch Series) — Free Running and Screw Locking B18.29.1-1993

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