



DRILL BUSHINGS
Boneham Metal Products, Inc.

Inch and Metric

ASME B 18.8. 2-2000
ASME B 18.8. 100m-2000

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BONEHAM'S STATEMENT OF QUALITY

Boneham Metal Products, Inc. is committed to supplying Drill Bushings that meet or exceed the tolerance specifications established by our Customer, the American National Standards Institute (ANSI), and the International Standards Organization (ISO).

We subscribe to the philosophies of maintaining superior levels of product quality through the techniques of Statistical Process Control, frequent quality audits of our operations, strict inspections of all incoming materials, and constant analyses of methods to improve our level of service.

Our Drill Bushings are manufactured to the material, functional, and dimensional parameters dictated by the operational requirements put forth by our customer. We strive to provide Drill Bushings that will maintain a service that life consistent with their intended use, and we are always working to deliver our products in the most expeditious time frame possible.

We solicit and welcome any recommendations which will enable us to provide a continuous level of improved service.



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STANDARD BUSHINGS

All of the bushings listed within this catalog are Boneham's range of standard sizes. The first section of this catalog contains our standard range of ANSI/Boneham style bushings whose tolerances conform with the guidelines established by the American National Standards Institute (ANSI). Our range of standard bushing bores are those standard letter, number, and fractional sizes, in both drill and reamer tolerances, as defined by ANSI. For this range of bushings, selected millimeter bores from 2.3mm to 10.5mm, as designated by a box on the back cover, are also available as STANDARD. Any bore size not indicated as standard on the back cover is considered to be special. Our Sales Service Representatives will be glad to supply you with appropriate pricing for all specials.

The second section of this catalog offers our new range of "Total Metric" bushings. These dimensions and tolerances conform with the guidelines established by the International Standards Organization (ISO). Please refer to pages 17 and 18 for ordering and technical information pertaining to these bushings.

SPECIAL BUSHINGS

When required dimensions vary from the standard catalog listings of ID., O.D., Length, or Tolerance, the bushings are considered to be "specials". Many specials can be made from standard cataloged items by minor alterations. Others can be manufactured from standard bushing blanks. Some items are so completely different they must be custom made. Boneham is ready to manufacture all specials required - from the minor alteration to the complete "from scratch" special. Please forward your specifications, whether verbal, by sketch, or blueprint, along with your material requirements to our Sales Service Representatives for expeditious review and quotation.

As always, please use our **TOLL FREE TELEPHONE** or FAX numbers:

800 Telephone: 1-800-631-7852

800 Fax: 1-800-526-9494

OVERSIZED BUSHINGS

All ANSI/Boneham Press Fit and Liner type bushings in the first section of this catalog are available with oversize (unground) O.D.'s. When ordering, use the same ANSI symbol system as for Finish Ground bushings and add a "U" at the end of the bushing length designation. Please note that all bushings will be considered to be Finish Ground unless specifically designated as Oversize or Unground.

For Example:

An Oversize Headless Liner with a 1" ID., a 1-3/8" O.D., and a 2-1/8" length would be described as L-88-34U. No drill size is required since liners have one standard bore size for a specific O.D. Also the "drill or reamer" specifications are not required due to the fact that renewable bushings are inserted into liners.

The following chart details the O.D. tolerances for oversize bushings:

Nom. O.D.	O/S Tol.	Nom. O.D.	O/S Tol.	Nom. O.D.	O/S Tol.
5/32	.166 .161	1/2	.520 .515	1-3/8	1.395 1.390
3/16	.198 .193	9/16	.582 .577	1-1/2	1.520 1.515
13/64	.213 .208	5/8	.645 .640	1-5/8	1.645 1.640
1/4	.260 .255	3/4	.770 .765	1-3/4	1.770 1.765
5/16	.327 .322	7/8	.895 .890	1-7/8	1.895 1.890
3/8	.393 .388	1	1.020 1.015	2-1/4	2.270 2.265
13/32	.421 .416	1-1/8	1.145 1.140	2-3/4	2.770 2.765
7/16	.455 .450	1-1/4	1.270 1.265		

GUARANTEE

Boneham Metal Products, Inc. Drill Bushings are guaranteed against defects in materials or workmanship. The tolerances of our products are guaranteed to conform to either ANSI, ISO, or catalog standards.



Ordering Information

ANSI/BMP BUSHINGS

For ordering information on ISO style Total Metric Bushings, please see page 19.

For ANSI/Boneham style bushings:

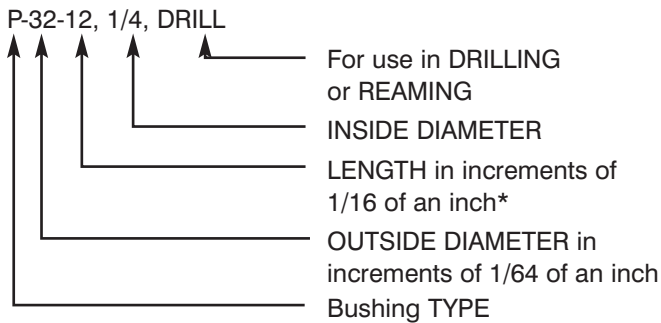
Please supply the following information:

- Bushing **TYPE**
- **OUTSIDE DIAMETER**
- Bushing **LENGTH**
- **INSIDE DIAMETER**
- Whether for a **DRILL** or **REAMER**

The bushings in this section of the catalog are defined by the ANSI Symbol System. This system is applied as follows:

Example Number 1:

A Headless Press Fit bushing with a 1/2" OD., a length of 3/4", a 1/4" bore, and to be used for drilling, would be described as:



*This is overall for headless press fit and all liner bushings and the "under-head" length for all head type press fit and renewable bushings.

Example Number 2:

A Slip-Fixed Renewable bushing with a 7/16" OD., a length of 1/2", a bore of 3mm, and to be used for Reaming, would be described as:

SF-TW-28-8, 3mm, REAMER

BUSHING TYPE DESTINATION

Bushing Type	ANSI/BMP Letter Designation	Thinwall Letter Designation
Headless Press Fit	P	P-TW
Head Press Fit	H	H-TW
Slip Fixed Renewable	SF	SF-TW
Headless Liner	L	L-TW
Head Type Liner	HL	-

PAYMENT TERMS

1% ten days, net 30. (Please note that invoices not paid within 60 days may be Subject to a 1-1/2% per month service charge).

SHIPPING

All prices quoted will be FOB. KENILWORTH, New Jersey.

RETURNS

When requesting authorization for a return please supply your purchase order number and Boneham's invoice number

Standard products returned up to 2 weeks from the invoice date will be subject to a 15% re-stocking charge.

Standard products returned over 2 weeks and up to 6 weeks from the invoice date will be subject to a 20% re-stocking charge.

Beyond 6 weeks after the invoice date, the return must be negotiated and will be subject to additional restocking charges. No return will be allowed if inventory conditions do not warrant such a return.

Returns must be shipped **prepaid**.

Special products are not returnable.

Any products returned because of errors made by Boneham will not be subject to restocking charges and replacements made because of Boneham errors will have all freight charges paid by Boneham.

Any items that are returned without prior approval will be returned at the sender's expense.

PRICES

ANSI/Boneham style bushings have the ANSI bushing symbol and Boneham price code in each identification box located in the charts on the following pages.

Please see separate price list for Boneham Standard Bushing Steel" bushings.

Boneham NITRALLOY Nitrided drill bushings will be quoted upon request.

Page 17 contains all information on prices for ISO/Boneham drill bushings.

Please note that all prices may be subject to change without notice.



BONEHAM BUSHING MATERIALS

1. Standard Boneham Drill Bushings (over .0400" bore) are manufactured from steel which demonstrates excellent wear resistance and dimensional stability characteristics. This material is "hardened" to Rc 62-64.
2. All Boneham Drill Bushings (.0625k bore and over), are offered in our Premium alloy NITRALLOY. Boneham NITRALLOY Nitrided Drill Bushings are "case hardened" to a case depth of .013" to Rc 67-69 equivalent. Hardness must be checked by using the 15Kg. Superficial Rockwell Scale. NITRALLOY Nitrided drill bushings demonstrate superior wear resistance and dimensional stability characteristics.
3. Our Sales Service Representatives will be glad to provide you with a quotation on those bushings which have material requirements that are different from our standard materials, ie. M-2 HSS, Stainless Steel, 0-6 Tool Steel, Carbide, Bronze (both sintered and wrought), D-2 Tool Steel.

BUSHING BODY CHARACTERISTICS

Entrance End

The entrance end of each Boneham Drill Bushing has a "blended radius". This permits easier tool entry and assistance in guiding the drill in cases of minor drill/drill bushing misalignment.

Counterbores

Any drill bushing with either a "small" bore, or with a "large" drill bushing length-to-bore ratio, is counterbored. This is to provide assistance with lubrication supply to the drill point, as well as expedient removal of chips. Those drill bushings that have standard counterbores are designated with either a • or †.

Please note that all drill bushings with standard counterbores can be supplied without counterbores. Our Sales Service Representatives will be glad to provide you with a quotation as per your requirements.

Chamfers Leads

All Press Fit Bushings and Liners ground to Press Fit tolerances are supplied with a chamfer and ground concentric lead on the O.D. of the exit end. This chamfer/lead combination provides assistance by "starting" the bushing into the hole, resulting in easier insertion.

Bushing Bore Tolerances

For Ansi/BMP Standard and Thinwall Bushings for DRILLS

Normal Bushing Bore	Bore Tolerance Over Nominal
from .0135" to .2500"	+.0001" –+.0004"
over. 2500" to 7500"	+.0001" –+.0005"
over. 7500" to 1.500"	+.0002" –+.0006"
over. 1.5000" to 1.8750"	+.0003" –+.0007"

For ANSI/BMP Standard and Thinwall Bushings for REAMERS

Normal Bushing Bore	Bore Tolerance Over Nominal
from .0135" to .2500"	+.0005" –+.0008"
over. 2500" to 1.0000"	+.0006" –+.0010"
over. 1.0000"	+.0008" –+.0012"

Concentricity Tolerances

For ANSI/BMP Standard Drill Bushings

Bores up to .5000"	.0003" T.I.R max
Bores over .5000"	.0005" T.I.R max

For Thinwall Drill Bushings

All Bore sizes	.0005" T.I.R max
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Please note that on Counterbored Drill Bushings, these concentricity specifications apply to the exit end of the bushing.



Boneham NITRALLOY

A premium quality bushing steel designed to provide extended wear life.

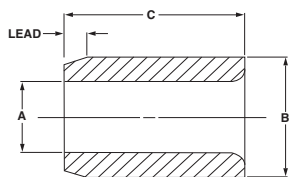
PRODUCTION AND QUALITY
STANDARDS OF BONEHAM NITRALLOY
PRODUCTS ARE ASSURED BY
APPROVAL TO:
ISO 9001
EN 29001
B55750 PT 1

- **NITRALLOY** is the *name* of an alloy. It is *not* a process.
- We *NITRIDE* **NITRALLOY** from 50 to 80 hours at 9000F to produce a .012" case depth, with a surface hardness of Rc 67-69 equivalent.
- The 32-34 Rc core "softness" of **NITRALLOY** makes it one of the "safest" bushing materials available. Unlike Tungsten Carbide drill bushings, it resists the tendency to shatter due to its tremendous ability to absorb "shock" from heavy "intermittent" cuts, crashes, abuse, or accident.
- **NITRALLOY** can withstand high operating temperatures which can reduce the hardness, effective service life, and dimensional integrity of ordinary steel bushings.
- The excellent "lubricity" and "anti-galling" characteristics of **NITRALLOY** make it the *ideal* bushing material to use with carbide and carbide tipped tooling.
- The wear life of **NITRALLOY** drill bushings can be up to 80% that of Tungsten Carbide drill bushings. It is *not* 80% of the cost of carbide. This makes **NITRALLOY** a cost effective alternative to carbide drill bushings.
- Being that **NITRALLOY** drill bushings demonstrate tremendous wear life characteristics, the opportunity to drastically reduce tooling costs exists. By simply using fewer drill bushings and incurring less machine downtime due to bushing changes, substantial cost savings can be realized.
- Renewable **NITRALLOY** drill bushings are stocked. Press Fit, ISO/Boneham **NITRALLOY**, and Special Design **NITRALLOY** drill bushings are made to your special order Standard Reamer tolerances as well as 86 selected metric bore sizes are available as standards.
- Our Sales Service Representatives are available to provide you with assistance in selecting the appropriate **NITRALLOY** Drill Bushings for your operational requirements.
- To order **NITRALLOY** drill bushings, add the prefix letter "N" to the ANSI/Boneham bushing symbol of the drill bushing you require (example: NSF-32-8, 1/4" I.D.). Please call or fax (toll free) our Sales Service Representatives for a quotation on those bushings you require to be made in **NITRALLOY**.

