Chockfast®

STERNTUBE/STRUT – TECHNICAL BULLETIN #632G
INSTALLATION GUIDE FOR CHOCKFAST ORANGE

Revised: 08/2018

INTRODUCTION

The guidelines contained in this bulletin are provided as an aid to marine designers, shipyards and ship owners who are using Chockfast Orange to secure main bearings into a ship's structure. Several design suggestions are presented, as well as a general installation procedure.

This guide may be followed, modified, or rejected by designers, owners, or shipyards since they — and not Chockfast (ITW Performance Polymers) — are responsible for proper design, planning and execution.

The recommendations within this guide are specifically for gaps of 12mm (1/2 in) – 50 mm (2 in) and in application environments above 18°C (65°F). **For gaps less than 12mm (1/2") and greater than 50 mm (2") or application environments less than 18°C (65°F), please contact a member of our worldwide distributor network or ITW Performance Polymers for specific installation instructions.**

APPLICATION BENEFITS

Installation of sterntube bearings using traditional methods of interference fitting can be a labor-intensive and time-consuming job. Boring bars and hydraulic jacks are difficult to set up and operate, and any resulting alignment errors are difficult to correct.

The use of Chockfast Orange pourable epoxy chocking compounds to install sterntube bearings is a technique which has been in existence since 1979 and has been used worldwide. Basically, the bearing, supported on jacking screws, is aligned inside the stern frame, which has previously been bored oversize.

The annular clearance between the bearing and the stern frame provides for flexibility in positioning the bearing for alignment purposes. Once the bearing is positioned, the annular area is dammed at the forward and aft end, then filled with Chockfast epoxy. The epoxy is either poured or pumped into the void space. After the epoxy cures, the bearing is "captured" (encapsulated) in the bore with near 100% surface contact.

The benefits of Cast-In-Place strut and sterntube bearings are:

- Maintains permanent alignment
- Provides better control of bearing fit
- Reduces installation costs
- Extends working life of bearings
- Helps shipyards build better vessels

DESIGN CONSIDERATIONS

In a typical installation, the sterntube and strut bearings are press-fitted into bearing sleeves while in the machine shop. The sleeve is often flanged on the aft end to facilitate bolting to the stern boss after installation on the ship. For installations incorporating forward and aft sterntube bearings, the sleeve can be one piece with a bearing installed in each end. In this case, the inboard flange is of a slip-on design, which is welded or bolted after insertion through the sterntube bore.

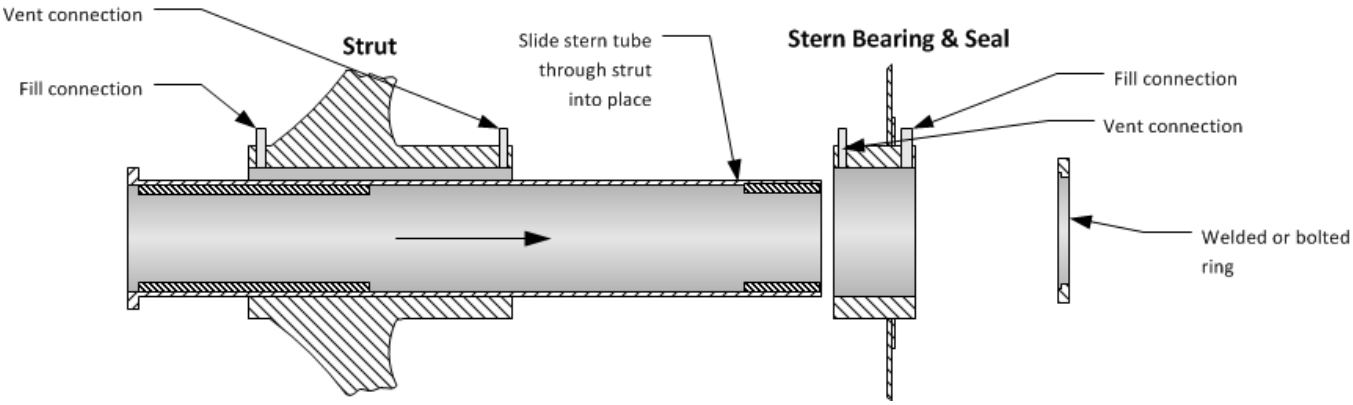

Figure 1

The bore through the stern frame is typically designed to have a diameter 25mm (1 inch) larger than the bearing sleeve(s). This provides a minimum average 12mm (1/2 inch) annular gap which will be filled with Chockfast after alignment. This gap size is recommended because it allows for a reasonable range of adjustment for alignment, while avoiding the possibility of a thick resin pour if the radial gap is totally eccentric. The gap can actually be any size.

