

Rudder Bushings

DX490



DX490 Rudder Bushings are molded from a 70 Scale D, Durometer, Nitrile Rubber Compound (approximately the same hardness as a bowling ball). They are formulated to withstand the rugged "impact" service encountered in ship's rudder steering systems. DX490 has high rigidity for maximum dimensional stability while still retaining a degree of resiliency required to dampen peak shock loads.

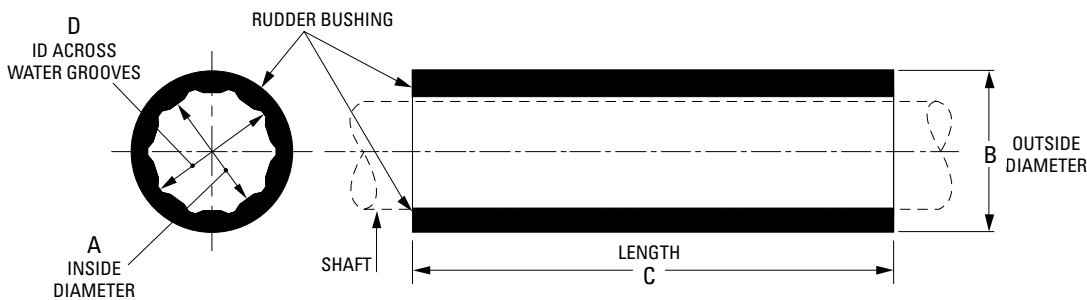
DX490 Rudder Bushings are supplied as unfinished cylinders molded with longitudinal lubrication grooves. The bushings can be easily machined in a local machine shop for proper fit. Grease, oil and water serve equally well as lubricants. The DX490 Rudder Bushing is resistant to deterioration by hydrocarbons, acids, salt water corrosion and electrolysis.

CAUTION:

DX490 Rudder Bushings are supplied as unfinished with molded I.D. and O.D. dimensions which allow ample material for finish machining. However, when finish boring I.D. dimensions do not remove more than 70% of the lubricant groove depth.

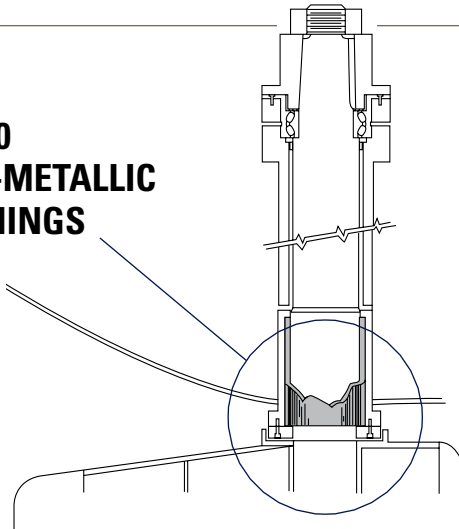
IMPORTANT: In addition to interference press fit, DX490 Rudder Bushings must be mechanically secured with set screws or other locking devices to prevent movement during operation and the expected operating temperature range.