Headless Press Fit Bushings



TO SIZE – ANSI AND BMP BUSHINGS



WHEN ORDERING STATE: Quantity, Symbol, Bore Size, whether for Drill or Reamer.

- For general info., ordering and technical data, see pages 4-6.
- To order Oversize bushings, suffix symbol with letter "U" (example: P-32-8U)
- To order NITRALLOY Nitrided bushings, prefix symbol with letter "N" (example: NP-32-8).
- NITRALLOY Nitrided drill bushings will be quoted upon request.
- For net prices on Standard Steel bushings, please see price list.
- OUTSIDE DIAMETER FINISH GROUND TO PRESS FIT SIZE.

Bore Size	Outside Diameter	C: Bushing Length and Price Code Number												
		Prefix	1/4"	5/16"	3/8"	1/2"	3/4"	1"	1 3/8"	1 3/4"	2 1/8"	2 1/2"	3"	
0.0135 to 0.0280	5/32	0.1578 0.1575	P 268	-10-4 290	-10-5 293	-10-6 297	-10-8 333	-10-12						
0.0292 to 0.0469	5/32	0.1578 0.1575	P 230	-10-4 235	-10-5 237	-10-6 252	-10-8† 290	-10-12†						
0.0520 to 0.0625	5/32	0.1578 0.1575	P 206	-10-4 210	-10-5 212	-10-6 213	-10-8 222	-10-12•						
0.0135 to 0.0280	13/64	0.2046 0.2043	P 268	-13-4 290	-13-5 293	-13-6 297	-13-8 333	-13-12						
0.0292 to 0.0469	13/64	0.2046 0.2043	P 230	-13-4 235	-13-5 237	-13-6 252	-13-8† 290	-13-12†						
0.0520 to 0.0625	13/64	0.2046 0.2043	P 206	-13-4 210	-13-5 212	-13-6 213	-13-8 222	-13-12• 237						
0.0635 to 0.0995	13/64	0.2046 0.2043	P 138	-13-4 146	-13-5 152	-13-6 153	-13-8 161	-13-12• 169	-13-16• 195					
0.0980 to 0.1406	1/4	0.2516 0.2513	P 134	-16-4 137	-16-5 142	-16-6 146	-16-8 155	-16-12 164	-16-16• 209	-16-22• 219				
0.1250 to 0.1935	5/16	0.3141 0.3138	P 123	-20-4 126	-20-5 129	-20-6 130	-20-8 135	-20-12 140	-20-16 169	-20-22• 201				
0.1875 to 0.2570	13/32	0.4078 0.4075	P 118	-26-4 119	-26-5 122	-26-6 123	-26-8 129	-26-12 137	-26-16 146	-26-22• 164				
0.1875 to 0.3160	1/2	0.5017 0.5014	P 118	-32-4 119	-32-5 122	-32-6 123	-32-8 129	-32-12 137	-32-16 146	-32-22• 164				
0.3125 to 0.4375	5/8	0.6267 0.6264	P 123	-40-4 118	-40-5 120	-40-6 120	-40-8 123	-40-12 126	-40-16 146	-40-22 155	-40-28 170	-40-34 290		
0.3125 to 0.5312	3/4	0.7518 0.7515	P 126	-48-4 119	-48-5 123	-48-6 123	-48-8 126	-48-12 130	-48-16 145	-48-22 158	-48-28 174	-48-34 235		
0.5000 to 0.6562	7/8	0.8768 0.8765			-56-5 138	-56-6 140	-56-8 134	-56-12 135	-56-16 138	-56-22 144	-56-28 159	-56-34 170	-56-40 191	-56-48 292
0.5000 to 0.7656	1	1.0018 1.0015				-64-8 135	-64-12 135	-64-16 139	-64-22 144	-64-28 161	-64-34 170	-64-40 191	-64-48 252	
0.6250 to 1.0312	1-3/8	1.3772 1.3768					-88-8 170	-88-12 155	-88-16 170	-88-22 189	-88-28 201	-88-34 213	-88-40 225	-88-48 305
1.1000 to 1.3906	1-3/4	1.7523 1.7519						-112-12 196	-112-16 189	-112-22 196	-112-28 206	-112-34 222	-112-40 235	-112-48 329
1.3750 to 1.7656	2-1/4	2.2525 2.2521							-144-16 207	-144-22 218	-144-28 227	-144-34 272	-144-40 299	-144-48 342

* Standard bore sizes available are per chart shown in rear of catalog – including LETTER, NUMBER and FRACTIONAL SIZES.

MILLIMETER – from 2.3 mm to 10.5 mm only for selected list designated by ■ on back cover.

• COUNTERBORED – with adequate bearing length – can also be supplied without counterbore upon request.

† COUNTERBORED – 0.0390 to 0.0469 with adequate bearing length; can also be supplied without counterbore upon request.



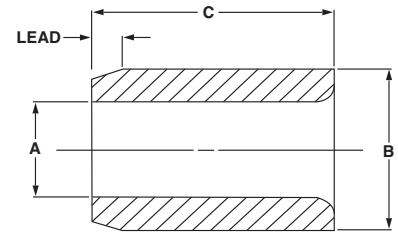
Headless Press Fit Bushings

TO SIZE – THIN WALL

WHEN ORDERING STATE:

Quantity, Symbol, Bore Size, whether for Drill or Reamer.

- For general info., ordering and technical data, see pages 4-6.
- To order Oversize bushings, suffix symbol with letter "U" (example: P-TW-36-8U)
- To order NITRALLOY Nitrided bushings, prefix symbol with letter "N" (example: NP-TW-36-8).
- NITRALLOY Nitrided drill bushings will be quoted upon request.
- For net prices on Standard Steel bushings, please see price list.
- OUTSIDE DIAMETER FINISH GROUND TO PRESS FIT SIZE.



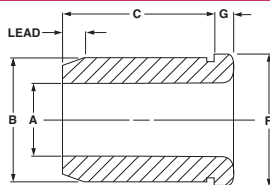
Hole Size	Outside Diameter		C: Bushing Length and Price Code Number												
			Prefix	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"	1 1/4"	1 1/2"	1 3/4"	2"	2 1/4"
0.0135 to 0.0280	3/16	0.1891	P-TW	.12-4	-12-5	-12-6	-12-8	-12-10	-12-12						
		0.1888		268	290	293	296	320	333						
0.0292 to 0.0469	3/16	0.1891	P-TW	-12-4	-12-5	-12-6	-12-8†	-12-10†	-12-12†						
		0.1888		230	235	237	252	268	290						
0.0520 to 0.0625	3/16	0.1891	P-TW	-12-4	-12-5	-12-6	-12-8	-12-10	-12-12•						
		0.1888		206	210	212	213	226	222						
0.0635 to 0.0995	3/16	0.1891	P-TW	-12-4	-12-5	-12-6	-12-8	-12-10	-12-12•						
		0.1888		138	146	151	153	158	161						
0.0995 to 0.1406	1/4	0.2516	P-TW	-16-4	-16-5	-16-6	-16-8	-16-10	-16-12						
		0.2513		134	137	142	146	152	155						
0.1406 to 0.1910	5/16	0.3141	P-TW	-20-4	-20-5	-20-6	-20-8	-20-10	-20-12	-20-16					
		0.3138		123	126	129	130	134	135	140					
0.1935 to 0.2280	3-8	0.3766	P-TW	-24-4	-24-5	-24-6	-24-8	-24-10	-24-12	-24-16					
		0.3763		118	119	122	123	126	129	137					
0.2340 to 0.2900	7/16	0.4392	P-TW	-28-4	-28-5	-28-6	-28-8	-28-10	-28-12	-28-16					
		0.4389		118	119	122	123	126	129	137					
0.2950 to 0.3437	9/16	0.5642	P-TW	-36-4	-36-5	-36-6	-36-8	-36-10	-36-12	-36-16					
		0.5639		123	118	120	120	122	123	126					
0.3480 to 0.4375	5/8	0.6267	P-TW		-40-5	-40-6	-40-8	-40-10	-40-12	-40-16	-40-20				
		0.6264			118	120	120	122	123	126	144				
0.4531 to 0.5312	3/4	0.7518	P-TW		-48-5	-48-6	-48-8	-48-10	-48-12	-48-16	-48-20				
		0.7515			119	123	123	126	126	130	146				
0.5469 to 0.6562	7/8	0.8768	P-TW			-56-6	-56-8	-56-10	-56-12	-56-16	-56-20	-56-24			
		0.8765				140	134	135	135	138	144	152			
0.6719 to 0.7500	1	1.0018	P-TW				-64-8	-64-10	-64-12	-64-16	-64-20	-64-24	-64-28		
		1.0015					135	135	135	139	144	153	161		
0.7656 to 0.8437	1-1/8	1.1270	P-TW				-72-8	-72-10	-72-12	-72-16	-72-20	-72-24	-72-28		
		1.1267					169	164	155	169	188	192	199		
0.8594 to 0.9375	1-1/4	1.2520	P-TW					-80-10	-80-12	-80-16	-80-20	-80-24	-80-28	-80-32	
		1.2517						164	155	169	188	192	199	217	
0.9531 to 1.0000	1-3/8	1.3772	P-TW					-88-10	-88-12	-88-16	-88-20	-88-24	-88-28	-88-32	
		1.3768						167	155	170	189	193	201	212	
1.0156 to 1.1250	1-1/2	1.5022	P-TW						-96-12	-96-16	-96-20	-96-24	-96-28	-96-32	-96-36
		1.5018							196	189	196	203	206	222	228

* Standard bore sizes available are per chart shown in rear of catalog – including LETTER, NUMBER and FRACTIONAL SIZES.
 MILLIMETER – from 2.3 mm to 10.5 mm only for selected list designated by ■ on back cover.
 • COUNTERBORED – with adequate bearing length – can also be supplied without counterbore upon request.
 † COUNTERBORED – 0.0390 to 0.0469 with adequate bearing length; can also be supplied without counterbore upon request.

Head Press Fit Bushings



TO SIZE – ANSI AND BMP STANDARD



WHEN ORDERING STATE: Quantity, Symbol, Bore Size, whether for Drill or Reamer.

- For general info., ordering and technical data, see pages 4-6.
- To order Oversize bushings, suffix symbol with letter "U" (example: H-32-8U)
- To order NITRALLOY Nitrided bushings, prefix symbol with letter "N" (example: NH-32-8).
- NITRALLOY Nitrided drill bushings will be quoted upon request.
- For net prices on Standard Steel bushings, please see price list.
- OUTSIDE DIAMETER FINISH GROUND TO PRESS FIT SIZE.

