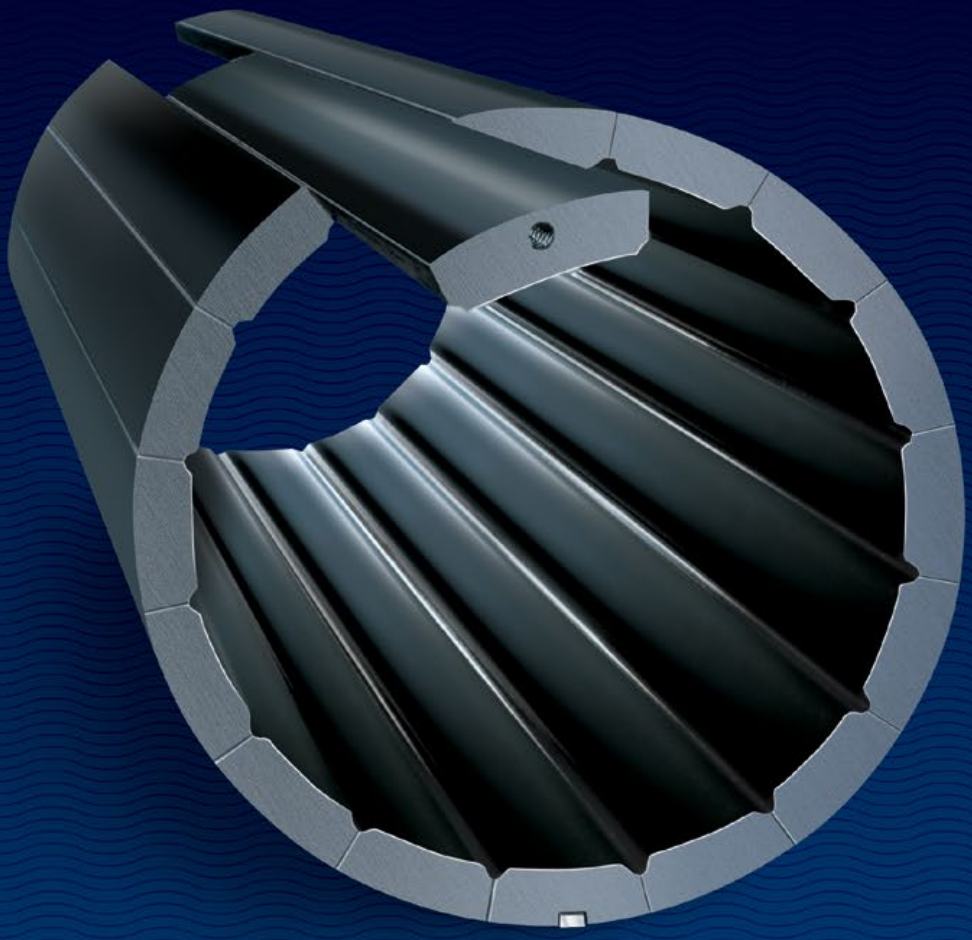
ADVANCED WATER-LUBRICATED BEARING SYSTEMS

Johnson®

Demountable Stave Bearing

- Replace staves without removing shaft
- Precision-fitted to stern tube
- Improves shaft alignment and reduces vibration



PRODUCT INFORMATION AND SELECTION GUIDE

Duramax Marine® is an ISO 9001:2015 Certified Company

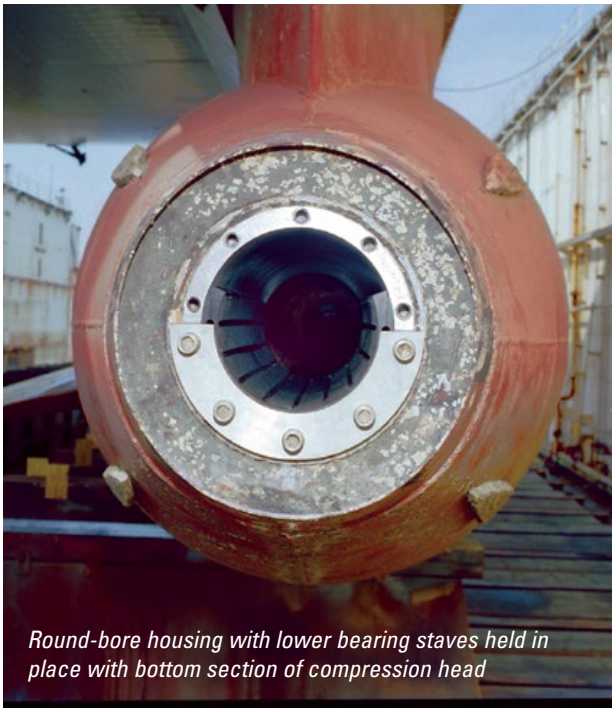
DURAMAX MARINE®

Water-lubricated, self-locking stave system for round-bore housings.

The Johnson® Demountable bearing system combines the performance of precision-fitted bearings, rugged simplicity, and inherent advantages of a rubber polymer water-lubricated system. It is made up of keystone-sided molded solid nitrile staves, precision-fitted to the stern tube housing.

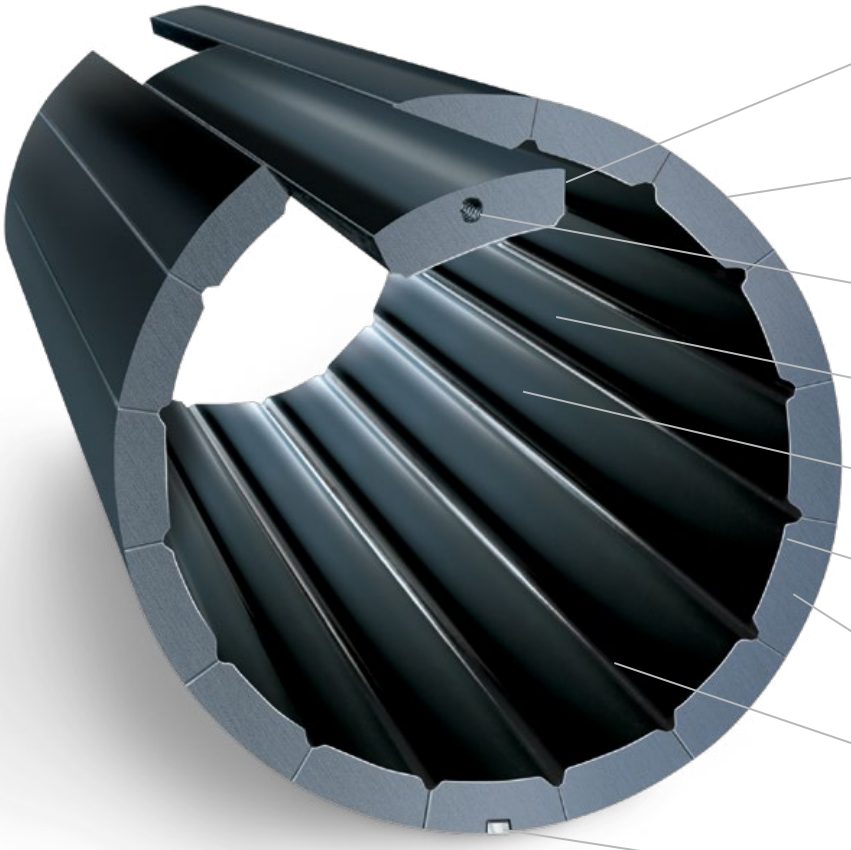
When installed, the staves form a self-locking cylindrical bearing for a round bore housing. The system provides improved water lubrication, improved shaft alignment, suppression of resonant vibration and minimizes the transfer of vibration to ship's structure.

Bearing replacement can be done safely and quickly without shaft withdrawal, saving time and money!



Round-bore housing with lower bearing staves held in place with bottom section of compression head

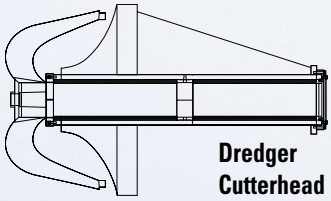
Johnson® Demountable Heavy-Duty Self-Locking Stave Bearing System.



- **Keystone sided staves** lock together forming tight frictional bond when compression force is applied
- **Cylindrical shaped stave** engineered to a prescribed clearance for optimum hydrodynamic lubrication
- **Pre-drilled hole** for self-expanding bolt used for withdrawal of staves
- **Engineered polymer compound** specially formulated for use in heavy-duty marine applications
- **Smooth rubber stave face** delivers extremely low coefficient of friction with wetted metal shaft/liner
- **Shaft sizes** can be as small as 2-1/2" to as large as 35-1/2", and larger if needed
- **Stave thickness** from 0.600" to 1.5" (Can be adjusted for shaft or liner wear)
- **Water grooves** molded into rubber allow for continuous hydrodynamic lubrication and to flush grit and abrasives away from shaft
- **Anti-Rotation bar** option is available

Benefits of Johnson® Demountable Stave Bearing.

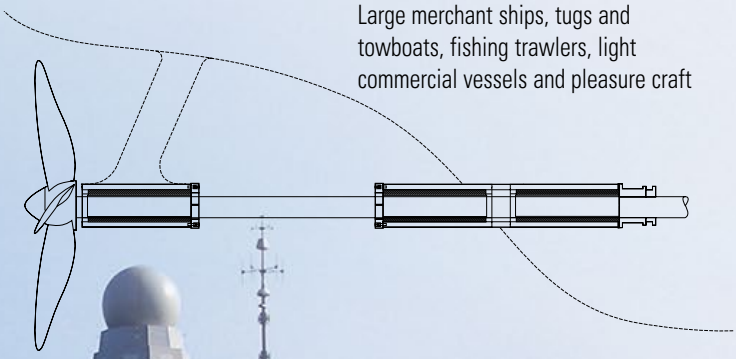
1. Optimum water-lubrication
2. Stave deflection helps improve shaft alignment
3. Extended liner life
4. Reduced mechanical vibration
5. Suppression of resonant vibration
6. Easy bearing installation/withdrawal with shaft & propeller in place
7. All bearings interchangeable throughout the shafting system
8. Housing bore is always straight never stepped
9. Bearing staves are solid precision-molded nitrile rubber
10. Self-locking bearing staves
11. Housing bore effectively sealed
12. Electrolysis substantially reduced
13. Initial cost competitive to conventional bearings-installed
14 Handling and storage problems minimized
15. Downtime due to bearing maintenance greatly minimized



Dredger
Cutterhead Systems

Propulsion Systems

Large merchant ships, tugs and towboats, fishing trawlers, light commercial vessels and pleasure craft



Johnson® Demountable System is precision fitted to shaft journal.

