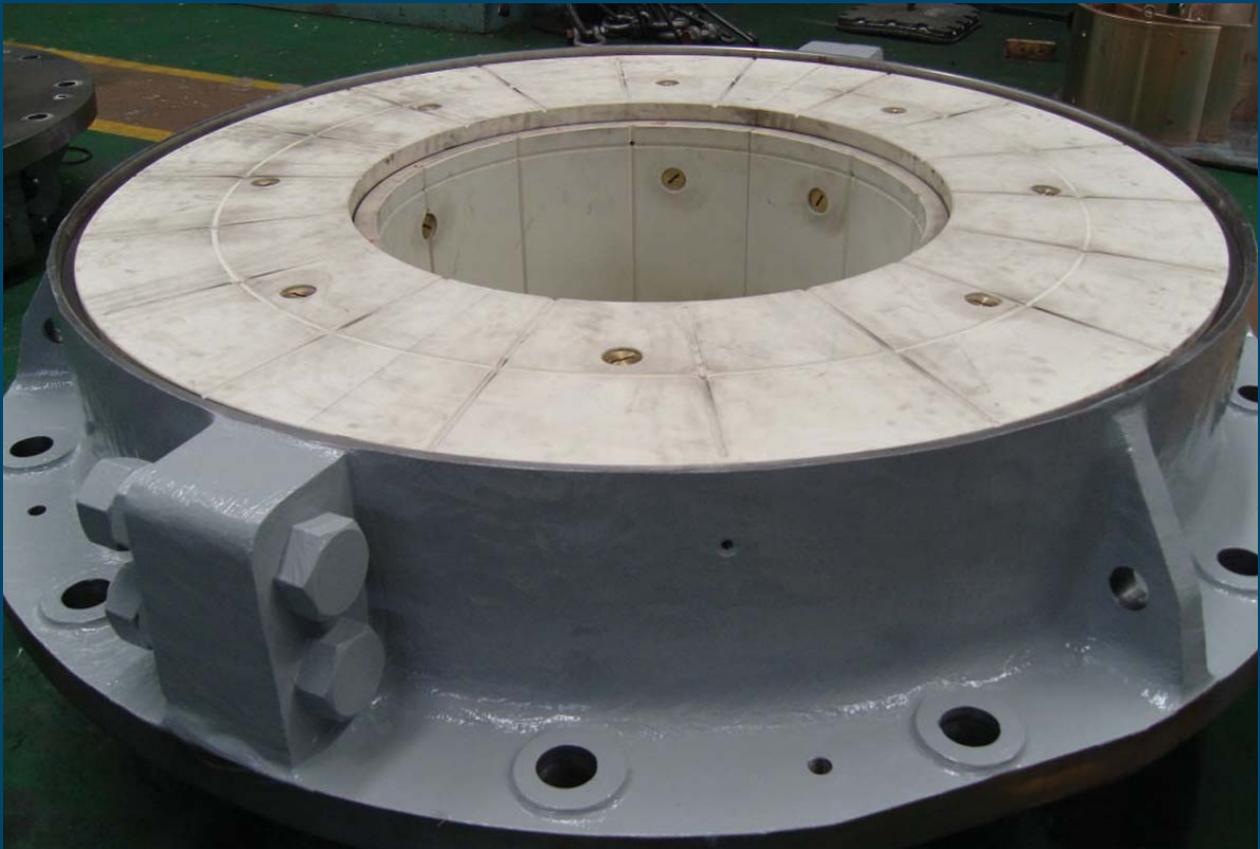


SXL Rudder Carrier Bearings



THORDON SXL RUDDER CARRIER BEARINGS

Introduction

Thordon SXL rudder carrier bearings (discs) are a complementary product to the established and proven SXL rudder pintle and stock bearings. Made from a high strength elastomeric polymer developed by Thordon Bearings, rudder carrier bearings are designed to support the rudder weight, allow the rudderstock to turn freely and accommodate rudder stock deflection. Thordon has also developed a new high performance rudder stock seal to complement the above and below waterline Thordon rudder bearing package.

ADVANTAGES

Eliminate or Reduce Greasing

Thordon SXL is an excellent alternative to the conventional bronze rudder carrier bearing. The primary advantage of Thordon SXL is its low coefficient of friction. This enables it to operate with little or no grease. In most of the new ships built using Thordon SXL rudder carrier discs, the builders have eliminated the automatic greasing system and replaced it with a less expensive and more environmentally friendly manual system. Thordon SXL can operate dry in most carrier disc applications, but grease is often used to protect the carbon steel components in the system from corroding

Tolerance to Edge Loading

In comparison to bronze bearings, the increased elastic deformability of Thordon SXL rudder carrier bearings enables them to better accommodate uneven and impact loading. This leads to reduced peak pressures (edge loading) and minimizes the local wear of the carrier bearing resulting in longer operating life. The elastomeric nature of Thordon enables it to recover from impact loading without the permanent deformation commonly found with bronze. Thordon is also much more abrasion resistant than bronze.