FIGURE 13



| Part Number | Code | A | | B | | C | | D | | Gross Wt. | |
|-------------|-------|---------------------------|--------|----------------------------|--------|------------------|--------|-----------------------------------|--------|-----------|------|
| | | Inside Diameter inches | mm | Outside Diameter inches | mm | Length inches | mm | ID Across Water Grooves inches | mm | lb. | kg. |
| 812100038 | DX150 | 1.45 | 36.83 | 2.35 | 59.69 | 11 | 279.40 | 1.62 | 41.15 | 1.0 | 0.5 |
| 812100044 | DX175 | 1.70 | 43.18 | 2.59 | 65.79 | 13 | 330.20 | 1.97 | 50.04 | 1.5 | 0.7 |
| 812100051 | DX200 | 1.95 | 49.53 | 3.07 | 77.98 | 15 | 381.00 | 2.20 | 55.88 | 2.5 | 1.1 |
| 812100057 | DX225 | 2.18 | 55.37 | 3.32 | 84.33 | 7 1/2 | 190.50 | 2.57 | 65.28 | 2.3 | 1.0 |
| 812100064 | DX250 | 2.44 | 61.98 | 3.68 | 93.47 | 9 | 228.60 | 2.75 | 69.85 | 2.7 | 1.2 |
| 812100070 | DX275 | 2.70 | 68.58 | 3.92 | 99.57 | 10 | 254.00 | 2.97 | 75.44 | 3.0 | 1.4 |
| 812100076 | DX300 | 2.95 | 74.93 | 4.20 | 106.68 | 11 | 279.40 | 3.39 | 86.11 | 4.0 | 1.8 |
| 812100083 | DX325 | 3.19 | 81.03 | 4.42 | 112.27 | 12 | 304.80 | 3.60 | 91.44 | 4.0 | 1.8 |
| 812100089 | DX350 | 3.34 | 84.84 | 5.19 | 131.83 | 13 | 330.20 | 3.76 | 95.50 | 7.5 | 3.4 |
| 812100095 | DX375 | 3.66 | 92.96 | 5.18 | 131.57 | 14 | 355.60 | 4.05 | 102.87 | 6.5 | 2.9 |
| 812100102 | DX400 | 3.93 | 99.82 | 5.45 | 138.43 | 15 | 381.00 | 4.28 | 108.71 | 7.5 | 3.4 |
| 812100108 | DX425 | 4.16 | 105.66 | 5.68 | 144.27 | 16 | 406.40 | 4.55 | 115.57 | 9.0 | 4.1 |
| 812100114 | DX450 | 4.42 | 112.27 | 6.02 | 152.91 | 17 | 431.80 | 4.68 | 118.87 | 11.0 | 5.0 |
| 812100121 | DX475 | 4.65 | 118.11 | 6.01 | 152.65 | 18 | 457.20 | 5.05 | 128.27 | 10.0 | 4.5 |
| 812100127 | DX500 | 4.93 | 125.22 | 6.68 | 169.67 | 19 | 482.60 | 5.31 | 134.87 | 15.0 | 6.8 |
| 812100135 | DX525 | 5.15 | 130.81 | 6.90 | 175.26 | 20 1/2 | 520.70 | 5.64 | 143.26 | 17.0 | 7.7 |
| 812100140 | DX550 | 5.39 | 136.91 | 7.61 | 193.29 | 21 | 533.40 | 5.91 | 150.11 | 21.0 | 9.5 |
| 812100146 | DX575 | 5.65 | 143.51 | 7.65 | 194.31 | 22 | 558.80 | 6.00 | 152.40 | 22.0 | 10.0 |
| 812100152 | DX600 | 5.87 | 149.10 | 8.65 | 219.71 | 22 | 558.80 | 6.40 | 162.56 | 24.0 | 10.9 |
| 812100165 | DX650 | 6.36 | 161.54 | 8.67 | 220.22 | 22 | 558.80 | 6.84 | 173.74 | 27.8 | 12.6 |
| 812100171 | DX675 | 6.65 | 168.91 | 9.00 | 228.60 | 23 | 584.20 | 7.16 | 181.86 | 31.0 | 14.1 |
| 812100178 | DX700 | 6.88 | 174.75 | 9.08 | 230.63 | 24 1/2 | 622.30 | 7.35 | 186.69 | 31.0 | 14.1 |
| 812100184 | DX725 | 7.10 | 180.34 | 10.47 | 265.94 | 27 1/2 | 698.50 | 7.60 | 193.04 | 38.0 | 17.2 |
| 812100191 | DX750 | 7.33 | 186.18 | 10.47 | 265.94 | 27 1/2 | 698.50 | 8.07 | 204.98 | 35.0 | 15.9 |
| 812100197 | DX775 | 7.70 | 195.58 | 10.47 | 265.94 | 27 1/2 | 698.50 | 8.30 | 210.82 | 45.0 | 20.4 |
| 812100203 | DX800 | 7.82 | 198.63 | 10.56 | 268.22 | 29 1/2 | 749.30 | 8.50 | 215.90 | 50.0 | 22.7 |
| 812100216 | DX850 | 8.37 | 212.60 | 12.20 | 309.88 | 35 | 889.00 | 9.09 | 230.89 | 65.0 | 29.5 |
| 812100222 | DX875 | 8.64 | 219.46 | 11.32 | 287.53 | 32 1/2 | 825.50 | 9.11 | 231.39 | 58.0 | 26.3 |
| 812100229 | DX900 | 8.89 | 225.81 | 11.32 | 287.53 | 32 1/2 | 825.50 | 9.49 | 241.05 | 73.0 | 33.1 |
| 812100235 | DX925 | 9.11 | 231.39 | 12.22 | 310.39 | 35 | 889.00 | 9.72 | 246.89 | 85.0 | 38.6 |