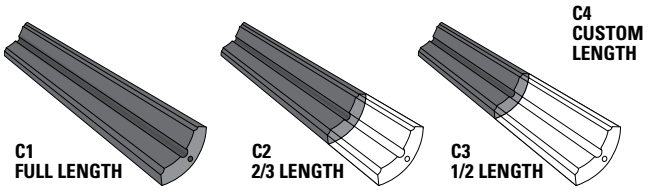
Duramax® quality control assures precision fit.

Procedures at Duramax Marine® include a complete fitting of all bearings and measurement of proper clearance before the system is packed and shipped. The ID of your Demountable System is machined to the proper dimensions. The complete bearing is then assembled in a tube of identical dimensions to those shown on your engineering drawings. The compression head is then applied to verify an accurate fit.

Finally, the bearing ID is checked for proper size. Clearances around a test shaft are measured and recorded. A copy of the pertinent data accompanies the bearing, together with installation instructions keyed to your specific installation.

Demountable Staves Available in 3 standard sizes:

Johnson demountable stave bearing lengths are normally engineered by the requirements of the application. Loading calculations for the propeller shaft on the staves are determined and the stave is typically designed to operate at 40 npsi or less. Standard stern tube stave bearing lengths will be approximately 4:1 Length/Diameter ratio. Forward stern tube bearings are typically 2:1 L/D however this is not absolute. Duramax Engineering is available anytime for support. Call +1-440-834-5400



Johnson® Demountable System carries high P.S.I. loads with low friction.

Smooth rubber bearing surface is ideal for water-lubrication.

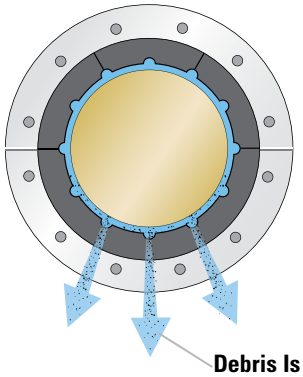
The stave of the Johnson Demountable Bearing smooth surface, the fact that rubber is one of the most slippery materials when wet, and metal journals have a high "affinity" for water and are easily "wetted", results in a very low coefficient of friction.

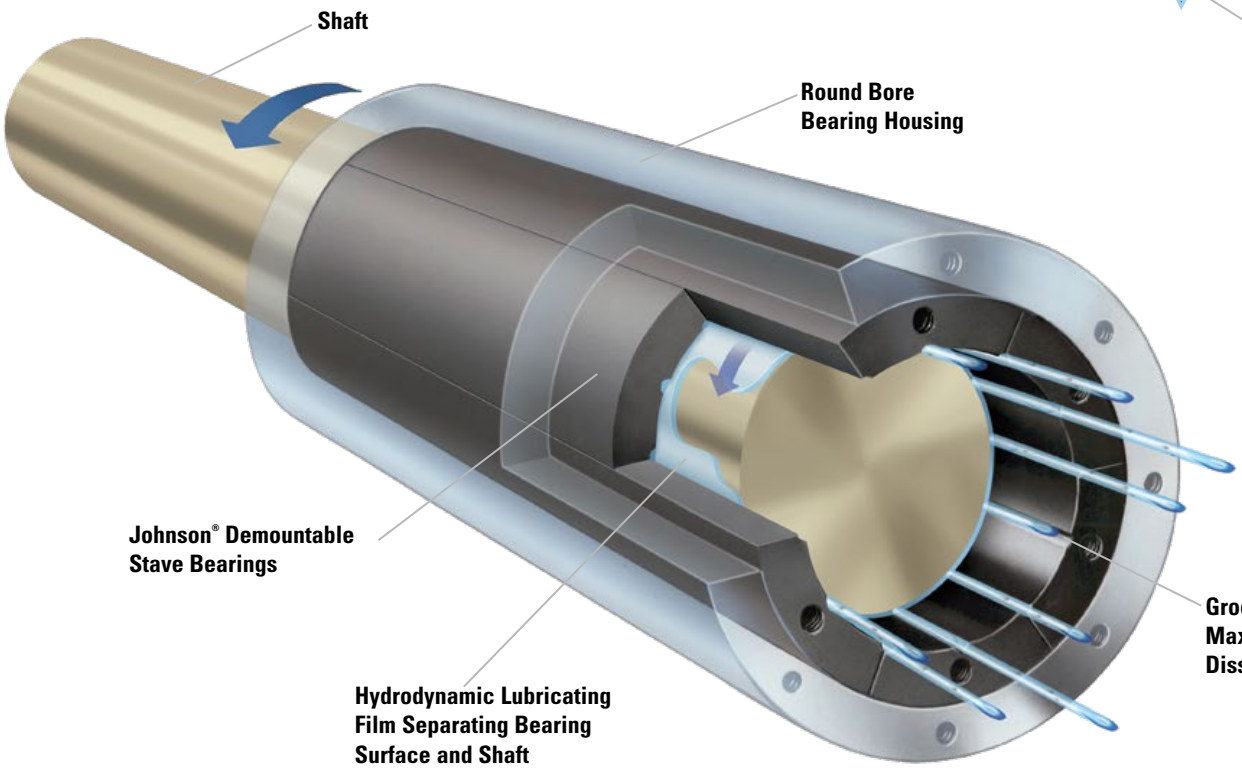
The solid Nitrile rubber staves are engineered to support relatively heavy loads, and molded longitudinal grooves allow water to pass through the entire length of the bearing continuously for a steady flow of lubrication.

Hydrodynamic design extends shaft and bearing life.

At shaft speeds in excess of 1m/sec (3.28 ft/sec) a hydrodynamic water wedge is created, separating the shaft from the bearing surface at the "Effective Area" of the bearing. A continuous hydrodynamic film of water is supplied through grooves to the sliding surfaces, minimizing frictional heat and extending wear life of the shaft and bearing.

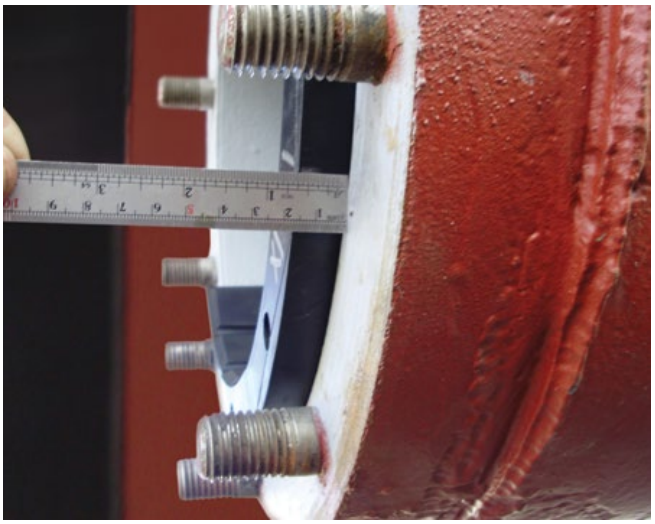
Because of the forgiving properties of the rubber stave, harmful abrasives and contaminants are pressed into stave surface, then flushed into the grooves away from shaft.





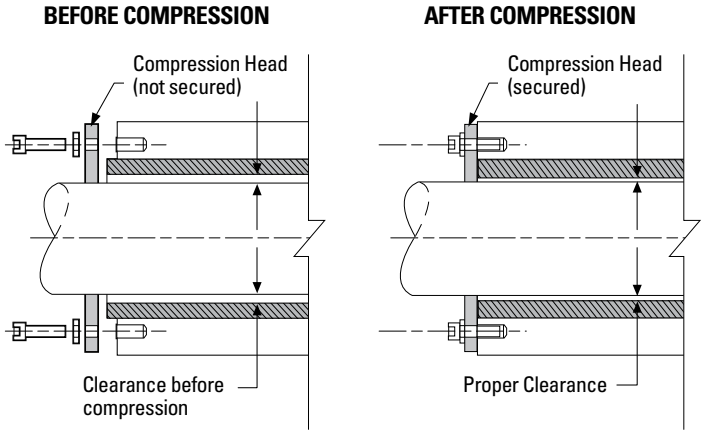
Installation and removal of the Johnson® Demountable Bearing System is simple.

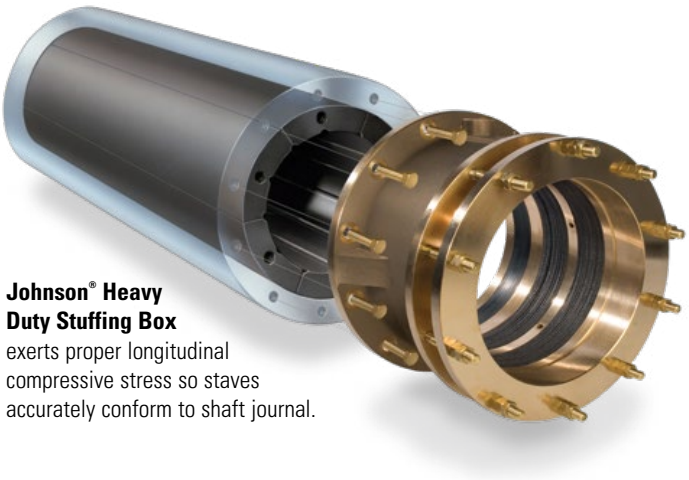
Whether it's new construction, or replacing an existing system, this engineered demountable bearing is designed for easy installation in any round bore housing, saving you time and money. A variety of sizes are readily available for v-strut, stern tube, nozzle, rudder, and cutter head dredger applications.



Installation is simple.

The "keystone" shape of the molded stave and frictional bonding will help secure bearing in the housing. You just place the staves around the inside of the round bore housing. The staves are sized to extend slightly after full insertion into housing. Once they are in place, a compression head, or stuffing box, is installed. It exerts longitudinal pressure producing a "keystone" action on the angled sides of the entire stave complement. The nitrile rubber staves undergo "controlled deformation". The molded stave is properly dimensioned to provide the correct compression force and secured bearing I.D. when in the locked position.