The surface finish of the outside diameter of the sleeve(s) is not critical, since the sleeve is not usually intended to be removable. It is, however, advisable not to deliberately interlock sleeves into the epoxy. Sterntube bearing assemblies which are intended to be removable should have a surface finish of N9 (6.3 Ra microns, 250 CLA micro-inches) or better, and be coated with ITW Release Agent.

Fill and vent connections must be provided, as shown in Figure 1. Usually these are specially drilled holes, but sometimes access can be made into the end of the annular gap. Installations where the epoxy will be poured, should have the filling connection on the top at the low end. Installations where the resin will be pumped, should have a valved connection at the bottom. See Figure 2.

Alignment of the sterntube is usually achieved with the aid of radial jacking screws. It is not always necessary to drill through the stern casting from the outside; sometimes external screws acting on the flange can be used. Three or four alignment screws are needed at each end, as seen in Figure 3.

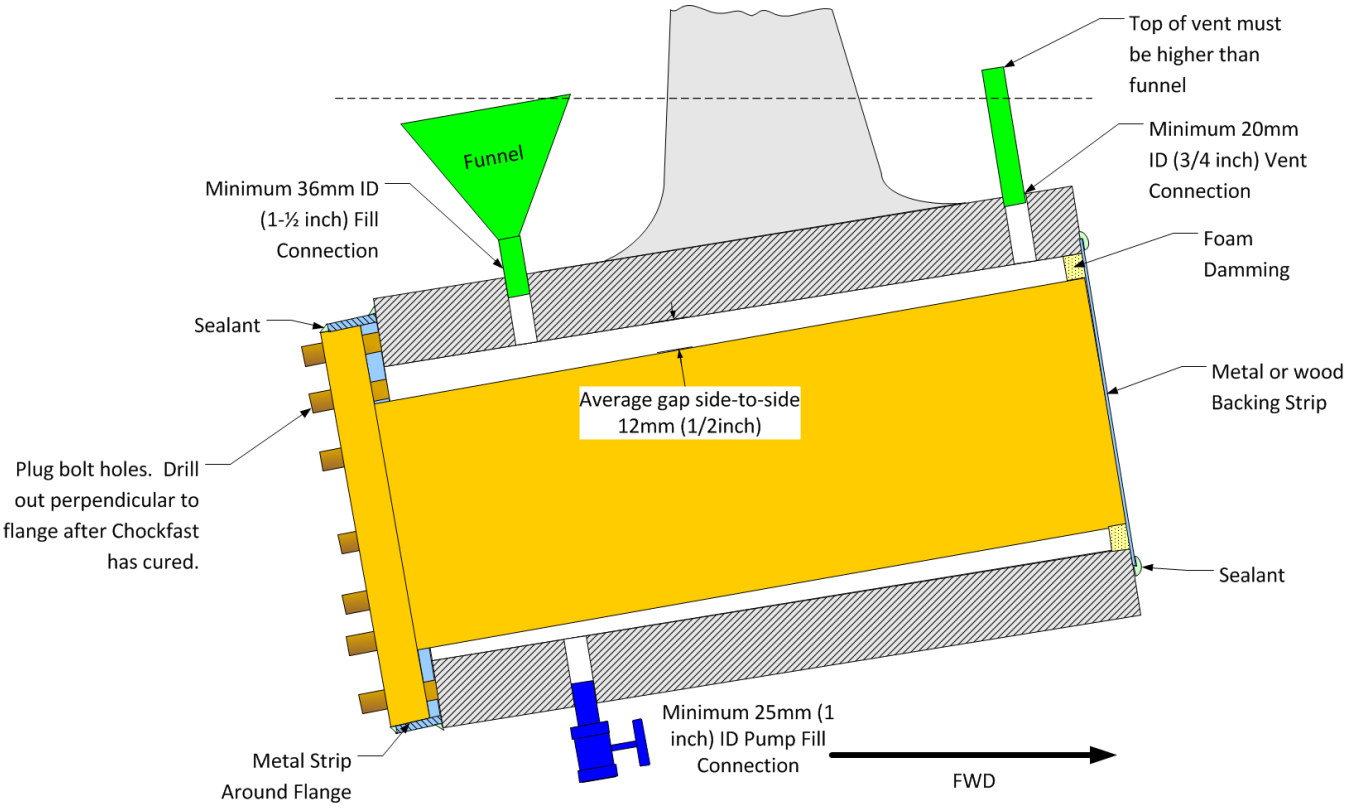

Figure 2

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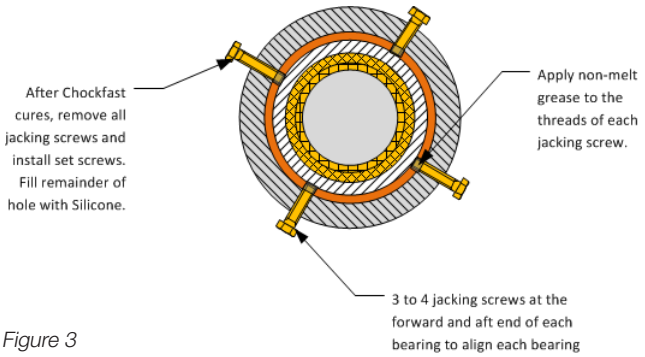