Bore Size	Outside Diameter	C: Length Under Head and Price Code Number												HEAD	
		Prefix	1/4"	5/16"	3/8"	1/2"	3/4"	1"	1 3/8"	1 3/4"	2 1/8"	2 1/2"	3"	Dia.	Thk.
A*	B													F	G
0.0135 to 0.0280	5/32	0.1578 0.1575	z H -10-4 290	-10-5 293	-10-6 298	-10-8 300	-10-12• 343							1/4	3/32
0.0292 to 0.0469	5/32	0.1578 0.1575	H -10-4 235	-10-5 237	-10-6 252	-10-8† 264	-10-12• 297							1/4	3/32
0.0520 to 0.0625	5/32	0.1578 0.1575	H -10-4 211	-10-5 212	-10-6 213	-10-8† 214	-10-12• 226							1/4	3/32
0.0135 to 0.0280	13/64	0.2046 0.2043	H -13-4 290	-13-5 293	-13-6 298	-13-8 300	-13-12† 340							19/64	3/32
0.0292 to 0.0469	13/64	0.2046 0.2043	H -13-4 235	-13-5 237	-13-6 252	-13-8† 264	-13-12† 297							19/64	3/32
0.0520 to 0.0625	13/64	0.2046 0.2043	H -13-4 211	-13-5 212	-13-6 213	-13-8• 214	-13-12• 226	-13-16• 264						19/64	3/32
0.0635 to 0.0995	13/64	0.2046 0.2043	H -13-4 158	-13-5 159	-13-6 164	-13-8 167	-13-12• 187	-13-16• 205	-13-22• 264					19/64	3/32
0.0980 to 0.1406	1/4	0.2516 0.2513	H -16-4 158	-16-5 152	-16-6 155	-16-8 158	-16-12 183	-16-16• 207	-16-22• 252					23/64	3/32
0.1250 to 0.1935	5/16	0.3141 0.3138	H -20-4 134	-20-5 137	-20-6 140	-20-8 142	-20-12 144	-20-16• 159	-20-22• 210	-20-28• 223				27/64	1/8
0.1875 to 0.2570	13/32	0.4078 0.4075	H -26-4 129	-26-5 130	-26-6 135	-26-8 137	-26-12 140	-26-16• 153	-26-22• 164	-26-28• 190				1/2	5/32
0.1875 to 0.3160	1/2	0.5017 0.5014	H -32-4 129	-32-5 130	-32-6 135	-32-8 137	-32-12 140	-32-16 153	-32-22• 165	-32-28• 190				39/64	7/32
0.3125 to 0.4375	5/8	0.6267 0.6264	H -40-4 135	-40-5 129	-40-6 130	-40-8 130	-40-12 135	-40-16 140	-40-22 164	-40-28 183	-40-34 194			51/64	7/32
0.3125 to 0.5312	3/4	0.7518 0.7515	H -48-4 140	-48-5 134	-48-6 135	-48-8 135	-48-12 140	-48-16 146	-48-22 167	-48-28 186	-48-34 196			59/64	7/32
0.5000 to 0.6562	7/8	0.8768 0.8765	H -56-8 149			-56-12 151	-56-16 153	-56-22 161	-56-28 189	-56-34 196	-56-40 212			1-7/64	1/4
0.5000 to 0.7656	1	1.0018 1.0015	H -64-8 152			-64-12 152	-64-16 158	-64-22 164	-64-28 193	-64-34 206	-64-40 221	-64-48 318		1-15/64	5/16
0.6250 to 1.0312	1-3/8	1.3772 1.3768	H -88-8 199			-88-12 192	-88-16 200	-88-22 208	-88-28 222	-88-34 237	-88-40 291	-88-48 335		1-39/64	3/8
1.1000 to 1.3906	1-3/4	1.7523 1.7519	H -112-12 227			-112-16 217	-112-22 227	-112-28 240	-112-34 294	-112-40 307	-112-48 347			1-63/64	3/8
1.3750 to 1.7656	2-1/4	2.2525 2.2521	H -144-16 276			-144-22 302	-144-28 322	-144-34 332	-144-40 339	-144-48 357				2-31/64	3/8

* Standard bore sizes available are per chart shown in rear of catalog – including LETTER, NUMBER and FRACTIONAL SIZES.
MILLIMETER – from 2.3 mm to 10.5 mm only for selected list designated by ■ on back cover.
• COUNTERBORED – with adequate bearing length – can also be supplied without counterbore upon request.
† COUNTERBORED – 0.0390 to 0.0469 with adequate bearing length; can also be supplied without counterbore upon request.



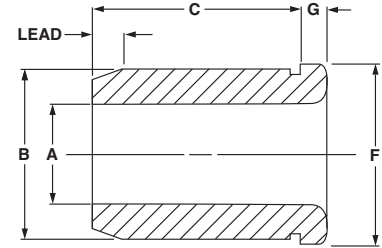
Head Press Fit Bushings

TO SIZE – THIN WALL

WHEN ORDERING STATE:

Quantity, Symbol, Bore Size, whether for Drill or Reamer.

- For general info., ordering and technical data, see pages 4-6.
- To order Oversize bushings, suffix symbol with letter "U" (example: H-TW-36-8U)
- To order NITRALLOY Nitrided bushings, prefix symbol with letter "N" (example: NH-TW-36-8).
- NITRALLOY Nitrided drill bushings will be quoted upon request.
- For net prices on Standard Steel bushings, please see price list.
- OUTSIDE DIAMETER FINISH GROUND TO PRESS FIT SIZE.



Bore Size	Outside Diameter		C: Length Under Head and Price Code Number												HEAD		
			Prefix	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"	1 1/4"	1 1/2"	1 3/4"	2"	2 1/4"	F	G
0.0135 to 0.0280	3/16	0.1891	H-TW	-12-4	-12-5	-12-6	-12-8	-12-10	-12-12							5/16	3/32
		0.1881		300	301	304	306	332	343								
0.0292 to 0.0469	3/16	0.1891	H-TW	-12-4	-12-5	-12-6	-12-8†	-12-10†	-12-12†							5/16	3/32
		0.1888		276	280	284	289	298	303								
0.0520 to 0.0625	3/16	0.1891	H-TW	-12-4	-12-5	-12-6	-12-8	-12-10•	-12-12•							5/16	3/32
		0.1888		222	224	228	230	240	248								
0.0635 to 0.0980	3/16	0.1891	H-TW	-12-4	-12-5	-12-6	-12-8	-12-10•	-12-12•							5/16	3/32
		0.1888		164	167	170	172	181	188								
0.0995 to 0.1406	1/4	0.2516	H-TW	-16-4	-16-5	-16-6	-16-8	-16-10	-16-12							3/8	3/32
		0.2513		146	152	155	158	167	183								
0.1406 to 0.1910	5/16	0.3141	HTW	-20-4	-20-5	-20-6	-20-8	-20-10	-20-12	-20-16						7/16	3/32
		0.3138		134	137	140	142	143	144	159							
0.1935 to 0.2280	3/8	0.3766	H-TW	-24-4	-24-5	-24-6	-24-8	-24-10	-24-12	-24-16						1/2	3/32
		0.3763		129	134	135	137	139	140	153							
0.2340 to 0.2900	7/16	0.4392	H-TW	-28-4	-28-5	-28-6	-28-8	-28-10	-28-12	-28-16						9/16	3/32
		0.4389		129	134	135	137	139	140	153							
0.2950 to 0.3437	9/16	0.5642	H-TW	-36-4	-36-5	-36-6	-36-8	-36-10	-36-12	-36-16						11/16	3/32
		0.5639		135	129	134	134	135	135	140							
0.3480 to 0.4375	5/8	0.6267	H-TW		-40-5	-40-6	-40-8	-40-10	-40-12	-40-16	-40-16					3/4	3/32
		0.6264			129	130	130	135	135	140	166						
0.4531 to 0.5312	3/4	0.7518	H-TW		-48-5	-48-6	-48-8	-48-10	-48-12	-48-16	-48-20					7/8	1/8
		0.7515			134	135	135	138	140	146	167						
0.5469 to 0.6562	7/8	0.8768	H-TW			-56-6	-56-8	-56-10	-56-12	-56-16	-56-20	-56-24				1-1/16	3/16
		0.8765				151	149	149	151	153	161	170					
0.6719 to 0.7500	1	1.0018	H-TW				-64-8	-64-10	-64-12	-64-16	-64-20	-64-24	-64-28			1-3/16	3/16
		1.0015					152	152	152	158	164	187	193				
0.7656 to 0.8437	1-1/8	1.1270	H-TW				-72-8	-72-10	-72-12	-72-16	-72-20	-72-24	-72-28			1-5/16	3/16
		1.1267					201	194	189	201	209	218	224				
0.8594 to 0.9375	1-1/4	1.2520	H-TW					-80-10	-80-12	-80-16	-80-20	-80-24	-80-28	-80-32		1-1/2	1/4
		1.2517						194	191	198	206	213	221	234			
0.9531 to 1.000	1-3/8	1.3772	H-TW					-88-10	-88-12	-88-16	-88-20	-88-24	-88-28	-88-32		1-5/8	1/4
		1.3768						193	192	200	209	214	222	237			
1.0156 to 1.1250	1-1/2	1.5022	H-TW						-96-12	-96-16	-96-20	-96-24	-96-28	-96-32	-96-36	1-3/4	1/4
		1.5018							225	213	225	229	234	291	299		

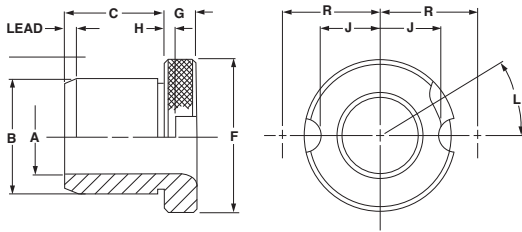
* Standard bore sizes available are per chart shown in rear of catalog – including LETTER, NUMBER and FRACTIONAL SIZES.
 MILLIMETER – from 2.3 mm to 10.5 mm only for selected list designated by ■ on back cover.
 • COUNTERBORED – with adequate bearing length – can also be supplied without counterbore upon request.
 † COUNTERBORED – 0.0390 to 0.0469 with adequate bearing length; can also be supplied without counterbore upon request.

Slip-Fixed Renewable Combination Bushings



ANSI AND BMP STANDARD

FOR USE AS EITHER TYPE



WHEN ORDERING STATE:

Quantity, Symbol, Bore Size, whether for Drill or Reamer.

- For general info., ordering and technical data, see pages 4-6.
- For dimensional data, see page 16
- To order NITRALLOY Nitrided bushings, prefix symbol with letter "N" (example: NSF-32-8).
- NITRALLOY Nitrided drill bushings will be quoted upon request.
- For net prices on Standard Steel bushings, please see price list.
- OUTSIDE DIAMETER FINISH GROUND FOR SLIP FIT INTO LINERS.

Bore Size	Outside Diameter	C: Bushing Length and Price Code Number												Lock Screw No.	
		Prefix	1/4"	5/16"	3/8"	1/2"	3/4"	1"	1 3/8"	1 3/4"	2 1/8"	2 1/2"	3"		
0.0135 to 0.0280	3/16	0.1875 0.1873	SF	-12-4 322	-12-5 324	-12-6 326	-12-8 327	-12-12 349							0
0.0292 to 0.0469	3/16	0.1875 0.1873	SF	-12-4 297	-12-5 299	-12-6 302	-12-8† 304	-12-12† 318							0
0.0520 to 0.0625	3/16	0.1875 0.1873	SF	-12-4 222	-12-5 224	-12-6 226	-12-8• 227	-12-12• 244							0
0.0135 to 0.0280	5/16	0.3125 0.3123	SF	-20-4 322	-20-5 324	-20-6 326	-20-8 327	-20-12 349							1
0.0292 to 0.0469	5/16	0.3125 0.3123	SF		-20-5 299	-20-6 302	-20-8† 304	-20-12† 318							1
0.0520 to 0.0625	5/16	0.3125 0.3123	SF		-20-5 224	-20-6 226	-20-8• 227	-20-12• 244							1
0.0635 to 0.0890	5/16	0.3125 0.3123	SF		-20-5 174	-20-6 180	-20-8 187	-20-12• 194	-20-16• 212						1
0.935 to 0.1935	5/16	0.3125 0.3123	SF		-20-5 164	-20-6 167	-20-8 170	-20-12 190	-20-16• 203	-20-22• 225					1
0.1405 to 0.1875	1/2	0.5000 0.4998	SF		-32-5 149	-32-6 152	-32-8 153	-32-12 161	-32-16• 177	-32-22• 192	-32-28• 204				1
0.1890 to 0.3437	1/2	0.5000 0.4998	SF		-32-5 139	-32-6 142	-32-8 144	-32-12 152	-32-16 161	-32-22• 187	-32-28• 195	-32-34• 304			1
0.2812 to 0.5625	3/4	0.7500 0.7498	SF				-48-8 143	-48-12 149	-48-16 153	-48-22 187	-48-28 196	-48-34 206	-48-40• 310	-48-48• 346	1
0.4687 to 0.7812	1	1.0000 0.9998	SF				-64-8 161	-64-12 164	-64-16 170	-64-22 188	-64-28 201	-64-34 217	-64-40 323	-64-48 348	2
0.7187 to 1.0625	1-3/8	1.3750 1.3757	SF					-88-12 204	-88-16 214	-88-22 224	-88-28 248	-88-34 294	-88-40 333	-88-48 355	2
0.9687 to 1.4062	1-3/4	1.7500 1.7497	SF					-112-12 264	-112-16 233	-112-22 264	-112-28 303	-112-34 322	-112-40 341	-112-48 356	3
1.3437 to 1.8750	2-1/4	2.2500 2.2496	SF					-144-12 328	-144-16 314	-144-22 328	-144-28 334	-144-34 345	-144-40 352	-144-48 360	3

* Standard bore sizes available are per chart shown in rear of catalog – including LETTER, NUMBER and FRACTIONAL SIZES.
MILLIMETER – from 2.3 mm to 10.5 mm only for selected list designated by ■ on back cover.
• COUNTERBORED – with adequate bearing length – can also be supplied without counterbore upon request.
† COUNTERBORED – 0.0390 to 0.0469 with adequate bearing length; can also be supplied without counterbore upon request.