Johnson® Heavy Duty Stuffing Box exerts proper longitudinal compressive stress so staves accurately conform to shaft journal.

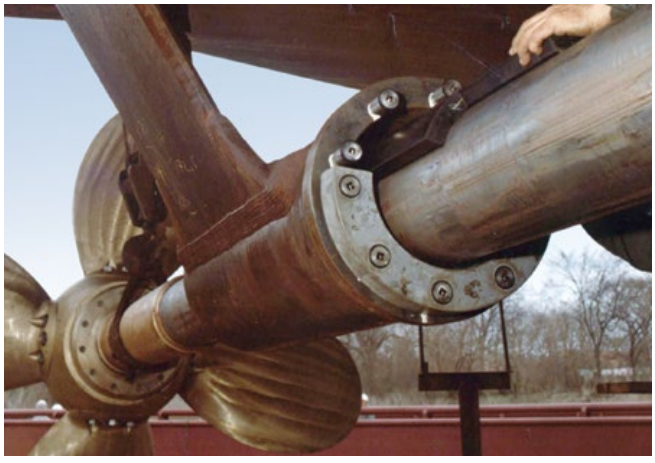
Two 180° compression heads exert proper longitudinal compressive stress so staves accurately conform to shaft journal.

Inspection of bearing clearance tolerances is recommended for optimal performance.

Although the bearing may appear to be in good condition, lubrication might be weakened due to bearing surface conditions, while alignment and vibration might also be adversely affected. If excessive bearing clearance is allowed without correction, eventually misalignment and vibration will become intolerable, and journal will wear.

Easy inspection and replacement without pulling the shaft or propeller.

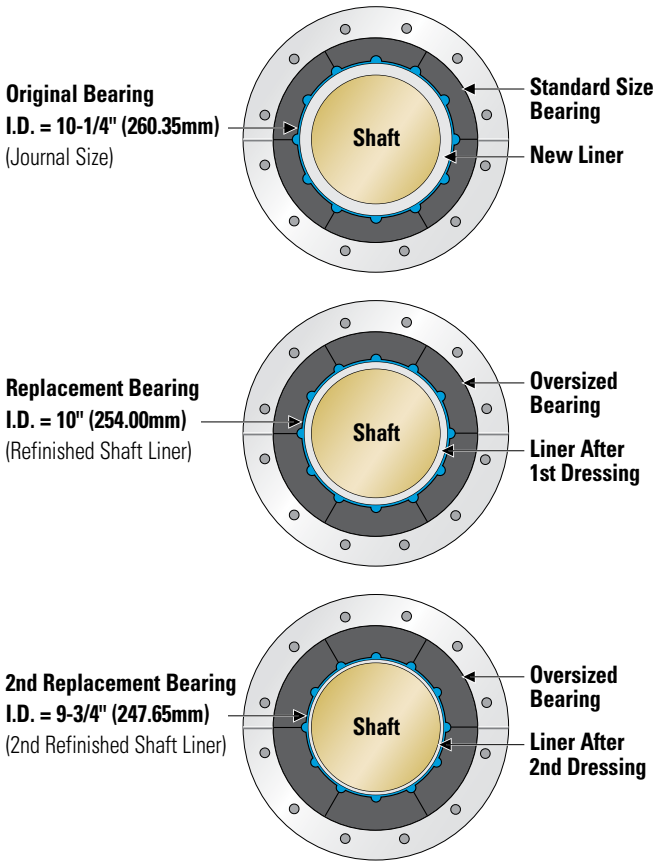
Remove the compression head or stuffing box to release the locking force on the staves. Then insert a self-expanding eye bolt into the threaded hole in a top stave and pull out the top stave. After the stave is removed and the original side clearance of the staves is regained sufficiently you can easily remove the rest of the upper staves longitudinally. Jack up tail shaft and propeller to release static load on lower staves for removal.



Two replacement sizes are available to maintain proper clearance.

Johnson® Demountable Precision Fitted Staves come in 3 different I.D./Journal sizes for every basic housing bore. We provide the original bearing size precision fitted to journal, along with two replacement sizes in larger increments to fit a refinished shaft liner, extending the life of a shaft liner.

EXAMPLE OF TYPICAL STAVE REPLACEMENTS:



Installation Procedure

NEW INSTALLATION

1. **Check if housing ID, housing length and shaft OD are identical** to Dimensional Data or to specific drawing.
2. **Check if housing is clean.** *(Fig. 1)*
3. **Insert rubber staves in the lower half of the bearing housing** (you will notice that the staves are longer than the housing. This is correct.). Lubricate the running surface of the staves; see "note and warning". *(Fig. 2)*
4. **Install the lower compression head half** and tighten bolts lightly. *(Fig. 3)*
5. **Carefully install and position the shaft** (upper half of bearing is not yet in place, providing ample clearance for moving and positioning the shaft). *(Fig. 4)*
6. **Insert upper half staves.** Lubricate stave surfaces and the sides of the last stave with liquid dish soap to obtain an easier fit of the last stave. DO NOT LUBRICATE THE BACKS OF THE STAVES. The last stave may need to be fitted with the help of a wooden mallet. *(Fig. 5)*
7. **Install the upper compression head half** and tighten the bolts lightly. *(Fig. 6)*
8. **Jack up the shaft** to press against the upper half staves so the positive setting is obtained.
9. **Tighten all bolts** using a torque pattern.
10. **Lower shaft.**
11. **Measure clearances between shaft and the bearing** by means of long feeler gauges and record the data.

NOTE: *Lubricate the running surface of the staves only and also the sides of the last stave. NEVER lubricate the back of the staves or the inside of the housing. Glycerin or a soap based lubricant is preferred. Do not use grease as this may clog the water grooves.*

WARNING: *Although the rubber is oil resistant, NEVER use oil or grease as a lubricant. It will contaminate the system and the environment. Keep each set of bearings strictly as a set; do not mix! Each set is individually matched. Install each set in number sequence as indicated on one end of the bearing staves.*

REPLACEMENT PROCEDURE

1. **Remove bolts and compression heads.**
2. **Insert an eyebolt with coarse thread** or a self-expanding bolt in the hole of one of the upper staves. The first stave can be withdrawn with the help of a pulley and the remaining staves can easily be withdrawn by hand.
3. **Jack up the shaft** in order to withdraw the lower staves.
4. **Clean the shaft and housing properly**. REMOVE ALL DIRT, RUST AND SCALE.
5. **Insert rubber staves in the lower half of the bearing housing**. You will notice that the staves are longer than the housing. This is correct. DO NOT CUT THE STAVES. Lubricate the running surface of the staves. (see note/warning)
6. **Install the lower compression head half** and tighten the bolts lightly.
7. **Lower the shaft and insert new staves in the upper half of the bearing**. Lubricate the stave surfaces and the sides of the last stave.
8. **Install the upper compression head half** and tighten bolts lightly.
9. **Jack up the shaft** to press against the upper half staves so that the positive setting is obtained.
10. **Tighten all bolts** using a torque pattern.
11. **Lower the shaft.**
12. **Measure clearances between the shaft and the bearing** by means of long feeler gauges and record data.

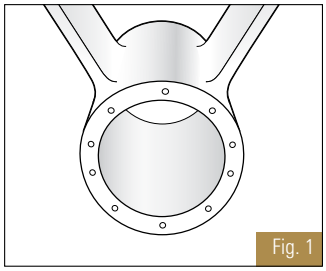


Fig. 1

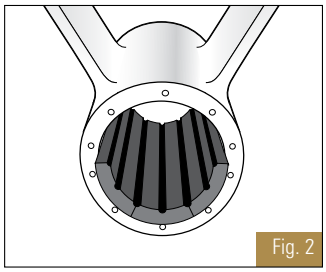


Fig. 2

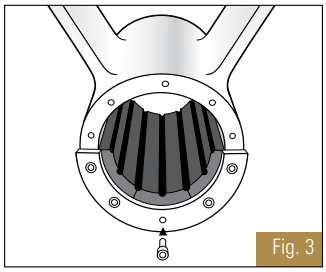


Fig. 3

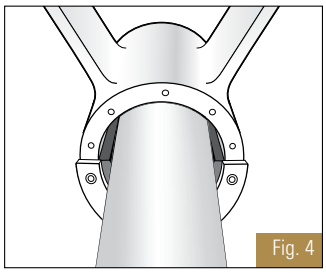


Fig. 4

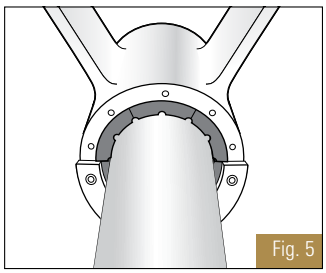


Fig. 5

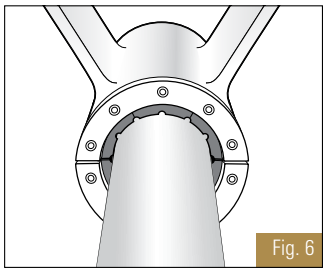


Fig. 6

General Product Information And Specifications

ORDERING INFORMATION

1. Dimensions: All mm dimensions are exact conversions of inch dimensions. All parts furnished in inch dimension.

2. Surfaces: All surfaces indicated (f) are 125 R.M.S.

3. Lengths: C1 bearing length over 60 inches (1524.00mm) consists of two 1/2-length staves. C1 bearing length over 125 inches (3175.00mm) consists of three 1/3-length staves.

Bearing stave length code:

C1 = full length
C2 = 2/3-length
C3 = 1/2-length
C4 = custom length. See pages 18-19

COMPRESSION HEAD AND RETAINER RING INFORMATION

4. Securing Bearing Staves

Bearing staves are secured in position by longitudinal compressive force applied against the end of the staves. Secured bearing stave length + amount of compression = unsecured bearing stave length.

NOTE: Duramax Marine® LLC determines the correct amount of compression to secure stave into the housing.