Figure 3

Flange-less water-lubricated bearings are also installed using Chockfast to hold the bearing in place, either by pouring directly around the bearing after it has been properly positioned or by pouring it around a dummy bearing which is subsequently removed and the operating bearing is interference fitted.

Synthetic bearing manufacturers are primarily concerned with the heat produced by the epoxy as it cures, and any negative effects it may have on the bearing. As a result, a maximum 25 mm (1 inch) annular gap is recommended between a synthetic bearing or sleeve surface and the I.D. of the bearing bore, unless otherwise permitted by the bearing manufacturer. This will provide an ample range of adjustment for alignment purposes and limit the heat generated by the epoxy.

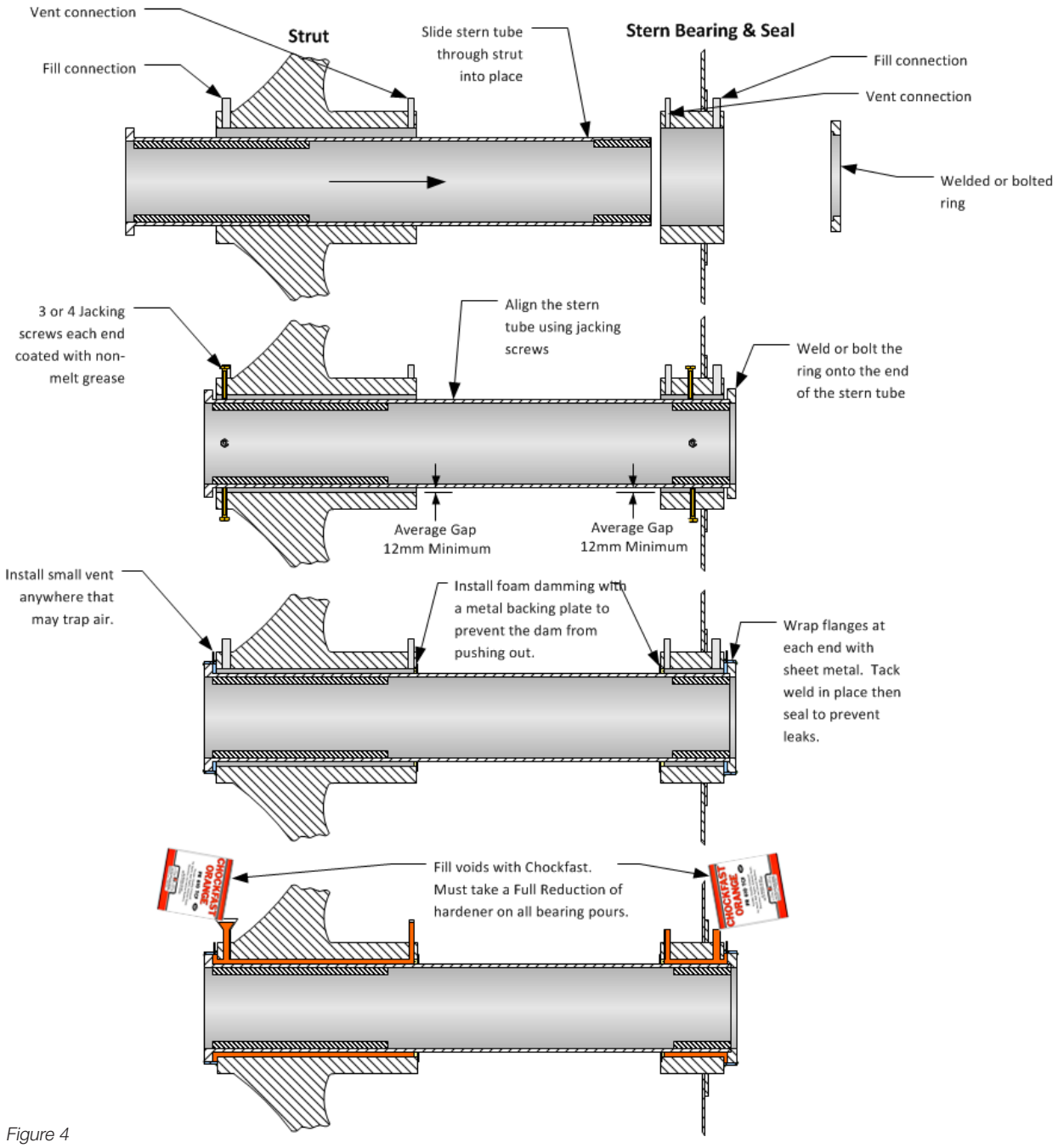

Figure 4

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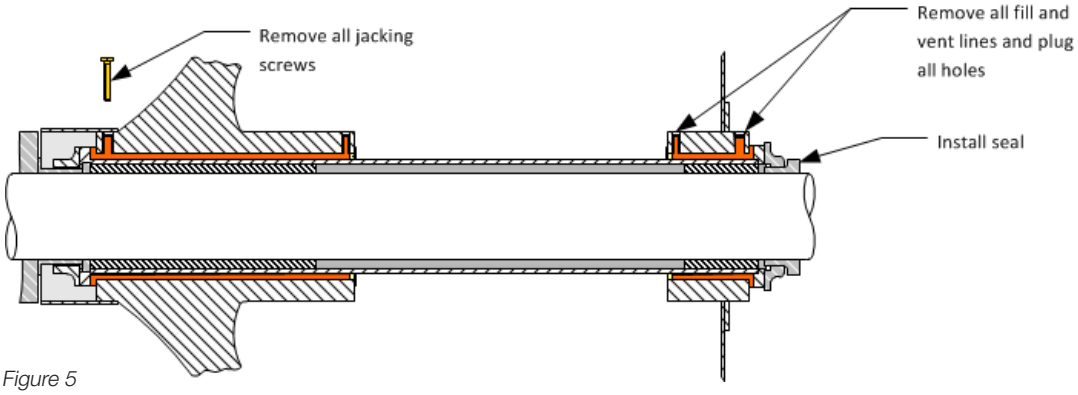

Figure 5

INSTALLATION PROCEDURE

1. Provide filling and vent connections by drilling through the strut and stern tube casting, as necessary.

2. The stern casting should not be drilled for the flange bolts (if they are required) until after the Chockfast work is complete. Plug the flange holes with either wood dowels or foam plugs to prevent the Chockfast from leaking.

3. Provide means of aligning the sterntube or bearing in the bore. The preferred method for doing this is by installing jacking bolts (alignment screws). The alignment screws can often be arranged to act on the flange, thus avoiding drilling the stern frame casting. See Figure 6.

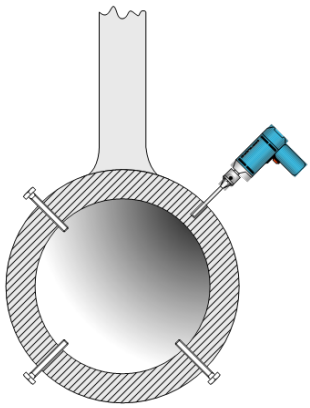

Figure 6