Our Sales Service Representatives are available to assist you in defining the appropriate sizes of the bushings that you require.



Slip-Fixed Renewable Combination Bushings

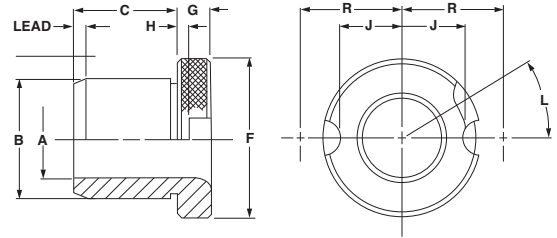
FOR USE AS EITHER TYPE

THIN WALL

WHEN ORDERING STATE:

Quantity, Symbol, Bore Size, whether for Drill or Reamer.

- For general info., ordering and technical data, see pages 4-6.
- For dimensional data, see page 16
- To order NITRALLOY Nitrided bushings, prefix symbol with letter "N" (example: NSF-TW-36-8).
- NITRALLOY Nitrided drill bushings will be quoted upon request.
- For net prices on Standard Steel bushings, please see price list.
- **OUTSIDE DIAMETER FINISH GROUND FOR SLIP FIT INTO LINERS.**

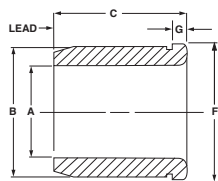


Bore Size	Outside Diameter		C: Length Under Head and Price Code Number													Lock Screw No.
			Prefix	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"	1 1/4"	1 1/2"	1 3/4"	2"	2 1/4"	
0.0135 to 0.0280	3/16	0.1875	SF-TW	-12-4	-12-5	-12-6	-12-8	-12-10	-12-12							0
		0.1873		322	324	326	327	337	349							
0.0292 to 0.0469	3/16	0.1875	SF-TW	-12-4	-12-5	-12-6	-12-8†	-12-10†	-12-12†							0
		0.1873		297	299	302	304	306	318							
0.0520 to 0.0625	3/16	0.1875	SF-TW	-12-4	-12-5	-12-6	-12-8•	-12-10•	-12-12•							0
		0.1873		222	224	226	227	233	244							
0.0635 to 0.0980	3/16	0.1875	SF-TW	-12-4	-12-5	-12-6	-12-8	-12-10•	-12-12•							0
		0.1873		170	177	180	187	191	194							
0.0995 to 0.1406	1/4	0.2500	SF-IW	-16-4	-16-5	-16-6	-16-8	-16-10	-16-12							TW-2
		0.2498		164	164	167	170	186	190							
0.1406 to 0.1910	5/16	0.3125	SF-TW	-20-4	-20-5	-20-6	-20-8	-20-10	-20-12	-20-16•						TW-2
		0.3123		161	161	164	168	177	188	201						
0.1935 to 0.2280	3/8	0.3750	SF-TW	-24-4	-24-5	-24-6	-24-8	-24-10	-24-12	-24-16						TW-2
		0.3748		135	139	142	146	149	152	161						
0.2340 to 0.2900	7/16	0.4375	SF-TW	-28-4	-28-5	-28-6	-28-8	-28-10	-28-12	-28-16						TW-2
		0.4373		135	139	142	146	149	152	161						
0.2950 to 0.3437	9/16	0.5625	SF-TW	-36-4	-36-5	-36-6	-36-8	-36-10	-36-12	-36-16						TW-2
		0.5623		135	139	142	146	149	152	161						
0.3480 to 0.4375	5/8	0.6250	SF-TW		-40-5	-40-6	-40-8	-40-10	-40-12	-40-16	-40-20					TW-2
		0.6248			143	143	143	146	149	153	187					
0.4531 to 0.5312	3/4	0.7500	SF-TW		-48-5	-48-6	-48-8	-48-10	-48-12	-48-16	-48-20					TW-2
		0.7498			142	142	143	149	149	153	187					
0.5469 to 0.6562	7/8	0.8750	SF-TW			-56-6	-56-8	-56-10	-56-12	-56-16	-56-20	-56-24				TW-7
		0.8748				161	161	164	166	170	188	193				
0.6719 to 0.7500	1	1.0000	SF-TW				-64-8	-64-10	-64-12	-64-16	-64-20	-64-24	-64-28			TW-7
		0.9998					161	164	164	170	188	192	201			
0.7656 to 0.8437	1-1/8	1.1250	SF-TW				-72-8	-72-10	-72-12	-72-16	-72-20	-72-24	-72-28			TW-7
		1.1248					203	204	205	214	224	230	240			
0.8594 to 0.9375	1-1/4	1.2500	SF-TW					-80-10	-80-12	-80-16	-80-20	-80-24	-80-28	-80-32		TW-7
		1.2498						204	205	214	224	231	240	293		
0.9531 to 1.000	1-3/8	1.3750	SF-TW					-88-10	-88-12	-88-16	-88-20	-88-24	-88-28	-88-32		TW-7
		1.3747						204	204	214	224	231	248	294		
1.0156 to 1.1250	1-1/2	1.5000	SF-TW						-96-12	-96-16	-96-20	-96-24	-96-28	-96-32	-96-36	TW-7
		1.4997							272	273	276	295	302	321	332	

* Standard bore sizes available are per chart shown in rear of catalog – including LETTER, NUMBER and FRACTIONAL SIZES.
 MILLIMETER – from 2.3 mm to 10.5 mm only for selected list designated by ■ on back cover.
 • COUNTERBORED – with adequate bearing length – can also be supplied without counterbore upon request.
 † COUNTERBORED – 0.0390 to 0.0469 with adequate bearing length; can also be supplied without counterbore upon request.

Head Type Liners

TO SIZE – ANSI AND BMP STANDARD



WHEN ORDERING STATE:

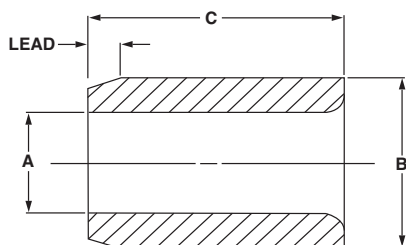
Quantity, Symbol.

- For general info., ordering and technical data, see pages 4-6.
- To order Oversize liners, suffix symbol with letter "U" (example: HL-32-22U).
- For net prices please see price list.
- OUTSIDE DIAMETER FINISH GROUND TO PRESS FIT SIZE.

Bore Size		Outside Diameter		C: Overall and Price Code Number											Head	
A		A		Prefix	5/16"	3/8"	1/2"	3/4"	1"	1 3/8"	1 3/4"	2 1/8"	2 1/2"	3"	Dia.	Thk.
A		A												F	G	
5/16	0.3129 0.3126	1/2	0.5017 0.5014	HL	-32-5 130	-32-6 135	-32-8 135	-32-12 140	-32-16 161	-32-22 189					5/8	3/32
1/2	0.5005 0.5002	3/4	0.7518 0.7515	HL	-48-5 134	-48-6 135	-48-8 135	-48-12 140	-48-16 152	-48-22 164	-48-28 187	-48-34 196			7/8	3/32
3/4	0.7506 0.7503	1	1.0018 1.0015	HL			-64-8 149	-64-12 153	64-16 159	-64-22 164	-64-28 191	-64-34 201	-64-40 217	-64-48 314	1-1/8	1/8
1	1.0007 1.0004	1-3/8	1.3772 1.3768	HL			-88-8 180	-88-12 164	-88-16 180	-88-22 190	-88-28 201	-88-34 211	-88-40 225	-88-48 335	1-1/2	1/8
1-3/8	1.3760 1.3756	1-3/4	1.7523 1.7519	HL				-112-12 198	-112-16 203	-112-22 210	-112-28 222	-112-34 237	-112-40 291	-112-48 350	1-7/8	3/16
1-3/4	1.7512 1.7508	2-1/4	2.2525 2.2521	HL				-144-12 233	-144-16 224	-144-22 234	-144-28 276	-144-34 301	-144-40 320	-144-48 353	2-3/8	3/16
2-1/4	2.2515 2.2510	2-3/4	2.7526 2.7522	HL				-176-12 299	-176-16 268	-176-22 301	176-28 316	-176-34 330	-176-40 338	-176-48 359	2-7/8	3/16

Headless Liners

TO SIZE – ANSI AND BMP STANDARD



WHEN ORDERING STATE:

Quantity and Symbol.

- For general info., ordering and technical data, see pages 4-6.
- To order Oversize liners, suffix symbol with letter "U" (example: L-64-22U).
- For net prices please see price list.
- OUTSIDE DIAMETER FINISH GROUND TO PRESS FIT SIZE.

Bore Size		Outside Diameter		C: Liner Length and Price Code Number											
A		A		Prefix	1/4"	5/16"	3/8"	1/2"	3/4"	1	1 3/8"	1 3/4"	2 1/8"	2 1/2"	3"
3/16	0.1879 0.1876	5/16	0.3141 0.3138	L	-20-4 123	-20-5 126	-20-6 129	-20-8 130	-20-12 135						
5/16	0.3129 0.3126	1/2	0.5017 0.5014	L	-32-4 118	32-5 119	-32-6 122	32-8 123	-32-12 129	-32-16 137	-32-22 146				
1/2	0.5005 0.5002	3/4	0.7518 0.7515	L		-48-5 119	-48-6 123	-48-8 123	-48-12 126	-48-16 130	-48-22 145	-58-28 158	-48-34 174		
3/4	0.7506 0.7503	1	1.0018 1.0015	L				-64-8 135	-64-12 135	-64-16 139	-64-22 144	-64-28 161	-64-34 170	-64-40 191	-64-48 252
1	1.0007 1.0004	1-3/8	1.3772 1.3768	L				-88-8 170	-88-12 155	-88-16 170	-88-22 189	-88-28 201	-88-34 213	-88-40 225	-88-48 305
1-3/8	1.3760 1.3756	1-3/4	1.7523 1.7519	L					-112-12 196	-112-16 189	-112-22 196	-112-28 206	-112-34 222	-112-40 235	-112-48 329
1-3/4	1.7512 1.7508	2-1/4	2.2525 2.2521	L					-144-12 218	-144-16 207	-144-22 218	-144-28 227	-144-34 272	-144-40 299	-144-48 342
2-1/4	2.2515 2.2510	2-3/4	2.7526 2.7522	L					-176-12 228	-176-16 218	-176-22 229	176-28 260	-176-34 294	-176-40 308	-176-48 344

BONEHAM METAL PRODUCTS, INC., 327 NORTH 14TH STREET, KENILWORTH, N.J. 07033

NJ PHONE: 908-272-1200 • FREE PHONE: 800-631-7852 • NJ FAX: 908-272-4124 • FREE FAX: 800-526-9494

EMAIL: sales@bonehamusa.com www.bonehamusa.com



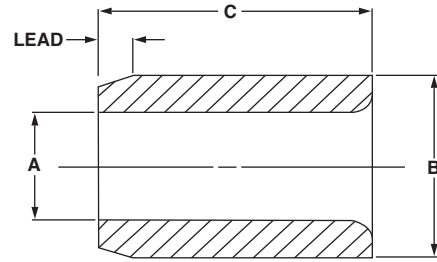
Headless Liners

TO SIZE – THIN WALL

WHEN ORDERING STATE:

Quantity and Symbol.