5. Determining Thickness of Retainer Ring

O.D. Shaft or Sleeve Journal		Thickness of Retainer Ring	
inch	mm	inch	mm
Up to 7-1/4	Up to 184.15	3/4	19.05
7-1/2 – 15	190.50 – 381.00	1	25.40
15-1/4 – 24	387.35 – 609.60	1-1/4	31.75
24-1/4 – 36	615.95 – 914.40	1-1/2	38.10

NOTE: I. D. of Compression Head and Retaining Ring must be concentric with housing bore within 1/32 of an inch (.794 mm) for journals up through 12-1/2 inches (317.500 mm). For larger journals, concentricity must be within 1/16 inch (1.588 mm).

LUBRICATION FLOW

6. Normal lubricating water flow

Normal water flow through the bearing is 2 GPM per inch of shaft diameter at 5-7 PSI greater than static head pressure at the bearing.

INSTALLING COMPRESSION HEAD

7. Drilling Bearing Housing

Compression head and/or stuffing box is recommended to be used as drill jig for stud location on bearing housing. Maintain .050/.060 inches (1.27/1.52mm) clearance between compression head halves.

BEARING STAVE REMOVAL

8. Stave Drilling Specifications

Self tapping eye bolt is recommended to be used for withdrawal of staves. Staves are drilled on one end only. Drilled end must face the installer.

O.D. Shaft or Sleeve Journal		Drill Hole Diameter		Drill Hole Depth	
inch	mm	inch	mm	inch	mm
Up to 4-1/2	Up to 114.300	1/4	6.350	1	25.400
4-3/4 – 7-1/4	120.650-184.150	3/8	9.525	1-1/4	31.750
7-1/2 – 9-1/2	190.500-241.300	1/2	12.700	1-1/2	38.100
9-3/4 – 14	247.650-355.601	5/8	15.875	2-1/4	57.150
14-1/4 & over	361.951 & Over	3/4	19.050	2-1/4	57.150

HOUSING BORE TOLERANCES

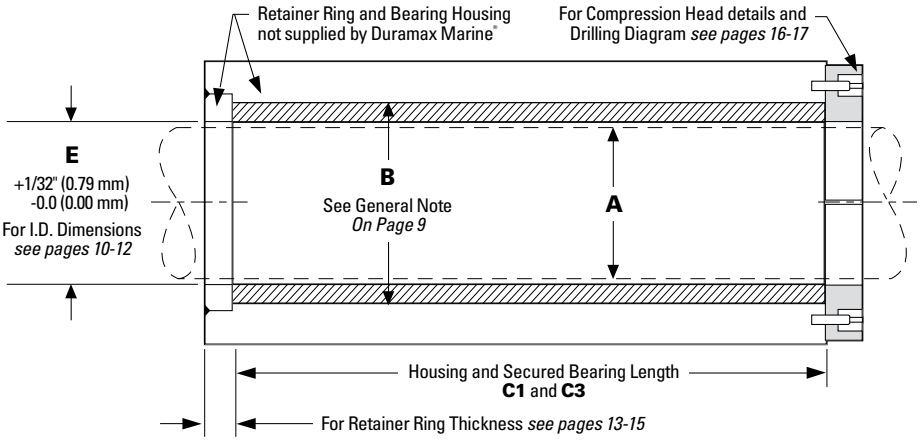
9. Use Table To Determine Tolerance

O.D. Shaft or Sleeve Journal		Housing Bore Tolerance (Bearing O.D.)	
inch	mm	inch	mm
Up to 4-1/2	Up to 114.300	+.003 -.000	+.076 -.000
4-3/4 – 7-1/4	120.650-184.150	+.005 -.000	+.127 -.000
7-1/2 – 9-1/2	190.500-241.300	+.008 -.000	+.203 -.000
9-3/4 & over	247.650 & Over	+.010 -.000	+.254 -.000

Johnson

Demountable Rubber Stave Bearing Dimensions

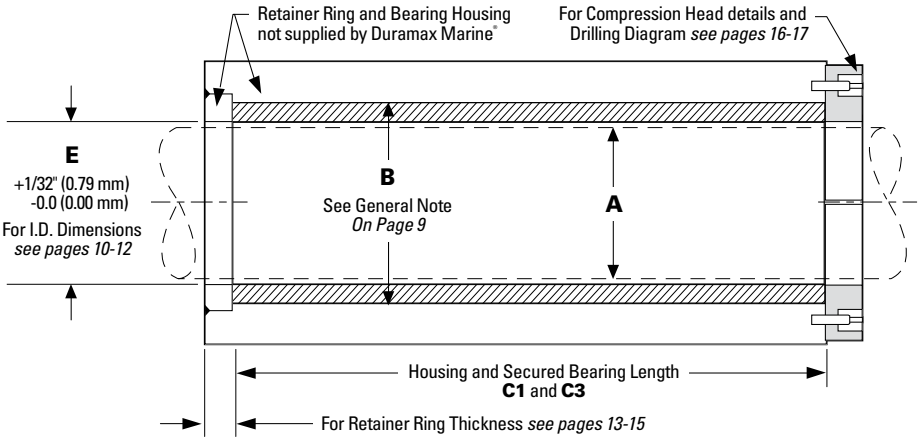
2-1/2" thru **14-3/4"** O.D. Shaft or Sleeve



A		Bearing Code Size	B		C1		C2		C3		Normal Shaft Clearance (Secured Bearing)	
O.D. Shaft Or Sleeve			Housing Bore (Bearing O.D.)		Housing/Secured Bearing (Full Length)		Housing/Secured Bearing (2/3 Length)		Housing/Secured Bearing (Half Length)			
inch	mm		inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
2-1/2	63.5-	L-0212-0312 x 4	3.5-	88.9-	10	254.-1	-	-	5	127.001	.012 -.023	.305 - .584
3 3-1/2	76.200 88.900	L-0300-0412 x 4 L-0312-0412 x 4	4.500	114.300	14	355.601	-	-	7	177.801	.012 -.023	.305 - .584
4 4-1/4	101.600 107.950	L-0400-0512 x 4 L-0414-0512 x 4	5.500	139.701	17	431.802	-	-	8-1/2	215.901	.015 -.024	.381 - .610
4-1/2 4-3/4	114.300 120.650	L-0412-0618 x 4 L-0434-0618 x 4	6.125	155.576	19	482.602	-	-	9-1/2	241.301	.015 -.024	.381 - .610
5 5-1/4	127.001 133.351	L-0500-0612 x 4 L-0514-0612 x 4	6.500	165.101	21	533.402	-	-	10-1/2	266.701	.018 -.030	.457 - .762
5-1/2 5-3/4	139.701 146.051	L-0512-0712 x 4 L-0534-0712 x 4	7.500	190.501	23	584.202	-	-	11-1/2	292.101	.018 -.030	.457 - .762
6 6-1/4	152.401 158.751	L-0600-0800 x 6 L-0614-0800 x 6	8.000	203.201	25	635.003	-	-	12-1/2	317.501	.018 -.030	.457 - .762
6-1/2 6-3/4	165.101 171.451	L-0612-0812 x 6 L-0634-0812 x 6	8.500	215.901	27	685.803	-	-	13-1/2	342.901	.018 -.030	.457 - .762
7 7-1/4	177.801 184.151	L-0700-0914 x 6 L-0714-0914 x 6	9.250	234.951	29	736.603	-	-	14-1/2	368.301	.020 -.032	.508 - .813
7-1/2 7-3/4 8	190.501 196.851 203.201	L-0712-1014 x 6 L-0734-1014 x 6 L-0800-1014 x 6	10.250	260.351	32	812.803	-	-	16	406.402	.020 -.034	.508 - .864
8-1/4 8-1/2 8-3/4	209.551 215.901 222.251	L-0814-1100 x 8 L-0812-1100 x 8 L-0834-1100 x 8	11.000	279.401	35	889.004	-	-	17-1/2	444.502	.020 -.034	.508 - .864
9 9-1/4 9-1/2	228.601 234.951 241.301	L-0900-1134 x 8 L-0914-1134 x 8 L-0912-1134 x 8	11.750	298.451	38	965.204	-	-	19	482.602	.022 -.038	.559 - .965
9-3/4 10 10-1/4	247.651 254.001 260.351	L-0934-1234 x 8 L-1000-1234 x 8 L-1014-1234 x 8	12.750	323.851	41	1041.404	-	-	20-1/2	520.702	.024 -.040	.609 -1.016
10-1/2 10-3/4 11	266.701 273.051 279.401	L-1012-1334 x 10 L-1034-1334 x 10 L-1100-1334 x 10	13.750	349.251	44	1117.604	-	-	22	558.802	.026 -.042	.660 -1.067
11-1/4 11-1/2 11-3/4	285.751 292.101 298.451	L-1114-1412 x 10 L-1112-1412 x 10 L-1134-1412 x 10	14.500	368.301	47	1193.805	-	-	23-1/2	596.902	.026 -.042	.660 -1.067
12 12-1/4 12-1/2	304.801 311.151 317.501	L-1200-1512 x 10 L-1214-1512 x 10 L-1212-1512 x 10	15.500	393.702	50	1270.005	-	-	25	635.003	.027 -.043	.686 -1.092
12-3/4 13 13-1/4	323.851 330.201 336.551	L-1234-1614 x 10 L-1300-1614 x 10 L-1314-1614 x 10	16.250	412.752	53	1346.205	-	-	26-1/2	673.103	.028 -.044	.711 -1.178
13-1/2 13-3/4 14	342.901 349.251 355.601	L-1312-1714 x 10 L-1334-1714 x 10 L-1400-1714 x 10	17.250	438.152	56	1422.406	-	-	28	711.203	.029 -.045	.737 -1.143
14-1/4 14-1/2 14-3/4	361.951 368.301 374.651	L-1414-1814 x 10 L-1412-1814 x 10 L-1434-1814 x 10	18.250	463.552	59	1498.606	-	-	29-1/2	749.303	.029 -.045	.737 -1.143