DX490 NON-METALLIC BUSHINGS



PHYSICAL PROPERTIES:

| Deformation | Load PSI | Deflection | Temperature | |
|---|------------------|---------------------------------|-------------|----------------|
| | 225 | .004" | 72° F | |
| | 300 | .0045" | 72° F | |
| Compressive Strength | 15,000 | Elastic Limit | 72° F | |
| Tensile | 3000 PSI | | | |
| Expansion and Contraction | Configuration | Contraction | Temp. | Recovery |
| | Std. Tubular | .002" -.0025" per inch of OD | -20° F | 100% |
| Absorption | Aging | Liquid | Temp. | Vol. Change % |
| | 70 hrs. | ASTM #3 Oil | 212° F | + 4.9% |
| | 70 hrs. | ASTM #3 Oil | 100° F | + less than 1% |
| | 70 hrs. | ASTM #3 Oil | 72° F | Negligible |
| | 70 hrs. | H ₂ O | 212° F | + 2.6% |
| 70 hrs. | H ₂ O | 100° F | Negligible | |
| Range of working temperature - -20° to 180° continuous service. | | | | |

CALCULATING THE FINISHED (MACHINED) SIZE OF DX490

Nominal Bushing I.D. and O.D. dimensions must be adjusted to allow for proper shaft to bearing running clearance, thermal expansion and contraction and interference press fit. Before machining, calculate the finished machined bearing I.D. and O.D. dimensions as follows:

EXAMPLE:

Nominal Shaft Diameter: 8 inches
Nominal Bearing Housing Diameter: 12 inches

To determine the finished machined bearing I.D. dimension

refer to the machining tables and add the running clearance (Table X), thermal factor (Table Y) and press fit allowance (Table Z), to the nominal shaft diameter.

Finished Machined Bearing I.D. Dimension equals:

| | |
|----------------------------------|-------------------|
| + Nominal Bearing Shaft Diameter | 8.000 |
| + Running Clearance (Table X) | 0.018 |
| + Thermal Factor (Table Y) | 0.016 |
| + Press Fit Allowance (Table Z) | 0.008 |
| | 8.042 inches I.D. |

To determine the finished machined bearing O.D. dimension

Refer to the machining tables and add the thermal factor (Table Y) and the press fit allowance (Table Z), to the nominal bearing housing diameter.

Finished Machined Bearing O.D. Dimension equals:

| | |
|------------------------------------|--------------------|
| + Nominal Bearing Housing Diameter | 12.000 |
| + Thermal Factor (Table Y) | 0.016 |
| + Press Fit Allowance (Table Z) | 0.008 |
| | 12.024 inches O.D. |

TABLE X — RUNNING CLEARANCE

| Nominal ID inches | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|-------------------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Allowance inches | 0.012 | 0.013 | 0.014 | 0.015 | 0.016 | 0.017 | 0.018 | 0.019 | 0.020 | 0.021 | 0.022 | 0.023 | 0.024 |
| Nominal ID mm | 50.80 | 76.20 | 101.60 | 127.00 | 152.40 | 177.80 | 203.20 | 228.60 | 254.00 | 279.40 | 304.80 | 330.20 | 355.60 |
| Allowance mm | 0.30 | 0.33 | 0.36 | 0.38 | 0.41 | 0.43 | 0.46 | 0.48 | 0.51 | 0.53 | 0.56 | 0.58 | 0.61 |

TABLE Y — THERMAL FACTOR

| Nominal ID inches | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|-------------------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Allowance inches | 0.004 | 0.006 | 0.008 | 0.010 | 0.012 | 0.014 | 0.016 | 0.018 | 0.020 | 0.022 | 0.024 | 0.026 | 0.028 |
| Nominal ID mm | 50.80 | 76.20 | 101.60 | 127.00 | 152.00 | 177.80 | 203.20 | 228.60 | 254.00 | 279.40 | 304.80 | 330.20 | 355.60 |
| Allowance mm | 0.10 | 0.15 | 0.20 | 0.25 | 0.30 | 0.35 | 0.41 | 0.46 | 0.51 | 0.56 | 0.61 | 0.66 | 0.71 |

TABLE Z — PRESS FIT ALLOWANCE

| Nominal ID inches | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|-------------------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Allowance inches | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.008 | 0.008 | 0.008 | 0.008 | 0.010 | 0.010 | 0.010 | 0.010 |
| Nominal ID mm | 50.80 | 76.20 | 101.60 | 127.00 | 152.00 | 177.80 | 203.20 | 228.60 | 254.00 | 279.40 | 304.80 | 330.20 | 355.60 |
| Allowance mm | 0.13 | 0.13 | 0.13 | 0.13 | 0.13 | 0.20 | 0.20 | 0.20 | 0.20 | 0.25 | 0.25 | 0.25 | 0.25 |