- For general info., ordering and technical data, see pages 4-6.
- To order Oversize liners, suffix symbol with letter "U" (example: LTW-28-6U).
- For net prices please see price list.
- OUTSIDE DIAMETER FINISH GROUND TO PRESS FIT SIZE.



Bore Size	Outside Diameter		C: Liner Length and Price Code Number												
			Prefix	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"	1 1/4"	1 1/2"	1 3/4"	2"	2 1/4"
3/16	0.1879	5/16	L-TW	-20-4	-20-5	-20-6	-20-8	-20-10	-20-12						
	0.1876			123	126	129	130	134	135						
1/4	0.2504	7/16	L-TW	-28-4	-28-5	-28-6	-28-8	-28-10	-28-12						
	0.2501			118	119	122	123	126	129						
5/16	0.3129	9/16	L-TW	-36-4	-36-5	-36-6	-36-8	-36-10	-36-12	-36-16					
	0.3126			123	118	120	120	122	123	126					
3/8	0.3754	5/8	L-TW	-40-4	-40-5	-40-6	-40-8	-40-10	-40-12	-40-16					
	0.3751			123	118	120	120	122	123	126					
7/16	0.4380	5/8	L-TW	-40-4X	-40-5X	-40-6X	-40-8X	-40-10X	40-12X	-40-16X					
	0.4377			123	118	120	120	122	123	126					
9/16	0.5630	7/8	L-TW	-56-4	-56-5	-56-6	-56-8	56-10	-56-12	-56-16					
	0.5627			140	138	140	134	135	135	138					
5/8	0.6255	7/8	L-TW		-56-5X	-56-6X	-56-8X	-56-10X	-56-12X	-56-16X	-56-20X				
	0.6252			138	140	134	135	135	138	144					
3/4	0.7506	1	L-TW		-64-5	-64-6	-64-8	-64-10	-64-12	-64-16	-64-20				
	0.7503			138	140	135	135	135	139	144					
7/8	0.8757	1-1/4	L-TW			-80-6	-80-8	-80-10	-80-12	-80-16	-80-20	-80-24			
	0.8754			169	169	164	155	169	188	192					
1	1.0007	1-3/8	L-TW				-88-8	-88-10	-88-12	-88-16	-88-20	-88-24	-88-28		
	1.0004			170	167	155	170	189	193	201					
1-1/8	1.1259	1-1/2	L-TW				-96-8	-96-10	-96-12	-96-16	-96-20	-96-24	-96-28		
	1.1255			190	190	196	189	196	203	206					
1-1/4	1.2509	1-5/8	L-TW					-104-10	-104-12	-104-16	-104-20	-104-24	-104-28	-104-32	
	1.2505			190	195	195	195	200	206	217					
1-3/8	1.3760	1-3/4	L-TW					-112-10	-112-12	-112-16	-112-20	-112-24	-112-28	-112-32	
	1.3756			196	196	189	196	200	206	222					
1-1/2	1.5010	1-7/8	L-TW						-120-12	-120-16	-120-20	-120-24	-120-28	-120-32	-20-36
	1.5006			195	195	195	200	198	218	225					

Boneham Metal Products, Inc. drill bushings are guaranteed against defects in materials or workmanship. The tolerances of our products are guaranteed to confirm to either ANSI, ISO or catalog standards.

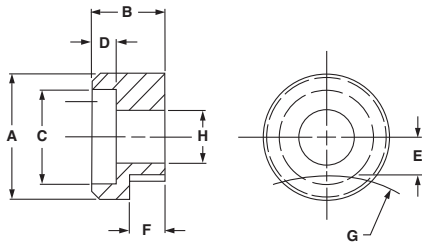
Renewable Bushing Dimensional Data



Body O.D.	F-Standard	F-Thinwall	G	H-Standard	H-Fixed Thinwall	H-Slip Thinwall	J Standard	J-Fixed Thinwall	J-Slip Thinwall	L	R-Standard	R-Fixed Thinwall	R-Slip Thinwall
3/16	5/16	5/16	3/16	3/32	3/32	3/32	5/64	5/64	5/64	55°	17/64	19/64	17/64
1/4		7/16	1/4		3/32	3/32		9/64	9/64	30°		23/64	21/64
5/16	35/64	9/16	1/4	1/8	1/8	1/8	11/64	13/64	13/64	65°	1/2	27/64	27/64
3/8		5/8	1/4		1/8	1/8		15/64	15/64	30°		29/64	29/64
7/16		5/8	1/4		1/8	1/8		15/64	15/64	30°		29/64	29/64
1/2	51/64		1/4	1/8			19/64			65°	5/8		
9/18		7/8	1/4		1/8	1/8		23/64	21/64	30°		37/64	37/64
5/8		7/8	1/4		1/8	1/8		23/64	21/64	30°		37/64	37/64
3/4	1-3/64	1	1/4	1/8	1/8	1/8	27/64	27/64	25/64	50°	3/4	41/64	41/64
7/8		1-1/4	3/8		3/16	3/16		31/64	33/64	30°		53/64	53/64
1	1-27/64	1-3/8	3/8	3/16	3/16	3/16	19/32	35/64	37/64	35°	59/64	57/64	57/64
1-1/8		1-1/2	3/8		3/16	3/16		39/64	41/64	35°		61/64	61/64
1-1/4		1-5/8	3/8		3/16	3/16		43/64	45/64	35°		1-1/64	1-1/64
1-3/8	1-51/64	1-3/4	3/8	3/16	3/16	3/16	25/32	47/64	49/64	30°	1-7/64	1-5/64	1-5/64
1-1/2		1-7/8	3/8		3/16	3/16		51/64	51/64	30°		1-9/64	1-9/64
1-3/4	2-19/64		3/8	3/16			1			30°	1-25/64		
2-1/4	2-51/64		3/8	3/16			1-1/4			25°	1-41/64		

Round Clamps

For Fixed Renewable Bushings

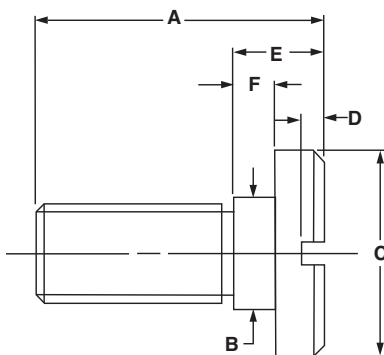


Round Clamp No.	A	B	C	D	E	F	G	H	Socket Head Screw	USA Bush Symb.
RC-1	5/8	5/16	31/64	5/32	0.203	1/8	17/32	21/64	5/16-18	SF-20 SF-32 SF-48
RC-2	5/8	7/16	31/64	7/32	0.194	3/16	29/32	21/64	5/16-18	SF-64 SF-88
RC-3	3/4	1/2	37/64	9/32	0.219	3/16	1-13/32	25/64	3/8-16	SF-112 SF-144

For prices see separate price list.

Lock Screws

For ANSI/BMP Standard and Thinwall Bushings



Lock Screw No.	A	B	C	D	E	F	Thread	Price
0	7/16	3/16	5/16	3/64	3/16	0.105 0.100	8-32	UNC-2A
1	5/8	3/8	5/8	1/16	1/4	0.138 0.132	5/16-18	UNC-2A
2	7/8	3/8	5/8	1/8	3/8	0.200 0.194	5/16-18	UNC-2A
3	1	7/16	3/4	1/8	3/8	0.200 0.194	3/8-16	UNC-2A
TW-1	7/16	3/16	5/16	3/64	3/16	3/32	8-32	UNC-2A
TW-2	1/2	1/4	3/8	1/16	1/4	1/8	10-32	UNF
TW-3	11/16	1/4	7/16	1/16	3/8	3/16	10-32	UNF
TW-4	7/8	3/8	9/16	1/8	1/2	1/4	5/16-18	UNC-2A
TW-5	1	3/8	5/8	1/8	5/8	5/16	5/16-18	UNC-2A
TW-7	3/4	3/8	5/8	1/16	3/8	3/16	5/16-18	UNC-2A

SEE PRICE LIST



ORDERING INFORMATION

Please supply the following information:

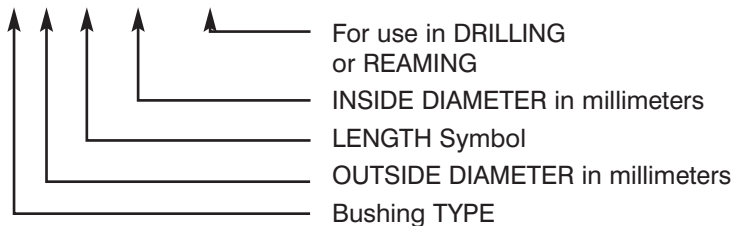
- Bushing **TYPE**
- **OUTSIDE DIAMETER**
- Bushing **LENGTH**
- **INSIDE DIAMETER**
- Whether for a **DRILL** or **REAMER**

The bushings in this section of the catalog are defined by the ISO Symbol System. This system is applied as follows:

Example Number 1:

A Headless Press Fit bushing with a 10mm OD., a length of 16mm, a bore of 6mm, and to be used for drilling, would be described as:

PP10F, 6.00mm, DRILL



BUSHING TYPE DESIGNATION

Bushing Type	ISO Letter Designation
Headless Press Fit	PP
Head Press Fit	PH
Slip-Fixed Renewable	RD
Headless Liner	LP
Head Type Liner	LH

LENGTH SYMBOLS

The ISO Length Designation System incorporates the use of "Letters" for specific standard bushing lengths. Each Boneham Metric drill bushing has three standard lengths as indicated in the identification charts. Standard ISO length symbols/lengths are as follows:

Length	Symbol	Length	Symbol	Length	Symbol
6mm	A	25mm	J	56mm	S
8mm	B	28mm	K	67mm	T
9mm	C	30mm	L	78mm	W
10mm	D	35mm	M	89mm	X
12mm	E	36mm	N	105mm	Y
16mm	F	40mm	P	112mm	Z
20mm	H	45mm	R		

The LENGTH of a Metric Drill Bushing is considered to be overall for headless press fit, all liner bushings, and head press fit, and the "under head" length for all renewable bushings.

STANDARD INCREMENT BORE SIZES

Metric Drill Bushings are manufactured with standard incremental bore sizes. The following chart outlines these standard increments:

Bore Size Range	Bore Size Increments
From 1.0mm to 3mm	0.05mm
Over 3mm to 14mm	0.1mm, and all 0.25mm and 0.75mm bore sizes
Over 14mm to 33mm	0.25mm
Over 33mm to 51mm	0.5mm
Over 51mm to 100mm	1.0mm

Any bore size that does not fall within the above standard range listings will be considered to be special. Our Sales Service Representatives will be glad to supply you with the appropriate pricing for all specials.

Metric Drill Bushings with bore sizes above 48mm are not stock items, and will be manufactured against customer's order.

Prices

Each ISO/Boneham style bushing has a "Bushing Reference" number. These reference numbers are located in the identification charts on the following pages.

Please note that all prices may be subject to change without prior notice.