Demountable Rubber Stave Bearing Dimensions

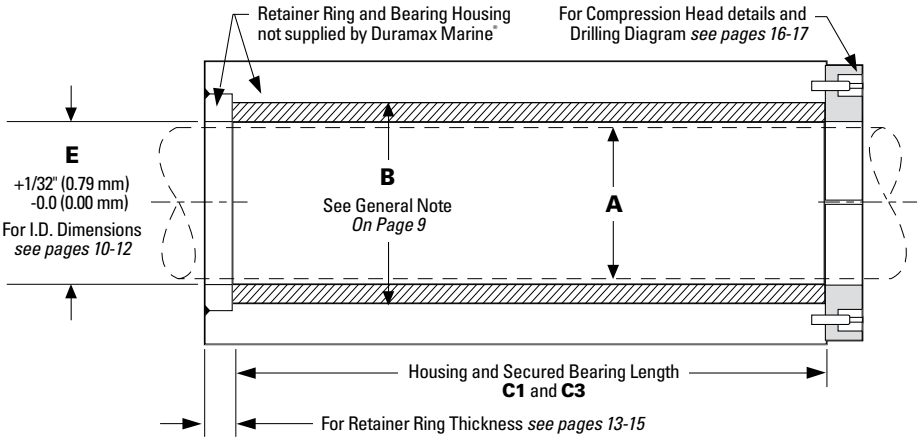
15" thru **26"** O.D. Shaft or Sleeve



A		Bearing Code Size	B		C1		C2		C3		Normal Shaft Clearance (Secured Bearing)	
O.D. Shaft Or Sleeve			Housing Bore (Bearing O.D.)		Housing/Secured Bearing (Full Length)		Housing/Secured Bearing (2/3 Length)		Housing/Secured Bearing (Half Length)			
inch	mm		inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
15	381.002	L-1500-1900 x 10										
15-1/4	387.352	L-1514-1900 x 10	19.000	482.602	62	1574.81	41	1041	31	787.403	.030-.046	.762 -1.168
15-1/2	393.702	L-1512-1900 x 10										
15-3/4	400.052	L-1534-2000 x 10										
16	406.402	L-1600-2000 x 10	20.000	508.002	65	1651.01	43	1092	32-1/2	825.503	.032-.048	.813 -1.219
16-1/4	412.752	L-1614-2000 x 10										
16-1/2	419.102	L-1612-2012 x 10										
16-3/4	425.452	L-1634-2012 x 10	20.500	520.702	68	1727.21	45	1043	34	863.603	.035-.050	.838 -1.270
17	431.802	L-1700-2012 x 10										
17-1/4	438.152	L-1714-2114 x 10										
17-1/2	444.502	L-1712-2114 x 10	21.250	539.752	71	1803.41	47	1194	35-1/2	901.704	.035-.050	.838 -1.270
17-3/4	450.852	L-1734-2114 x 10										
18	457.202	L-1800-2200 x 10										
18-1/4	463.552	L-1814-2200 x 10	22.000	558.802	74	1879.61	49	1245	37	939.804	.036-.052	.914 -1.321
18-1/2	469.902	L-1812-2200 x 10										
18-3/4	476.252	L-1834-2234 x 10										
19	482.602	L-1900-2234 x 10	22.750	577.852	77	1955.81	51	1295	38-1/2	977.904	.038-.054	.965 -1.372
19-1/4	488.952	L-1914-2234 x 10										
19-1/2	495.302	L-1912-2312 x 10										
19-3/4	501.652	L-1934-2312 x 10	23.500	596.902	80	2032.01	53	1346	40	1016.004	.040-.056	1.016 -1.422
20	508.002	L-2000-2312 x 10										
20-1/4	514.352	L-2014-2414 x 10										
20-1/2	520.702	L-2012-2414 x 10	24.250	615.952	83	2108.21	55	1397	41-1/2	1054.104	.040-.056	1.016 -1.422
20-3/4	527.052	L-2034-2414 x 10										
21	533.402	L-2100-2500 x 10										
21-1/4	539.752	L-2114-2500 x 10	25.000	635.003	86	2184.41	57	1488	43	1092.204	.043-.060	1.092 -1.524
21-1/2	546.102	L-2112-2500 x 10										
21-3/4	552.452	L-2134-2534 x 10										
22	558.802	L-2200-2534 x 10	25.750	654.053	89	2260.61	59	1499	44-1/2	1130.304	.044-.062	1.118 -1.575
22-1/4	565.152	L-2214-2534 x 10										
22-1/2	571.502	L-2212-2612 x 10										
22-3/4	577.852	L-2234-2612 x 10	26.500	673.103	92	2336.81	61	1549	46	1168.405	.047-.065	1.194 -1.651
23	584.202	L-2300-2612 x 10										
23-1/4	590.552	L-2314-2714 x 10										
23-1/2	596.902	L-2312-2714 x 10	27.250	692.153	95	2413.01	63	1600	47-1/2	1206.505	.047-.065	1.194 -1.651
23-3/4	603.252	L-2334-2714 x 10										
24	609.602	L-2400-2800 x 10										
24-1/4	615.952	L-2414-2800 x 10	28.000	711.203	98	2489.21	65	1651	49	1244.605	.048-.066	1.219 -1.676
24-1/2	622.302	L-2412-2800 x 10										
24-3/4	628.652	L-2434-2834 x 10										
25	635.003	L-2500-2834 x 10	28.750	730.253	101	2565.41	67	1702	50-1/2	1282.705	.051-.069	1.295 -1.753
25-1/4	641.353	L-2514-2834 x 10										
25-1/2	647.703	L-2512-2912 x 10										
25-3/4	654.053	L-2534-2912 x 10	29.500	749.303	104	2641.61	69	1753	52	1320.805	.052-.070	1.321 -1.778
26	660.403	L-2600-2912 x 10										

Demountable Rubber Stave Bearing Dimensions

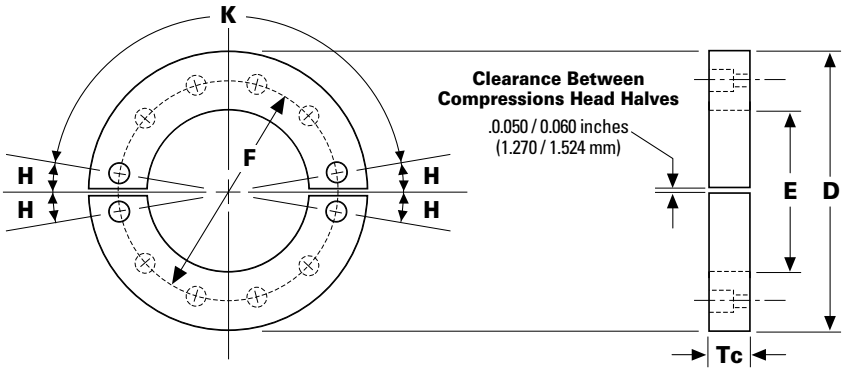
26-1/4" thru **35-3/4"** O.D. Shaft or Sleeve



A		Bearing Code Size	B		C1		C2		C3		Normal Shaft Clearance (Secured Bearing)	
O.D. Shaft Or Sleeve			Housing Bore (Bearing O.D.)		Housing/Secured Bearing (Full Length)		Housing/Secured Bearing (2/3 Length)		Housing/Secured Bearing (Half Length)			
inch	mm		inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
26-1/4	666.753	L-2614-3014 x 10										
26-1/2	673.103	L-2612-3014 x 10	30.250	768.353	107	2717.81	71	1803	53-1/2	1358.91	.052 -.070	1.321 -1.778
26-3/4	679.453	L-2634-3014 x 10										
27	685.803	L-2700-3100 x 10										
27-1/4	692.153	L-2714-3100 x 10	31.000	787.403	110	2794.01	73	1854	55	1397.01	.055 -.073	1.397 -1.854
27-1/2	698.503	L-2712-3100 x 10										
27-3/4	704.853	L-2734-3134 x 10										
28	711.203	L-2800-3134 x 10	31.750	806.453	113	2870.21	75	1905	56-1/2	1435.11	.056 -.074	1.422 -1.880
28-1/4	717.553	L-2814-3134 x 10										
28-1/2	723.903	L-2812-3212 x 10										
28-3/4	730.253	L-2834-3212 x 10	32.500	825.503	116	2946.41	77	1956	58	1473.21	.059 -.077	1.499 -1.956
29	736.603	L-2900-3212 x 10										
29-1/4	742.953	L-2914-3314 x 10										
29-1/2	749.303	L-2912-3314 x 10	33.250	844.553	119	3022.61	79	2007	59-1/2	1511.31	.059 -.077	1.499 -1.956
29-3/4	755.653	L-2934-3314 x 10										
30	762.003	L-3000-3400 x 12										
30-1/4	768.353	L-3014-3400 x 12	34.000	863.603	122	3098.81	81	2057	61	1549.41	.060 -.080	1.524 -2.032
30-1/2	774.703	L-3012-3400 x 12										
30-3/4	781.053	L-3034-3434 x 12										
31	787.403	L-3100-3434 x 12	34.750	882.653	125	3175.01	83	2108	62-1/2	1587.51	.063 -.083	1.600 -2.108
31-1/4	793.753	L-3114-3434 x 12										
31-1/2	800.103	L-3112-3512 x 12										
31-3/4	806.453	L-3134-3512 x 12	35.500	901.704	128	3251.21	85	2159	64	1625.61	.064 -.084	1.626 -2.134
32	812.803	L-3200-3512 x 12										
32-1/4	819.153	L-3214-3614 x 12										
32-1/2	825.503	L-3212-3614 x 12	36.250	920.754	131	3327.41	87	2210	65-1/2	1663.71	.064 -.084	1.626 -2.134
32-3/4	831.853	L-3234-3614 x 12										
33	838.203	L-3300-3700 x 12										
33-1/4	844.553	L-3314-3700 x 12	37.000	939.804	134	3403.61	89	2261	67	1701.81	.067 -.087	1.702 -2.210
33-1/2	850.903	L-3312-3700 x 12										
33-3/4	857.253	L-3334-3734 x 12										
34	863.603	L-3400-3734 x 12	37.750	958.854	137	3479.81	91	2311	68-1/2	1739.91	.068 -.088	1.727 -2.235
34-1/4	869.953	L-3414-3734 x 12										
34-1/2	876.303	L-3412-3812 x 12										
34-3/4	882.653	L-3434-3812 x 12	38.500	977.904	140	3556.01	93	2362	70	1778.01	.071 -.091	1.803 -2.311
35	889.004	L-3500-3812 x 12										
35-1/4	895.354	L-3514-3914 x 12										
35-1/2	901.704	L-3512-3914 x 12	39.250	996.954	143	3632.21	95	2413	71-1/2	1816.11	.071 -.091	1.803 -2.311
35-3/4	908.054	L-3534-3914 x 12										