Guaranteed Long Bearing Wear Life

As with Thordon SXL pintle and rudder stock bearings, Thordon Bearings also guarantees SXL Carrier Bearings in newbuild classed vessels as follows:

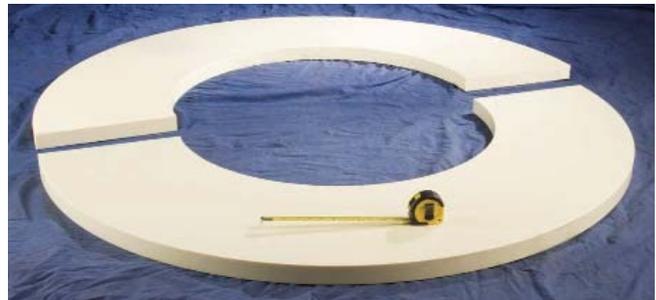
Thordon SXL Rudder Carrier Bearings will meet Class Society wear specifications for 15 years or Thordon Bearings Inc. will supply a new bearing free of charge.

Easy Handling - Lightweight Compared to Bronze

Thordon SXL also has a significant handling advantage over large bronze bearings, both in terms of weight (as indicated by the example below) and in terms of risk of damage during handling. Thordon SXL rudder carrier bearings can be supplied split or not split to suit virtually any size of rudder.

Carrier Disk Material	C93200 Bronze	Thordon SXL
Carrier Disk Weight*	49 kg (108 lbs.)	6.4 kg (14 lbs.)

**Based on rudder carrier dimensions of 800mm x 600mm x 25mm (31.50"x 23.62"x0.98")*



Split SXL Rudder Carrier Bearing

Typical Arrangement of a Rudder Carrier Bearing in Rudder System

A typical arrangement of a rudder carrier bearing with a radial bearing below is shown in Figure 1. Occasionally, a radial bearing will be located above the carrier bearing.

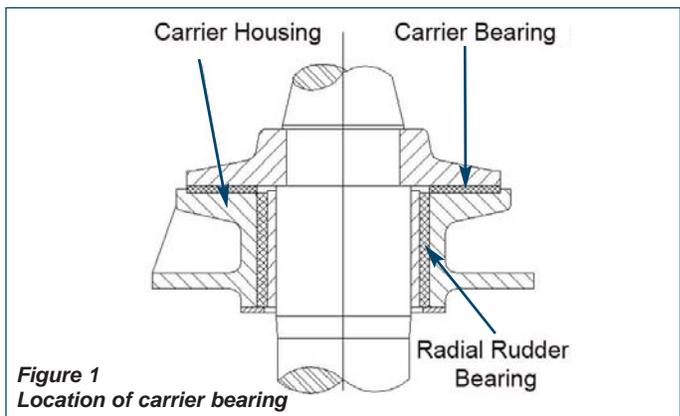
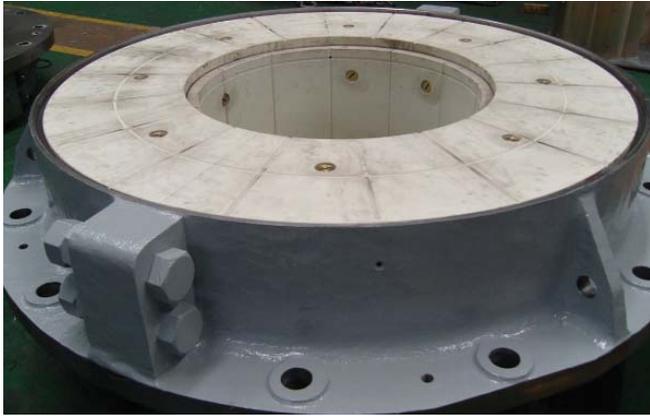


Figure 1
Location of carrier bearing



Typical SXL rudder carrier bearing installed in housing

Material

Thordon SXL is used for rudder carrier applications due to the low coefficient of friction that allows it to operate either dry or greased. It also has the inherent flexibility that enables it to adjust to shock and edge loading. It is approved by the major marine Classification Societies for rudder bearing applications up to 12 MPa (1740 psi). Studies of actual loads on rudder carrier bearings indicate that they are normally designed considerably less than 12 MPa (1740 psi) and are therefore well within the working range of Thordon SXL.