Special Bushings

When required dimensions vary from the standard catalog listings of ID., O.D., Length, or Tolerance, the bushings are considered to be "specials". Many specials can be made from standard cataloged items by minor alterations. Others can be manufactured from standard bushing blanks. Some items are so completely different they must be custom made. Boneham is ready to manufacture all Metric specials required - from the minor alteration to the complete from "scratch" special. Please forward your specifications, whether verbal, by sketch, or blueprint, along with your material requirements, to our Sales Service Representatives for expeditious review and quotation.

As always, please use our **TOLL FREE TELEPHONE** or FAX numbers:

800 Telephone: 1-800-631-7852
800 Fax: 1-800-526-9494



METRIC BUSHING MATERIALS

1. Boneham Metric Drill Bushings are manufactured from steel which demonstrates excellent wear resistance and dimensional stability characteristics. This material is hardened to Rc 62-64.
2. All Boneham Metric Drill Bushings (1.6mm bore and over), are offered in our Premium alloy NITRALLOY. Boneham NITRALLOY Nitrided Drill Bushings are case "hardened" to a case depth of .013" to Rc 67-69 equivalent. Hardness must be checked by using the 15Kg. Superficial Rockwell Scale. NITRALLOY Nitrided drill bushings demonstrate superior wear resistance and dimensional stability characteristics. Our Sales Service Representatives will be glad to provide you with a quotation on those Metric Drill Bushings required in NITRALLOY.

BUSHING BODY CHARACTERISTICS

Entrance End

The entrance end of each ISO/Boneham Metric Drill Bushing has an internal chamfer. This "angle", which is closely matched to the angle of a drill point, permits easier tool entry and assistance in guiding the drill in cases of minor drill/drill bushing misalignment.

Chamfers/Leads

All Metric Press Fit Bushings and Liners ground to Press Fit tolerances are supplied with a chamfer and ground concentric lead on the O.D. of the exit end. This chamfer/lead combination provides assistance by "starting" the bushing into the hole, resulting in easier insertion.

Bushing Bore Tolerances

Bore limits for ISO/Boneham Standard Drill Bushings for DRILLS and REAMERS

ISO Bore Tolerances (mm)					
Normal Bore Sizes (mm)		Limits for Bores of Drill Bushings (F7 Hole)		Limits for Bores of Reamer Bushings	
Over	Up to	High+	Low+	High+	Low+
-	3	.016	.006	.018	.011
3	6	.022	.010	.023	.015
6	10	.028	.013	.027	.018
10	18	.034	.016	.031	.021
18	30	.041	.020	.038	.025
30	50	.050	.025	.046	.030
50	80	.060	.030	-	-
80	120	.071	.036	-	-

Bushing O.D. Tolerances

O.D. limits for ISO/Boneham Standard Drill Bushings for Press Fit Bushings and Liners, and Renewable Bushings

ISO O.D. Bore Tolerances (mm)					
Normal O.D. Sizes (mm)		O.D. Limits for Press Fit Bushings (n6)		O.D. Limits for Renewable Bushings (m6)	
Over	Up to	High+	Low+	High+	Low+
-	3	.010	.004	.008	.002
3	6	.016	0.08	.012	.004
6	10	.019	0.10	.015	.006
10	18	.023	.012	.018	.007
18	30	.028	.015	.021	.008
30	50	.033	.017	.025	.009
50	80	.039	.020	.030	.011
80	120	.045	.023	.035	.013

Concentricity Tolerances

For ISO/Boneham Standard Drill Bushings	
Bores up to 16mm	0.008mm T.I.R max
over 16mm to 48mm	0.012mm T.I.R max
over 48mm	0.04mm T.I.R max

Counterbores

All of the standard Boneham metric drill bushings listed in this catalog are manufactured without counterbores. Our Sales Service Representatives will be glad to provide you with a quotation should you require metric drill bushings that are counterbored. Please note that if counterbored bushings are required, the concentricity tolerances outlined above apply to the exit end of the bushing.

LOCKING SCREW THREAD TOLERANCES

The screw threads on all Metric locking screws are manufactured to class 6g tolerances.

METRIC CONVERSION FACTORS

Multiply	By	To Obtain
inch	25.4	millimeter
millimeter	0.03937008	inch



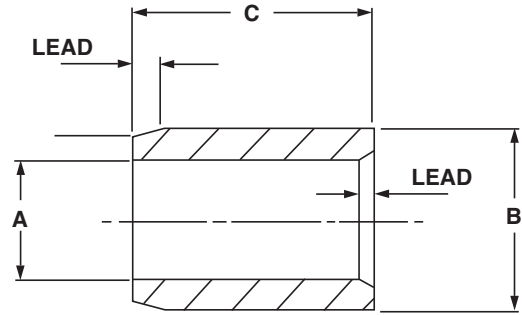
Headless Press Fit Bushings

ISO AND BMP STANDARD

WHEN ORDERING STATE:

Quantity, Symbol, Bore Size, whether for Drill or reamer.

- For general info., ordering and technical data, see pages 17-18.
- NITRALLOY Nitrided drill bushings will be quoted upon request.
- For net prices on Standard Steel bushings, please see price list.
- OUTSIDE DIAMETER FINISH GROUND TO PRESS FIT SIZE.



F7 Limits (Drills) A Dia * Limits (Reamers)		B Dia. n6 Limits	Length C and Bushing Reference					
From	Up to		Short		Long		Extra Long	
			C	Ref.	C	Ref.	C	Ref.
—	1	3	6	PP3A	9	PP3C	—	—
1.05	1.8	4	6	PP4A	9	PP4C	—	—
1.85	2.6	5	6	PP5A	9	PP5C	—	—
2.65	3.3	6	8	PP6B	12	PP6E	16	PP6F
3.4	4	7	8	PP7B	12	PP7E	16	PP7F
4.1	5	8	8	PP8B	12	PP8E	16	PP8F
5.1	6	10	10	PP10D	16	PP10F	20	PP10H
6.1	8	12	10	PP12D	16	PP12F	20	PP12H
8.1	10	15	12	PP15E	20	PP15H	25	PP15J
10.1	12	18	12	PP18E	20	PP18H	25	PP18J
12.1	15	22	16	PP22F	28	PP22K	36	PP22N
15.25	18	26	16	PP26F	28	PP26K	36	PP26N
18.25	22	30	20	PP30H	36	PP30N	45	PP30R
22.25	26	35	20	PP35H	36	PP35N	45	PP35R
26.25	30	42	25	PP42J	45	PP42R	56	PP42S
30.25	35	48	25	PP48J	45	PP48R	56	PP48S
35.50	42	55	30	PP55L	56	PP55S	67	PP55T
42.50	48	62	30	PP62L	56	PP62S	67	PP62T
48.50	55	70	30	PP70L	56	PP70S	67	PP70T
56	63	78	35	PP78M	67	PP78T	78	PP78W
64	70	85	35	PP85M	67	PP85T	78	PP85W
71	78	95	40	PP95P	78	PP95W	105	PP95Y
79	85	105	40	PP105P	78	PP105W	105	PP105Y
86	95	115	45	PP115R	89	PP115X	112	PP115Z
96	105	125	45	PP125R	89	PP125X	112	PP125Z

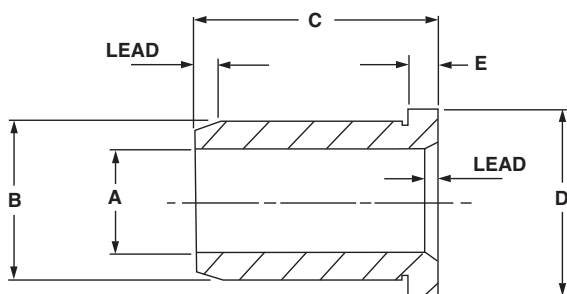
ALL DIMENSIONS IN MILLIMETERS

*See page 18 for table showing ISO Bore Tolerances of reamer bushings

Boneham Metal Products, Inc. strives to provide drill bushings that will maintain a service life consistent with their intended use, and we are always working to deliver our products in the most expeditious time frame possible

Head Press Fit Bushings

ISO AND BMP STANDARD



WHEN ORDERING STATE:

Quantity, Symbol, Bore Size, whether for Drill or Reamer.

- For general info., ordering and technical data, see pages 17-18.
- NITRALLOY Nitrided drill bushings will be quoted upon request.
- For net prices on Standard Steel bushings, please see price list.
- OUTSIDE DIAMETER FINISH GROUND TO PRESS FIT SIZE.

F7 Limits (Drills) A Dia * Limits (Reamers)		B Dia. n6 Limits	Length C and Bushing Reference						D Dia.	E Length
From	Up to		Short		Long		Extra Long			
			C	Ref.	C	Ref.	C	Ref.		
-	1	3	6	PH3A	9	PH3C	—	—	6	2
1.05	1.8	4	6	PH4A	9	PH4C	—	—	7	
1.85	2.6	5	6	PH5A	9	PH5C	—	—	8	
2.65	3.3	6	8	PH6B	12	PH6E	16	PH6F	9	2.5
3.4	4	7	8	PH7B	12	PH7E	16	PH7F	10	
4.1	5	8	8	PH8B	12	PH8E	16	PH6F	11	
5.1	6	10	10	PH10D	16	PH10F	20	PH10H	13	3
6.1	8	12	10	PH12D	16	PH12F	20	PH12H	15	
8.1	10	15	12	PH15E	20	PH15H	25	PH15J	18	
10.1	12	18	12	PH18E	20	PH18H	25	PH18J	22	4
12.1	15	22	16	PH22F	28	PH22K	36	PH22N	26	
15.25	18	26	16	PH26F	28	PH26K	36	PH26N	30	
18.25	22	30	20	PH30H	36	PH30N	45	PH30R	34	5
22.25	26	35	20	PH35H	36	PH35N	45	PH35R	39	
26.25	30	42	25	PH42J	45	PH42R	56	PH42S	46	
30.25	35	48	25	PH48J	45	PH48R	56	PH48S	52	6
35.50	42	55	30	PH55L	56	PH55S	67	PH55T	59	
42.50	48	62	30	PH62L	56	PH62S	67	PH62T	66	
48.50	55	70	30	PH70L	56	PH70S	67	PH70T	74	6
56	63	78	35	PH78M	67	PH78T	78	PH78W	82	
64	70	85	35	PH85M	67	PH85T	78	PH85W	90	
71	78	95	40	PH95P	78	PH95W	105	PH95Y	100	6
79	85	105	40	PH105P	78	PH105W	105	PH105Y	110	
86	95	115	45	PH115R	89	PH115X	112	PH115Z	120	
96	105	125	45	PH125R	89	PH125X	112	PH125Z	130	

ALL DIMENSIONS IN MILLIMETERS

*See page 18 for table showing ISO Bore Tolerances of reamer bushings

Boneham Metal Products, Inc. is committed to supplying drill bushings that meet or exceed the tolerance specifications established by our Customer, the American National Standards Institute (ANSI), and the International Standards Organisation (ISO).



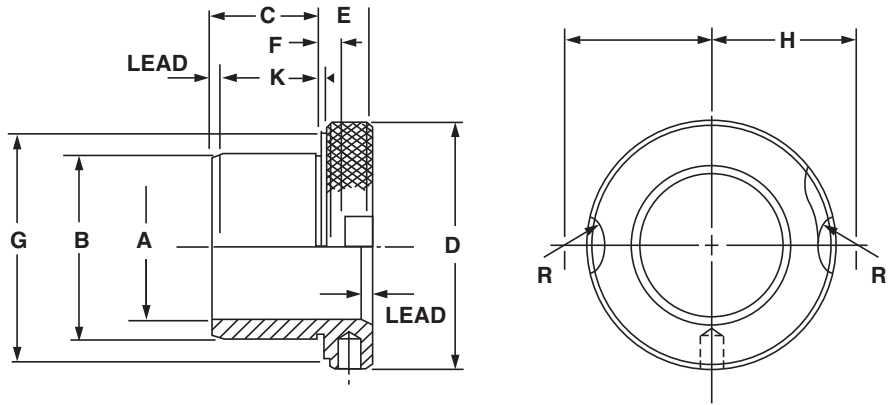
Slip-Fixed Renewable Combination Bushings

ISO AND BMP STANDARD

WHEN ORDERING STATE:

Quantity, Symbol, Bore Size, whether for Drill or Reamer.