Compression Head Dimensions

2-1/2" thru **14-3/4"** O.D. Shaft or Sleeve



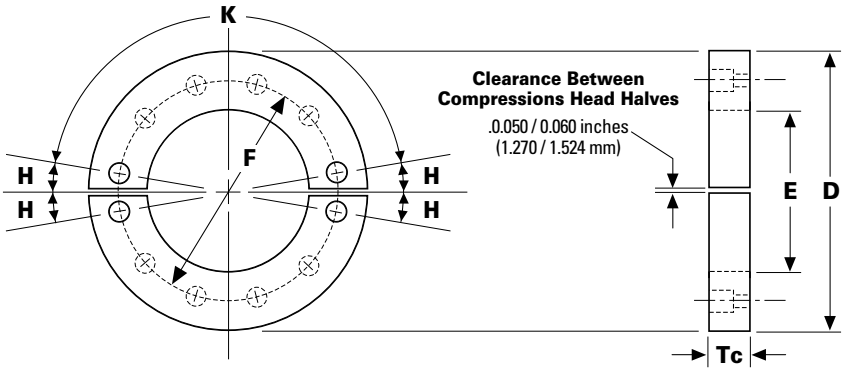
NOTE: I.D. of Compression Head and Retaining Ring must be concentric with housing bore within 1/32 inch (0.0794mm) for journals up through 12-1/2 inches (317.500 mm). For larger journals, concentricity must be within 1/16 inch (1.588 mm)

A		D		E		F		Tc		DEG. SYM. ABOUT CENTER LINE	NUMBER OF HOLES EQUALLY SPACED
O.D. Shaft Or Sleeve		Outside Diameter		Inside Diameter		Bolt Circle Diameter		Thickness		Bolt Hole Location (Compression Head Half)	
inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	H	K
2-1/2	63.500	6.000	152.401	2.813	71.450	4.438	112.726	1.000	25.400	--	4
3 3-1/2	76.200 88.900	7.000	177.801	4.000	101.600	5.438	138.126	1.000	25.400	15	3
4 4-1/4	101.600 107.950	8.000	203.201	4.875	123.825	6.438	163.526	1.000	25.400	15	3
4-1/2 4-3/4	114.300 120.650	8.625	219.076	5.375	136.526	7.063	179.401	1.000	25.400	15	3
5 5-1/4	127.001 133.351	9.000	228.601	5.875	149.226	7.438	188.926	1.500	38.100	10	3
5-1/2 5-3/4	139.701 146.051	10.000	254.001	6.375	161.926	8.438	214.326	1.500	38.100	10	3
6 6-1/4	152.401 158.751	10.500	266.701	6.875	174.626	8.938	227.026	1.500	38.100	15	4
6-1/2 6-3/4	165.101 171.451	11.000	279.401	7.375	187.326	9.438	239.726	1.500	38.100	10	5
7 7-1/4	177.801 184.151	12.250	311.151	7.875	200.026	10.375	263.526	2.125	53.975	10	5
7-1/2 7-3/4 8	190.501 196.851 203.201	13.250	336.551	8.625	219.076	11.375	288.926	2.125	53.975	10	5
8-1/4 8-1/2 8-3/4	209.551 215.901 222.251	14.000	355.601	9.375	238.126	12.125	307.976	2.125	53.975	10	5
9 9-1/4 9-1/2	228.601 234.951 241.301	15.750	400.052	10.125	257.176	13.250	336.551	2.750	69.850	10	5
9-3/4 10 10-1/4	247.651 254.001 260.351	16.750	425.452	10.875	276.226	14.250	361.951	2.750	69.850	10	5
10-1/2 10-3/4 11	266.701 273.051 279.401	17.750	450.852	11.875	301.626	15.250	387.352	2.750	69.850	10	5
11-1/4 11-1/2 11-3/4	285.751 292.101 298.451	18.500	469.902	12.375	314.326	16.000	406.402	2.750	69.850	10	5
12 12-1/4 12-1/2	304.801 311.151 317.501	19.500	495.302	13.375	339.726	17.000	431.802	2.750	69.850	10	5
12-3/4 13 13-1/4	323.851 330.201 336.551	20.250	514.352	14.000	355.601	17.750	450.852	2.750	69.850	10	5
13-1/2 13-3/4 14	342.901 349.251 355.601	21.250	539.752	14.875	377.826	18.750	476.252	2.750	69.850	10	5
14-1/4 14-1/2 14-3/4	361.951 368.301 374.651	22.250	565.152	15.500	393.702	19.750	501.652	2.750	69.850	10	5

Johnson

Compression Head Dimensions

15" thru **26"** O.D. Shaft or Sleeve

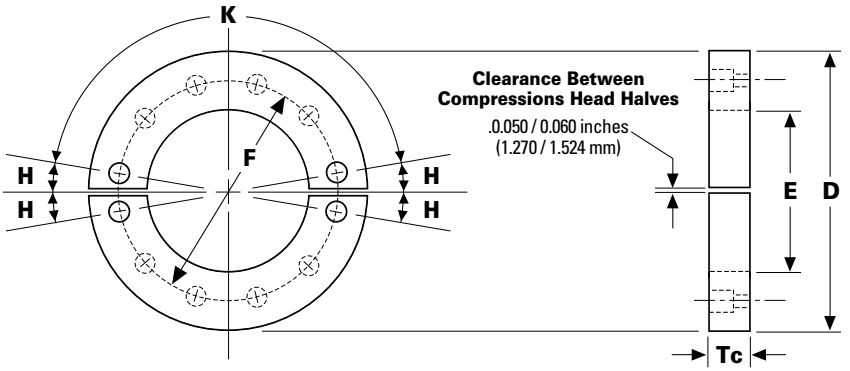


NOTE: I.D. of Compression Head and Retaining Ring must be concentric with housing bore within 1/32 inch (0.0794mm) for journals up through 12-1/2 inches (317.500 mm). For larger journals, concentricity must be within 1/16 inch (1.588 mm)

A		D		E		F		Tc		DEG. SYM. ABOUT CENTER LINE	NUMBER OF HOLES EQUALLY SPACED
O.D. Shaft Or Sleeve		Outside Diameter		Inside Diameter		Bolt Circle Diameter		Thickness		Bolt Hole Location (Compression Head Half)	
inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	H	K
15 15-1/4 15-1/2	381.002 387.352 393.702	23.000	584.202	16.375	415.927	20.500	520.702	2.750	69.850	10	5
15-3/4 16 16-1/4	400.052 406.402 412.752	24.000	609.602	17.125	434.977	21.500	546.102	2.750	69.850	10	6
16-1/2 16-3/4 17	419.102 425.452 431.802	24.500	622.302	17.875	454.027	22.000	558.802	2.750	69.850	10	6
17-1/4 17-1/2 17-3/4	438.152 444.502 450.852	25.250	641.353	18.625	473.077	22.750	577.852	2.750	69.850	10	6
18 18-1/4 18-1/2	457.202 463.552 469.902	26.000	660.403	19.375	492.127	23.500	596.902	2.750	69.850	10	6
18-3/4 19 19-1/4	476.252 482.602 488.952	26.750	679.453	20.125	511.177	24.250	615.952	2.750	69.850	10	6
19-1/2 19-3/4 20	495.302 501.652 508.002	27.500	698.503	20.875	530.227	25.000	635.003	2.750	69.850	10	6
20-1/4 20-1/2 20-3/4	514.352 520.702 527.052	28.250	717.553	21.625	549.277	25.750	654.053	2.750	69.850	10	6
21 21-1/4 21-1/2	533.402 539.752 546.102	29.000	736.603	22.375	568.327	26.500	673.103	2.750	69.850	11.25	8
21-3/4 22 22-1/4	552.452 558.802 565.152	29.750	755.653	23.125	587.377	27.250	692.153	2.750	69.850	11.25	8
22-1/2 22-3/4 23	571.502 577.852 584.202	30.500	774.703	23.875	606.427	28.000	711.203	2.750	69.850	11.25	8
23-1/4 23-1/2 23-3/4	590.552 596.902 603.252	31.250	793.753	24.625	625.477	28.750	730.253	2.750	69.850	11.25	8
24 24-1/4 24-1/2	609.602 615.952 622.302	33.000	838.203	25.375	644.528	29.875	758.828	3.500	88.900	11.25	8
24-3/4 25 25-1/4	628.652 635.003 641.353	33.750	857.253	26.125	663.578	30.625	777.878	3.500	88.900	11.25	8
25-1/2 25-3/4 26	647.703 654.053 660.403	34.500	876.303	26.875	682.628	31.375	796.928	3.500	88.900	11.25	8

Compression Head Dimensions

26-1/4" thru **35-3/4"** O.D. Shaft or Sleeve

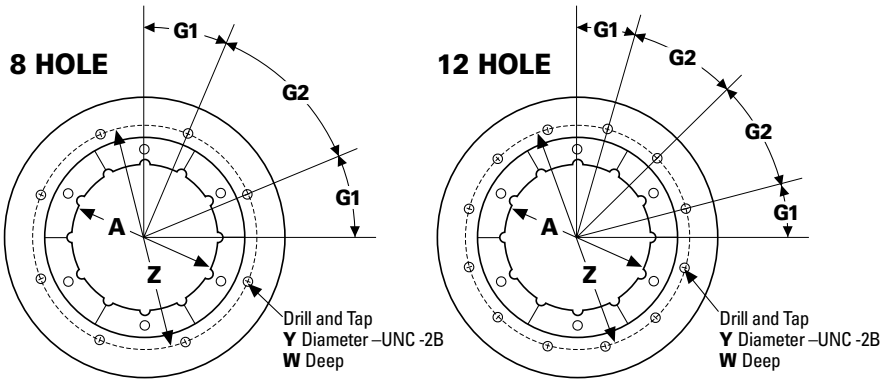


NOTE: I.D. of Compression Head and Retaining Ring must be concentric with housing bore within 1/32 inch (0.0794mm) for journals up through 12-1/2 inches (317.500 mm). For larger journals, concentricity must be within 1/16 inch (1.588 mm)