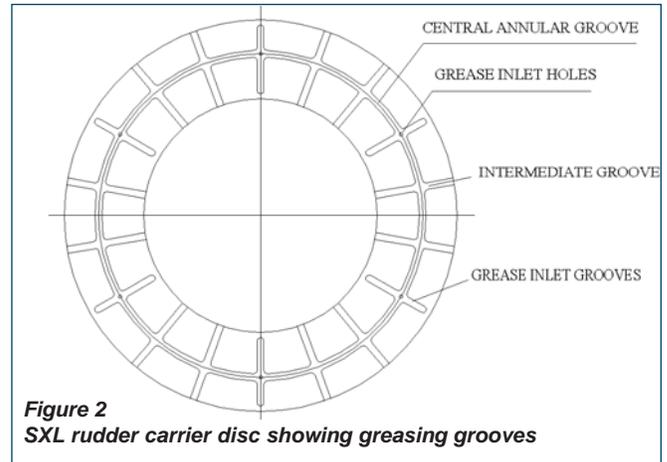
Lubrication

Although Thordon SXL has the ability to run dry in most rudder bearing applications, the normal procedure with large rudder carrier bearings is to lubricate with grease. Grease is used mainly to protect metal parts of the system from corroding, but it can also reduce friction and increase wear life of the carrier bearing in relatively clean environments. The greasing system for a Thordon SXL carrier bearing can be less complex than what is required for a bronze bearing because Thordon is capable of operating in a marginally greased condition as well as dry. In most newbuild installations with Thordon SXL rudder carrier bearings, the automatic greasing system has been replaced with a manual system. This reduces equipment cost, the amount of grease required and also eliminates pollution from the excess grease that an automatic system typically produces.

Thordon SXL can be designed to operate dry in rudder carrier applications as long as the metallic parts of the system do not require grease to prevent corrosion.

Grooving

If a Thordon SXL rudder carrier bearing is to be greased, proper grooving is essential for achieving optimal performance. Figure 2 shows the groove pattern and geometry for a proven design. Grooving should ensure adequate grease injection around the circumference, and ensure that the grease is adequately spread over the whole bearing surface. Specific groove design can be provided on a case-by-case basis as required.

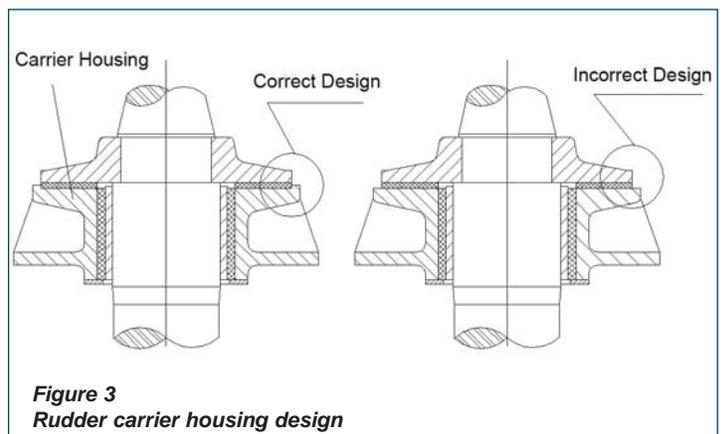


*Figure 2
SXL rudder carrier disc showing greasing grooves*

Bearing Housing

The carrier bearing housing should have a shoulder on the outside diameter (O.D.) with a height of 0.3 to 0.5 times the carrier bearing thickness – see Figure 3. The shoulder secures the position of the carrier bearing. This is especially important when split bearings are used. The shoulder also improves the stiffness of the bearing by limiting its ability to spread.

When Thordon SXL bearings are bonded into place, there should also be a shoulder on the I.D.



*Figure 3
Rudder carrier housing design*

Installation

Thordon SXL rudder carrier bearings are normally installed either by fastening with screws, or by bonding using a Thordon approved adhesive. Bolting can be accomplished using bolts with shoulders or countersunk head cap screws with metal inserts fitted into the bearing. These are used to prevent excessive tightening of the bolts, causing deflection of the SXL.

Bonded Thordon SXL rudder carrier bearings should be fitted into housings that have shoulders designed into both the O.D. and I.D. sections. Detailed mixing, application and curing instructions for the chosen adhesive must be followed.

Split vs. Non Split Carrier Bearings

Thordon SXL rudder carrier bearings can be designed split or non-split. In many designs split carrier bearings are required to facilitate installation. In terms of installation procedures and load bearing capacity, there is no difference between split and non-split bearings.

Classification Society Approvals

Thordon SXL carrier bearings are approved by many of the major Classification Societies either specifically or as part of their general rudder bearing approval. Approved pressure is in the range of 10-12 MPa (1450-1740psi).

References

Thordon SXL rudder carrier bearings have been installed in more than 300 vessels over the past 15 years, with the majority installed in new ships built in South Korea. A detailed reference list is available from Thordon Bearings Inc.

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