- For general info., ordering and technical data, see pages 17-18.
- NITRALLOY Nitrided drill bushings will be quoted upon request.
- For net prices on Standard Steel bushings, please see price list.
- OUTSIDE DIAMETER FINISH GROUND FOR SLIP FIT INTO LINERS.



F7 Limits (Drills) A Dia * Limits (Reamers)		B Dia. m6 Limits	Length C and Bushing Reference						D.Dia	G Dia. +0 -0.25	E Length	F Thick- ness	K Length	H	R Rad.
From	Up to		Short		Long		Extra Long								
			C	Ref.	C	Ref.	C	Ref.							
1.0	4	8	10	RD8D	16	RD8F	-	-	15	12	8	3	11.5	7	
3.7	6	10	12	RD10E	20	RD10H	25	RD10J	18	15			13		
5.7	8	12	12	RD12E	20	RD12H	25	RD12J	22	18			16		
7.7	10	15	16	RD15F	28	RD15K	36	RD15N	26	22	10	4	18	8.5	
9.6	12	18	16	RD18F	28	RD18K	36	RD18N	30	26			20		
11.5	15	22	20	RD22H	36	RD22N	45	RD22R	34	30			23.5		
14.5	18	26	20	RD26H	36	RD26N	45	RD26R	39	35	12	5.5	26	10.5	
17.5	22	30	25	RD30J	45	RD30R	56	RD30S	46	42			29.5		
21.5	26	35	25	RD35J	45	RD35R	56	RD35S	52	46			32.5		
25.5	30	42	30	RD42L	56	RD42S	67	RD42T	59	53	16	7	36	12.5	
29	35	48	30	RD48L	56	RD48S	67	RD48T	66	60			41		
34	42	55	30	RD55L	56	RD55S	67	RD55T	74	68			45		
41	48	62	35	RD62M	67	RD62T	78	RD62W	82	76	2	2	49	12.5	
47	55	70	35	RD70M	67	RD70T	78	RD70W	90	84			53		
53	63	78	40	RD78P	78	RD78W	105	RD78Y	100	94			58		
61	70	85	40	RD85P	78	RD85W	105	RD85Y	110	104	16	7	63	12.5	
68	78	95	45	RD95R	89	RD95X	112	RD95Z	120	114			68		
76	85	105	45	RD105R	89	RD105X	112	RD105Z	130	124			73		

ALL DIMENSIONS IN MILLIMETERS

*See page 18 for table showing ISO Bore Tolerances of reamer bushings

Boneham Metal Products, Inc. solicits and welcomes any recommendations which will enable us to provide a continuous level of improved service.

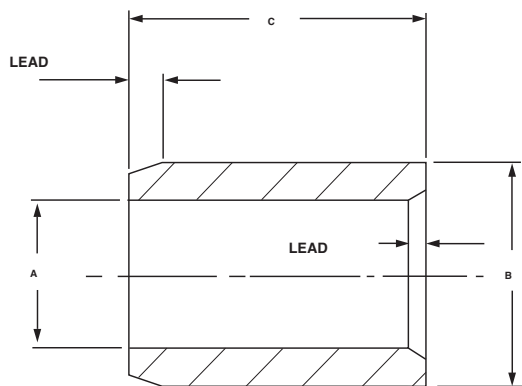
Our Sales Service Representatives are available to provide you with assistance. It is our pleasure to serve you.

Headless Liners

WHEN ORDERING STATE:

Quantity, Symbol, Bore Size, whether for Drill or Reamer.

- For general info., ordering and technical data, see pages 17-18.
- For net prices please see price list.
- **OUTSIDE DIAMETER FINISH GROUND TO PRESS FIT SIZE.**



A Dia. F7 Limits	B Dia. n6 Limits	Length C and Bushing Reference					
		Short		Long		Extra Long	
		C	Ref.	C	Ref.	C	Ref.
8	12	10	LP12D	16	LP12F	-	-
10	15	12	LP15E	20	LP15H	25	LP15J
12	18	12	LP18E	20	LP18H	25	LP18J
15	22	16	LP22F	28	LP22K	36	LP22N
18	26	16	LP26F	28	LP26K	36	LP26N
22	30	20	LP30H	36	LP30N	45	LP30R
26	35	20	LP35H	36	LP35N	45	LP35R
30	42	25	LP42J	45	LP42R	56	LP42S
35	48	25	LP48J	45	LP48R	56	LP48S
42	55	30	LP55L	56	LP55S	67	LP55T
48	62	30	LP62L	56	LP62S	67	LP62T
55	70	30	LP70L	56	LP70S	67	LP70T
62	78	35	LP78M	67	LP78T	78	LP78W
70	85	35	LP85M	67	LP85T	78	LP85W
78	95	40	LP95P	78	LP95W	105	LP95Y
85	105	40	LP105P	78	LP105W	105	LP105Y
95	115	45	LP115R	89	LP115X	112	LP115Z
105	125	45	LP125R	89	LP125X	112	LP125Z

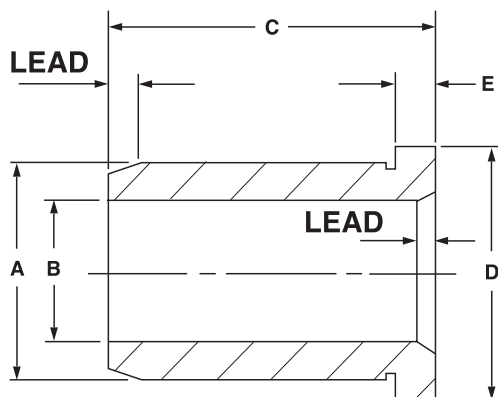
ALL DIMENSIONS IN MILLIMETERS

Head Type Liners

WHEN ORDERING STATE:

Quantity, Symbol, Bore Size, whether for Drill or Reamer.

- For general info., ordering and technical data, see pages 17-18.
- For net prices please see price list.
- **OUTSIDE DIAMETER FINISH GROUND TO PRESS FIT SIZE.**



A Dia. F7 Limits	B Dia. n6 Limits	Length C and Bushing Reference						B Dia.	E Length
		Short		Long		Extra Long			
		C	Ref.	C	Ref.	C	Ref.		
8	12	10	LH12D	16	LH12F	-	-	15	3
10	15	12	LH15E	20	LH15H	25	LH15J	18	
12	18	12	LH18E	20	LH18H	25	LH18J	22	
15	22	16	LH22F	28	LH22K	36	LH22N	26	4
18	26	16	LH26F	28	LH26K	36	LH26N	30	
22	30	20	LH30H	36	LH30N	45	LH30R	34	
26	35	20	LH35H	36	LH35N	45	LH35R	39	5
30	42	25	LH42J	45	LH42R	56	LH42S	46	
35	48	25	LH48J	45	LH48R	56	LH48S	52	
42	55	30	LH55L	56	LH55S	67	LH55T	59	6
48	62	30	LH62L	56	LH62S	67	LH62T	66	
55	70	30	LH70L	56	LH70S	67	LH70T	74	
62	78	35	LH78M	67	LH78T	78	LH78W	82	
70	85	35	LH85M	67	LH85T	78	LH85W	90	
78	95	40	LH95P	78	LH95W	105	LH95Y	100	
85	105	40	LH105P	78	LH105W	105	LH105Y	110	
95	115	45	LH115R	89	LH115X	112	LH115Z	120	
105	125	45	LH125R	89	LH125X	112	LH125Z	130	

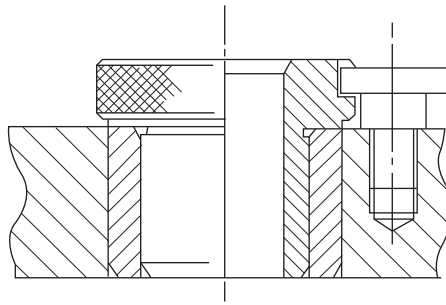
ALL DIMENSIONS IN MILLIMETERS



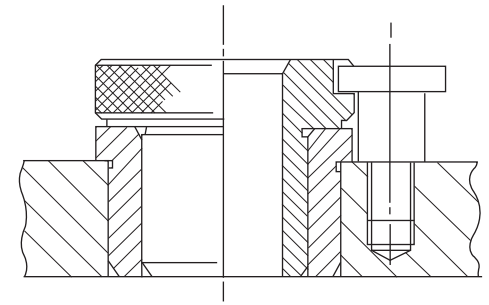
Lock Screws and Round Clamps

ISO AND BMP STANDARD

BUSHING MOUNTED IN HEADLESS LINER



BUSHING MOUNTED IN HEAD TYPE LINER



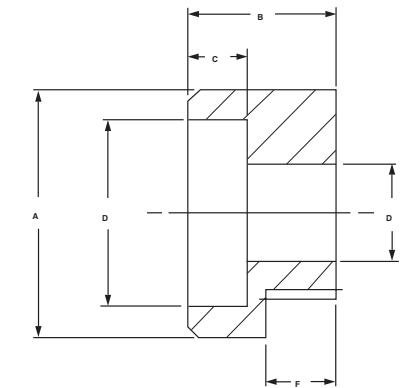
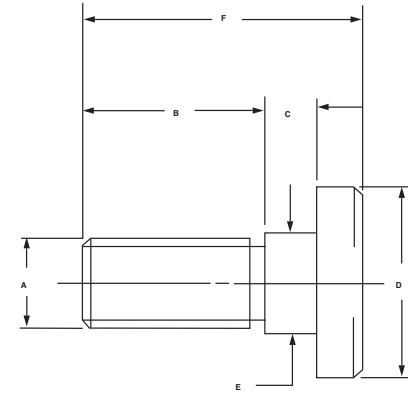
Lock Screws

WHEN BUSHING IS MOUNTED IN HEADLESS LINER

For use with Bushings	F	C	B	D	E	A	Screw Ref.
RD8 - RD10	15	3	9	13	7.5	M5	MS5
RD12 - RD18	18	4	10	16	9.5	M6	MS6
RD22 - RD42	22	5.5	11.5	20	12.0	M8	MS8
RD48 - RD105	32	7	18.5	24	15.0	M10	MS10

WHEN BUSHING IS MOUNTED IN HEAD TYPE LINER

For use with Bushings	F	C	B	D	E	A	Screw Ref.
RD8 - RD10	18	6	9	13	7.5	M5	LMS5
RD12 - RD18	22	8	10	16	9.5	M6	LMS6
RD22 - RD42	27	10.5	11.5	20	12.0	M8	LMS8
RD48 - RD105	38	13	18.5	24	15.0	M10	LMS10



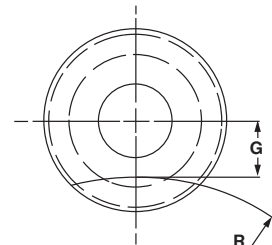
Round Clamps

WHEN BUSHING IS MOUNTED IN HEADLESS LINER

For use with Bushings	B	F	C	A	D	E	R	G	Size of Fixing Screw	Clamp Ref.
RD8 - RD10	8	3	4	13	10	5.1	9.5	3.7	M5	DMS5
RD12 - RD18	10	4	5	16	12	6.1	15	4.7	M6	DMS6
RD22 - RD42	12	5.5	5	20	15	8.1	30	6.2	M8	DMS8
RD48 - RD105	16	7	7	24	18	10.1	80	7.5	M10	DMS10

WHEN BUSHING IS MOUNTED IN HEAD TYPE LINER

For use with Bushings	B	F	C	A	D	E	R	G	Size of Fixing Screw	Clamp Ref.
RD8 - RD10	11	6	4	13	10	5.1	9.5	3.7	M5	DMS5
RD12 - RD18	14	8	5	16	12	6.1	15	4.7	M6	DMS6
RD22 - RD42	17	10.5	5	20	15	8.1	30	6.2	M8	DMS8
RD48 - RD105	22	13	7	24	18	10.1	80	7.5	M10	DMS10