A		D		E		F		Tc		DEG. SYM. ABOUT CENTER LINE	NUMBER OF HOLES EQUALLY SPACED
O.D. Shaft Or Sleeve		Outside Diameter		Inside Diameter		Bolt Circle Diameter		Thickness		Bolt Hole Location (Compression Head Half)	
inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	H	K
26-1/4 26-1/2 26-3/4	666.753 673.103 679.453	35.250	895.354	27.625	701.678	32.125	815.978	3.500	88.900	11.25	8
27 27-1/4 27-1/2	685.803 692.153 698.503	36.000	914.404	28.375	720.728	32.875	835.028	3.500	88.900	11.25	8
27-3/4 28 28-1/4	704.853 711.203 717.553	36.750	933.454	29.125	739.778	33.625	854.078	3.500	88.900	11.25	8
28-1/2 28-3/4 29	723.903 730.253 736.603	37.500	952.504	29.875	758.828	34.375	873.128	3.500	88.900	10	9
29-1/4 29-1/2 29-3/4	742.953 749.303 755.653	38.250	971.554	30.625	777.878	35.125	892.179	3.500	88.900	10	9
30 30-1/4 30-1/2	762.003 768.353 774.703	39.000	990.604	31.375	796.928	35.875	911.229	3.500	88.900	10	9
30-3/4 31 31-1/4	781.053 787.403 793.753	39.750	1009.654	32.125	815.978	36.625	930.279	3.500	88.900	9	10
31-1/2 31-3/4 32	800.103 806.453 812.803	40.500	1028.704	32.875	835.028	37.375	949.329	3.500	88.900	9	10
32-1/4 32-1/2 32-3/4	819.153 825.503 831.853	41.250	1047.754	33.625	854.078	38.125	968.379	3.500	88.900	9	10
33 33-1/4 33-1/2	838.203 844.553 850.903	42.000	1066.804	34.375	873.128	38.875	987.429	3.500	88.900	9	10
33-3/4 34 34-1/4	857.253 863.603 869.953	42.750	1085.854	35.125	892.179	39.625	1006.479	3.500	88.900	9	10
34-1/2 34-3/4 35	876.303 882.653 889.004	43.500	1104.904	35.875	911.229	40.375	1025.529	3.500	88.900	9	10
35-1/4 35-1/2 35-3/4	895.354 901.704 908.054	44.250	1123.954	36.625	930.279	41.125	1044.579	3.500	88.900	9	10

Drilling Diagram

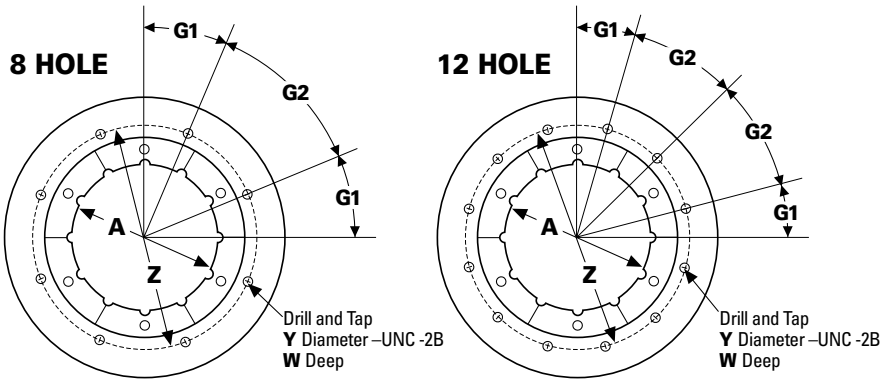
FORWARD STERN TUBE
STUFFING BOX MATING FLANGE



A		Z		No. of Holes	Y		W		G-1	G-2
O.D. Shaft Or Sleeve		Bolt Circle Diameter			Thread Diameter		Thread Depth		Stud Spacing	
inch	mm	inch	mm		inch	mm	inch	mm	Degrees	
3 3-1/4	76.200 82.550	6.250	158.751	8	5/8	15.875	1-1/16	26.988	30	30
3-1/2 3-3/4	88.900 95.250	6.750	171.451	8	5/8	15.875	1-1/16	26.988	30	30
4 4-1/4	101.600 107.950	7.250	184.151	8	5/8	15.875	1-1/16	26.988	30	30
4-1/2 4-3/4	114.300 120.650	8.000	203.201	8	5/8	15.875	1-1/16	26.988	30	30
5 5-1/4	127.001 133.351	8.750	222.251	8	5/8	15.875	1-1/16	26.988	30	30
5-1/2 5-3/4	139.701 146.051	9.250	234.951	8	5/8	15.875	1-1/16	26.988	30	30
6 6-1/4	152.401 158.751	10.125	257.176	8	5/8	15.875	1-1/16	26.988	30	30
6-1/2 6-5/8	165.101 168.276	11.375	288.926	8	3/4	19.050	1-1/4	31.750	22˚ 30'	45
6-3/4 6-7/8 7	171.451 174.626 177.801	12.000	304.801	8	3/4	19.050	1-1/4	31.7501	22˚ 30'	45
7-1/8 7-1/4 7-3/8	180.976 184.151 187.326	12.375	314.326	8	3/4	19.050	1-1/4	31.750	22˚ 30'	45
7-1/2 7-5/8 7-3/4	190.501 193.676 196.851	12.750	323.851	8	3/4	19.050	1-1/4	31.750	22˚ 30'	45
7-7/8 8 8-1/8	200.026 203.201 206.376	13.125	333.376	8	3/4	19.050	1-1/4	31.750	22˚ 30'	45
8-1/4 8-3/8 8-1/2	209.551 212.726 215.901	13.500	342.901	8	3/4	19.050	1-1/4	31.750	22˚ 30'	45
8-5/8 8-3/4 8-7/8	219.076 222.251 225.426	13.875	352.426	8	3/4	19.050	1-1/4	31.750	22˚ 30'	45
9 9-1/8 9-1/4	228.601 231.776 234.951	14.250	361.951	8	3/4	19.050	1-1/4	31.750	22˚ 30'	45
9-3/8 9-1/2 9-5/8	238.126 241.301 244.476	14.625	371.476	8	3/4	19.050	1-1/4	31.750	22˚ 30'	45

Drilling Diagram

FORWARD STERN TUBE
STUFFING BOX MATING FLANGE



A		Z		No. of Holes	Y		W		G-1	G-2
O.D. Shaft Or Sleeve		Bolt Circle Diameter			Thread Diameter		Thread Depth		Stud Spacing	
inch	mm	inch	mm		inch	mm	inch	mm	Degrees	
9-3/4 9-7/8 10	247.651 250.826 254.001	15.000	381.002	8	3/4	19.050	1-1/4	31.750	22° 30′	45
10-1/8 10-1/4 10-3/8	257.176 260.351 263.526	15.750	400.052	8	7/8	22.225	1-9/16	39.688	22° 30′	45
10-1/2 10-5/8 10-3/4	266.701 269.876 273.051	16.125	409.577	8	7/8	22.225	1-9/16	39.688	22° 30′	45
10-7/8 11 11-1/8	276.226 279.401 282.576	16.500	419.102	8	7/8	22.225	1-9/16	39.688	22° 30′	45
11-1/4 11-3/8 11-1/2	285.751 288.926 292.101	16.875	428.627	8	7/8	22.225	1-9/16	39.688	22° 30′	45
11-5/8 11-3/4 11-7/8	295.276 298.451 301.626	17.250	438.152	12	7/8	22.225	1-9/16	39.688	15	30
12 12-1/8 12-1/4	304.801 307.976 311.151	17.625	447.677	12	7/8	22.225	1-9/16	39.688	15	30
12-3/8 12-1/2 12-5/8	314.326 317.501 320.676	18.000	457.202	12	7/8	22.225	1-9/16	39.688	15	30
12-3/4 12-7/8 13	323.851 327.026 330.201	18.375	466.727	12	7/8	22.225	1-9/16	39.688	15	30
13-1/8 13-1/4 13-3/8	333.376 336.551 339.726	18.875	479.427	12	7/8	22.225	1-9/16	39.688	15	30
13-1/2 13-5/8 13-3/4	342.901 346.076 349.251	19.250	488.952	12	7/8	22.225	1-9/16	39.688	15	30
13-7/8 14 14-1/8	352.426 355.601 358.776	19.625	498.477	12	7/8	22.225	1-9/16	39.688	15	30
14-1/4 14-3/8 14-1/2	361.951 365.126 368.301	20.000	508.002	12	7/8	22.225	1-9/16	39.688	15	30
14-5/8 14-3/4	371.476 374.651	20.375	517.527	12	7/8	22.225	1-9/16	39.688	15	30
14-7/8 15	377.826 381.002	20.625	523.877	12	7/8	22.225	1-9/16	39.688	15	30

Water Lubrication Requirements

APPLICATIONS

Design Rules:

Stern tube, struts, rudders, cutterheads and continuously immersed pump bearings are adequately lubricated when the following 4 rules are adhered to:

1. **Nominal loading should not exceed 0.26 N/mm2 (40 psi).** If nominal loading is in excess of 0.26 N/mm2 (40 psi), please consult Duramax Marine® for recommendations.
2. **Shaft or sleeve surface speed should be in excess of 1m/ sec (3.25 ft/ sec)** to create a hydrodynamic water wedge, thus minimizing frictional heat generation.
3. **Proper clearances should be applied** to accommodate potential shaft misalignment and moderate environmental temperature increases. This is to support water wedge formation. If poor bearing installation should occur, non-uniform shaft clearances can serve as a warning signal.
4. **A minimum constant water flow and pressure, as specified in the graph below**, should be maintained, not only to develop the water wedge but also to dissipate frictional heat. Important notes:

   a. If design circumstances require violation of any one of the first three rules, the bearing design criteria will change. We then strongly recommend forced water lubrication to prevent bearing destruction due to increased friction heat generation. The minimum required water flow should then be 4 times the rate derived from the graph. We also recommend forced water lubrication when the out board water conditions are very dirty and the flow of water has to prevent abrasives and contaminants from entering the bearing. The minimum required water should then be 2 times the rate derived from the graph.

   b. If design circumstances require violation of two or more of first three rules in addition to forced water lubrication, keeper bars are recommended.

   c. Rule 4 must not be violated at any time. Water lubrication interruption to any rubber-lined bearing will generate rapid frictional heat and failure.

   d. None of the four rules can be ignored or abused without consequences. In case any of the 4 rules are violated, Duramax Marine® should be contacted to verify the proper modifications of the design criteria. If care is taken, water lubricated rubber bearings will offer years of dependability and economic savings.