ALL DIMENSIONS IN MILLIMETERS

Standard Drill Sizes and Decimal Equivalents



MILLIMETER SIZES DESIGNATED BY ■ AVAILABLE AS STANDARD

Decimal	English	mm	Decimal	English	mm	Decimal	English	mm	Decimal	English	mm	Decimal	English	mm	Decimal	English	mm	Decimal	English	mm	Decimal	English	mm	
0.0135	80	■	0.0846		2.15	0.1595	■	4.05	0.2598	■	6.60	0.3860	W		0.6299		16.00	1.0156	1-1/64		1.4075		35.75	
0.0145	79	■	0.0860	44	■	0.1610	20	■	0.2610	G	■	0.3898		9.90	0.6398		16.25	1.0236		26.00	1.4173		36.00	
0.0156	1/64	■	0.0866		2.20	0.1614	■	4.10	0.2638	■	6.70	0.3906	25/64	■	0.6406	41/64	■	1.0312	1-1/32		1.4219	1-27/64	■	
0.0160	78	■	0.0886		2.25	0.1654		4.20	0.2656	17/64	■	0.3937	■	10.00	0.6496		16.50	1.0335		26.25	1.4272		36.25	
0.0180	77	■	0.0890	43	■	0.1660	19	■	0.2657	■	6.75	0.3970	X	■	0.6562	21/32	■	1.0433		26.50	1.4370		36.50	
0.0200	76	■	0.0906	■	2.30	0.1673	■	4.25	0.2660	H	■	0.3976	■	10.10	0.6594		16.75	1.0469	1-3/64		1.4375	1-7/16	■	
0.0210	75	■	0.0925	■	2.35	0.1693	■	4.30	0.2677	■	6.80	0.4016		10.20	0.6693		17.00	1.0531		26.75	1.4469		36.75	
0.0225	74	■	0.0935	42	■	0.1695	18	■	0.2717		6.90	0.4035		10.25	0.6719	43/64	■	1.0625	1-1/16		1.4531	1-29/64	■	
0.0240	73	■	0.0937	3/32	■	0.1719	11/64	■	0.2720	I	■	0.4040	Y	■	0.6791		17.25	1.0630		27.00	1.4567		37.00	
0.0250	72	■	0.0945	■	2.40	0.1730	17	■	0.2756		7.00	0.4055	■	10.30	0.6875	11/16	■	1.0728		27.25	1.4665		37.25	
0.0260	71	■	0.0960	41	■	0.1732	■	4.40	0.2770	J	■	0.4062	13/32	■	0.6890		17.50	1.0781	1-5/64		1.4687	1-15/32	■	
0.0280	70	■	0.0965	■	2.45	0.1752	■	4.45	0.2795	■	7.10	0.4094	■	10.40	0.6988		17.75	1.0827		27.50	1.4764		37.50	
0.0292	69	■	0.0980	40	■	0.1770	16	■	0.2810	K	■	0.4130	Z	■	0.7031	45/64	■	1.0925		27.75	1.4844	1-31/64	■	
0.0310	68	■	0.0984	■	2.50	0.1772	■	4.50	0.2812	9/32	■	0.4134	■	10.50	0.7087		18.00	1.0937	1-3/32		1.4862		37.75	
0.0312	1/32	■	0.0995	39	■	0.1791	■	4.55	0.2835	■	7.20	0.4219	27/64	■	0.7185		18.25	1.1024		28.00	1.4961		38.00	
0.0320	67	■	0.1004	■	2.55	0.1800	15	■	0.2854		7.25	0.4232		10.75	0.7187	23/32	■	1.1094	1-7/64		1.5000	1-1/2	■	
0.0330	66	■	0.1015	38	■	0.1811	■	4.60	0.2874		7.30	0.4252		10.80	0.7284		18.50	1.1122		28.25	1.5059		38.25	
0.0350	65	■	0.1024	■	2.60	0.1820	14	■	0.2900	L	■	0.4291		10.90	0.7344	47/64	■	1.1220		28.50	1.5156	1.33/64	■	
0.0360	64	■	0.1040	37	■	0.1831	■	4.65	0.2913	■	7.40	0.4331		11.00	0.7382		18.75	1.1250	1-1/8		1.5158		38.50	
0.0370	63	■	0.1043	■	2.65	0.1850	13	■	0.2950	M	■	0.4370		11.10	0.7480		19.00	1.1319		28.75	1.5256		38.75	
0.0380	62	■	0.1063	■	2.70	0.1870	■	4.75	0.2953	■	7.50	0.4375	7/16	■	0.7500	3/4	■	1.1406	1-9/64		1.5312	1-17/32	■	
0.0390	61	■	0.1065	36	■	0.1875	3/16	■	0.2969	19/64	■	0.4409		11.20	0.7579		19.25	1.1417		29.00	1.5454		39.00	
0.0394		1.00	0.1083	■	2.75	0.1890	12	■	0.2992	■	7.60	0.4429		11.25	0.7656	49/64	■	1.1516		29.25	1.5453		39.25	
0.0400	60	■	0.1094	7/64	■	0.1910	11	■	0.3020	N	■	0.4488		11.40	0.7677		19.50	1.1562	1-5/32		1.5469	1-35/64	■	
0.0410	59	■	0.1100	35	■	0.1929	■	4.90	0.3032	■	7.70	0.4528		11.50	0.7776		19.75	1.1614		29.50	1.5551		39.50	
0.0413		1.05	0.1102	■	2.80	0.1935	10	■	0.3051	■	7.75	0.4531	29/64	■	0.7812	25/32	■	1.1713		29.75	1.5625	1-9/16	■	
0.0420	58	■	0.1110	34	■	0.1949	■	4.95	0.3071		7.80	0.4567		11.60	0.7874		20.00	1.1719	1-11/64		1.5650		39.75	
0.0430	57	■	0.1122	■	2.85	0.1960	9	■	0.3110		7.90	0.4606		11.70	0.7969	51/64	■	1.1811		30.00	1.5748		40.00	
0.0433		1.10	0.1130	33	■	0.1968	■	5.00	0.3125	5/16	■	0.4626		11.75	0.7972		20.25	1.1875	1-3/16		1.5781	1-37/64	■	
0.0453		1.15	0.1142	■	2.90	0.1990	8	■	0.3150	■	8.00	0.4646		11.80	0.8071		20.50	1.1910		30.25	1.5846		40.25	
0.0465	56	■	0.1160	32	■	0.2008	■	5.10	0.3160	O	■	0.4687	15/32	■	0.8125	13/16	■	1.2008		30.50	1.5937	1-19/32	■	
0.0469	3/64	■	0.1161	■	2.95	0.2010	7	■	0.3189	■	8.10	0.4724		12.00	0.8169		20.75	1.2031	1-13/64		1.5945		40.50	
0.0472		1.20	0.1181	■	3.00	0.2031	13/64	■	0.3228		8.20	0.4764		12.10	0.8268		21.00	1.2107		30.75	1.6043		40.75	
0.0492		1.25	0.1200	31	■	0.2040	6	■	0.3230	P	■	0.4803		12.20	0.8281	53/64	■	1.2187	1-7/32		1.6094	1-39/64	■	
0.0512		1.30	0.1220	■	3.10	0.2047	■	5.20	0.3248	■	8.25	0.4823		12.25	0.8366		21.25	1.2205		31.00	1.6142		44.00	
0.0520	55	■	0.1250	1/8	■	0.2055	5	■	0.3268		8.30	0.4842		12.30	0.8437	27/32	■	1.2304		31.25	1.6240		42.25	
0.0532		1.35	0.1260	■	3.20	0.2067	■	5.25	0.3281	21/64	■	0.4844	31/64	■	0.8465		21.50	1.2344	1-15/64		1.6250	1-5/8	■	
0.0550	54	■	0.1280	■	3.25	0.2087	■	5.30	0.3307	■	8.40	0.4882		12.40	0.8563		21.75	1.2402		31.50	1.6339		41.50	
0.0551		1.40	0.1285	30	■	0.2090	4	■	0.3320	Q	■	0.4921		12.50	0.8594	55/64	■	1.2500	1-1/4		31.75	1.6406	1-41/64	■
0.0571		1.45	0.1299	■	3.30	0.2126	■	5.40	0.3346	■	8.50	0.4961		12.60	0.8661		22.00	1.2598		32.00	1.6437		41.75	
0.0591		1.50	0.1339		3.40	0.2130	3	■	0.3386		8.60	0.5000	1/2	■	0.8750	7/8	■	1.2656	1-17/64		1.6535		42.00	
0.0595	53	■	0.1358		3.45	0.2165	■	5.50	0.3390	R	■	0.5020		12.75	0.8760		22.25	1.2697		32.25	1.6562	1-21/32	■	
0.0610		1.55	0.1360	29	■	0.2187	7/32	■	0.3425	■	8.70	0.5039		12.80	0.8858		22.50	1.2795		32.50	1.6634		42.25	
0.0625	1/16	■	0.1378	■	3.50	0.2205	■	5.60	0.3437	11/32	■	0.5079		12.90	0.8906	57/64	■	1.2812	1-9/32		1.6719	1-43/64	■	
0.0630		1.60	0.1398		3.55	0.2210	2	■	0.3445	■	8.75	0.5118		13.00	0.8957		22.75	1.2894		32.75	1.6732		42.50	
0.0635	52	■	0.1405	28	■	0.2244	■	5.70	0.3465	■	8.80	0.5156	33/64	■	0.9055		23.00	1.2969	1-9/64		1.6831		42.75	
0.0650		1.65	0.1406	9/64	■	0.2264		5.75	0.3480	S	■	0.5217		13.25	0.9062	29/32	■	1.2992		33.00	1.6875	1-11/16	■	
0.0669		1.70	0.1417	■	3.60	0.2280	1	■	0.3504	■	8.90	0.5312	17/32	■	0.9154		23.25	1.3090		33.25	1.6929		43.00	
0.0670	51	■	0.1437	■	3.65	0.2283	■	5.80	0.3543		9.00	0.5315		13.50	0.9219	59/64	■	1.3125	1-5/16		1.7028		43.25	
0.0689		1.75	0.1440	27	■	0.2323		5.90	0.3580	T	■	0.5413		13.75	0.9252		23.50	1.3189		33.50	1.7031	1-45/64	■	
0.0700	50	■	0.1457	■	3.70	0.2340	A	■	0.3583	■	9.10	0.5469	35/64	■	0.9350		23.75	1.3281	1-21/64		1.7126		43.50	
0.0709		1.80	0.1470	26	■	0.2344	15/64	■	0.3594	23/64	■	0.5512		14.00	0.9375	15/16	■	1.3287		33.75	1.7187	1-23/32	■	
0.0728		1.85	0.1476	■	3.75	0.2362	■	6.00	0.3622	■	9.20	0.5610		14.25	0.9449		24.00	1.3386		34.00	1.7224		43.75	
0.0730	49	■	0.1495	25	■	0.2380	B	■	0.3642		9.25	0.5625	9/16	■	0.9531	61/64	■	1.3437	1-11/32		1.7323		44.00	
0.0748		1.90	0.1496	■	3.80	0.2402	■	6.10	0.3661		9.30	0.5709		14.50	0.9547		24.25	1.3484		34.25	1.7344	1-47/64	■	
0.0760	48	■	0.1516	■	3.85	0.2420	C	■	0.3680	U	■	0.5781	37/64	■	0.9646		24.50	1.3583		34.50	1.7421		44.25	
0.0768		1.95	0.1520	24	■	0.2441	■	6.20	0.3701	■	9.40	0.5807		14.75	0.9687	31/32	■	1.3594	1-23/64		1.7500	1-3/4	■	
0.0781	5/64	■	0.1535	■	3.90	0.2460	D	■	0.3740		9.50	0.5906		15.00	0.9744		24.75	1.3681		34.75	1.7520		44.50	
0.0785	47	■	0.1540	23	■	0.2461	■																	