EFFICIENT LUBRICATION

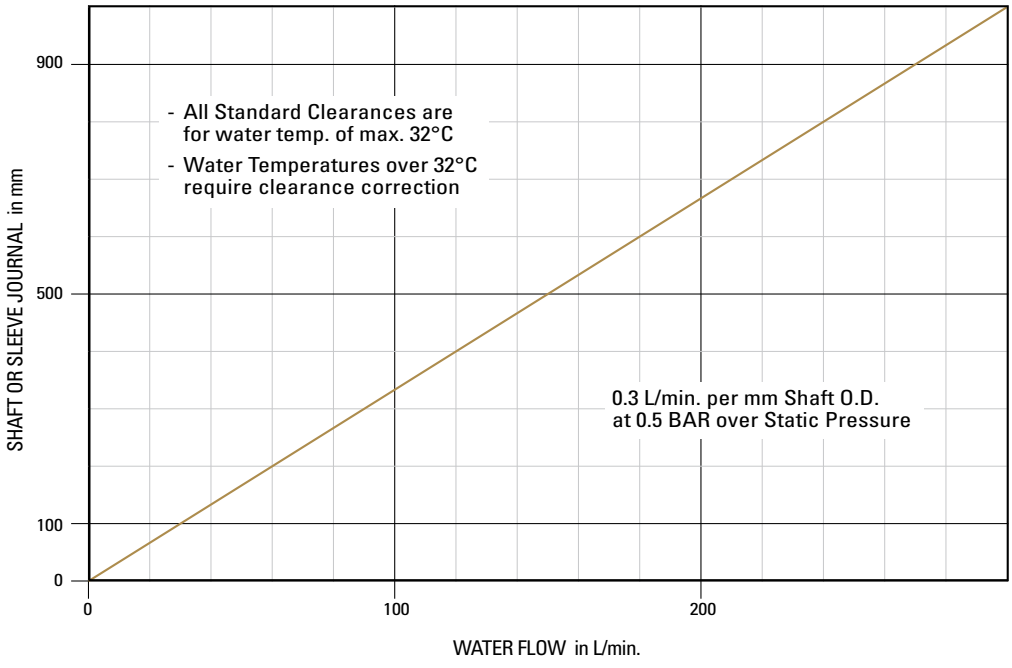
Normal Lubricating Water Flow

Normal water flow through the bearing is 2 GPM per inch of shaft diameter at 5-7 PSI greater than static head pressure at the bearing.

Water is an ideal lubricant because it is non-polluting and does not require expensive seals. Water has a tendency to adhere to metal but not to rubber. Water entering the bearing grooves is immediately diverted to the revolving shaft and driven concentrically to form a continuous lubricating film. This film separates the bearing from the shaft and the result is a reduction of friction and heat. The radially spaced grooves at calculated intervals assure full and complete lubrication and cooling of the entire bearing, even at slow shaft speeds. A continuous water supply flushes away abrasives and contaminants.

FILTRATION

Heavily contaminated water may cause shaft and bearing wear. Service life can be improved by reducing the abrasives in the water by filtration.



Technical Information

PHYSICAL PROPERTIES

Material	: Rubber Nitrile no. 3825
Durometer	: 70 ±5 Shore C scale
Density	: 1.16 gr/cm^3
Tensile strength	: 13,8 N/mm^2
Temperature Range	: -29°C to +93°C
Thermal expansion	: 170 x 10-6/°C
Absorption	: Negligible
Compression set	: at 22°C

Aging	**Residual Stress**
72 hrs	70%
1 year	60%
over 1 year	50%

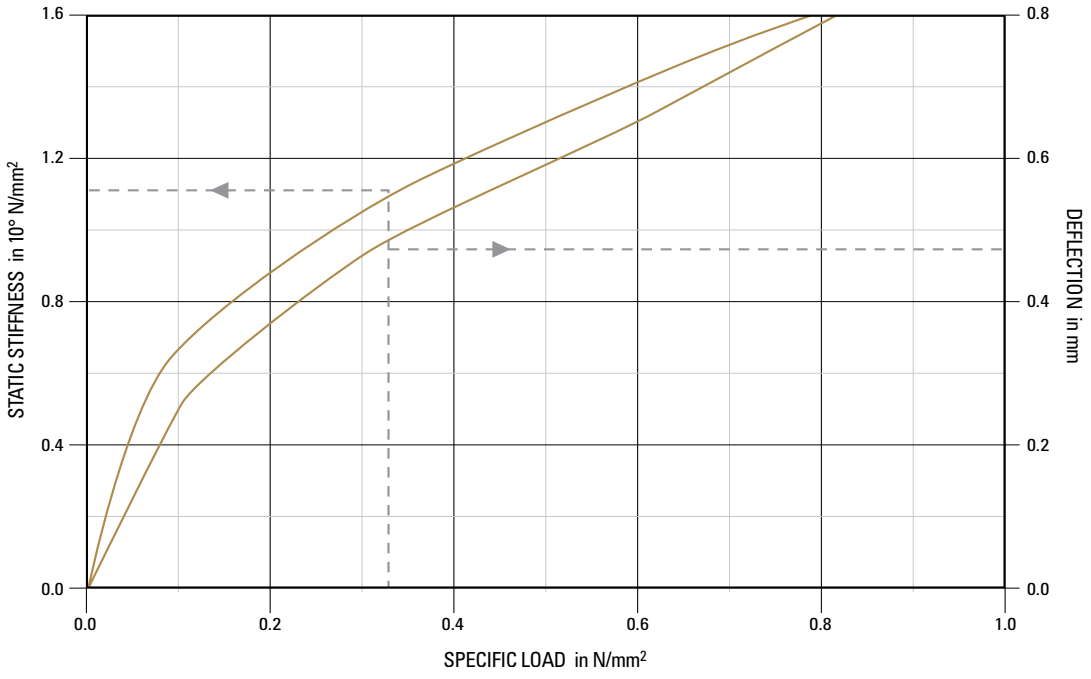
DEFLECTION

Due to the contour design and the quality of the rubber, Johnson demountable rubber stave bearings will support very heavy loads. The contour design allows the shaft to see more surface area, decreasing the load calculated per unit of projected area (nominal- or specific load). The loading force will deflect a rubber bearing. The deflection is shown as a function of the specific load.

STIFFNESS AND DAMPING

An extended testing program produced the stiffness and damping coefficients for Johnson demountable rubber stave bearings. The influence of the running speed was found to be negligible. Static stiffness is a function of load and deflection and not dependent on shaft speed or any frequency. In line-shaft vibration analysis the primary variable of interest is the frequency. Therefore the dynamic stiffness and damping coefficients are a function of the forcing frequency, with the specific load as a parameter.

NOTE *All coefficients shown are for the tested bearing code L-1012-1334 x 10 C3. For all other bearings multiply the coefficients by the new bearing diameter times length in mm, divided by 149 X 103*



Bearing Stave Installation & Storage

LUBRICANT FOR STAVE INSTALLATION

(At installation/replacement only). Use only a water soluble solution such as glycerin or liquid soap mixed with water to lubricated surface of staves. It should be an unadulterated product, not containing acids, ammonia, chlorine or any other harmful additive.

NOTE: *Lubricate the running surface of the staves only and also the sides of the last stave. NEVER lubricate the back of the staves or the inside of the housing.*

WARNING: *Although the rubber is oil resistant NEVER use oil or grease as a lubricant. It will contaminate the system and the environment.*

MAXIMUM WEAR CLEARANCE

The maximum running clearance we advise for water lubricated rubber bearings in marine application is:

O.D. Shaft or Sleeve Journal		Maximum Clearance	
inch	mm	inch	mm
1 - 2	25 - 50	.04	1.0 + 1% of O.D.
2 - 4	50 - 100	.06	1.5 + 1% of O.D.
4 - 8	100 - 200	.08	2.0 + 1% of O.D.
8-20	200 - 500	.10	2.5 + 1% of O.D.
20-40	500 -1000	.12	3.0 + 1% of O.D.

This is the clearance, measured with feeler gauges, between shaft or sleeve journal and bearing. It includes both bearing and journal wear. Although the inside diameter of the compression head and the depth of the water grooves in the bearing will allow more wear, we advise that the advised maximum wear not be exceeded. Excessive wear can cause too much shaft deflection, and as a consequence, damage of seals and shaft-line bearings. The advised maximum wear values relate to the water lubricated rubber bearings only. They do not take into account any requirements of the seal manufacturer.

RECOMMENDED TOOLS

a. For mounting and dismantling of the compression head, use a (extended) hex-key. For dimensions see inside back cover.

b. For driving in the last stave, use a wooden mallet or a sledge hammer and a piece of wood.

c. For withdrawing staves, use a coarse-threaded eyebolt or rawlplug. The aid of the 'come-along' or pulley may be required for withdrawing the first stave. For hole dimensions in the front end of the staves see pages 15 and 16.

STORAGE OF STAVES

To assure extended shelf life, the rubber staves should be protected from compression set, age hardening and extensive heat or cold during storage. Compression set occurs when rubber must sustain a prolonged concentrated load. Age hardening results from degradation of the rubber by environmental forces and pollutants. Johnson demountable rubber stave bearings can be stored for an unlimited period as long as the following precautions are taken:

a. The bearing should be stored in its original box.

b. At moderate temperature between 0° and 50°C (32° to 122°F).

c. Away from high voltage electrical equipment.

d. Away from ozone producing sources. Protect from exposure to ultra-violet light (including sunlight and fluorescent lights).

e. WARNING: If the vessel is laid up for a longer period, the shaft should be rotated regularly to avoid sea growth on the liner. We recommend one complete rotation of the shaft per week. Duramax Marine®, LLC reserves the right to change design, dimensions and/or specifications without notice or incurring obligations.


H41

Notes:

Notes:

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ROMOR®I Stave Bearings and Segmental Housings
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DuraBlue® Bearings, Rudder & Pintle Bushings, Thrust Washers, and Wear Pads
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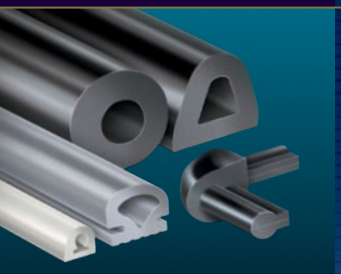

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