4. Thoroughly clean the internal diameter of the stern frame or strut or the outer diameter of the bearing or bearing sleeve, targeting removal of any corrosion, rust, or other surface contaminants. If adhesion is desired, it is important to thoroughly clean surfaces which will be in contact with Chockfast. Although each shipyard may have its own preferred procedure, ITW Performance Polymers recommends the following for maximizing adhesion:

    a. All surfaces should be sand-blasted to a near-white finish, machined or power-tool cleaned.
    b. Wipe all surfaces with clean rags liberally soaked with IXT-59 solvent at least three times, changing to a new rag each time.
    c. Immediately before installing the bearing or sterntube assembly into the ship, solvent-wipe the surfaces a final time.

5. If a primer is used, apply one very thin coating (less than 3 mils or 0.075mm) of an epoxy-based rust inhibitive primer to the strut and sterntube housings.

6. If the initial design requires removal of a dummy bearing or has provision for future removal of the sterntube bearing assembly, spray the outer surface with ITW Release Agent.

7. If the bearing is oil-lubricated, seal any oil connections which could be plugged by the epoxy. (It is often convenient to use soluble plugs of foamed polystyrene. These can be dissolved out later with acetone.)

8. Install and align the bearing or sterntube assembly.

9. Fit the damming foam, making sure it is adequately strong to withstand the pressure of liquid epoxy. Closed cell foam should be used.

10. It is very important to install a wood or metal backing plate on the outside of the foam to prevent it from being pushed out by the weight of the Chockfast.

11. At the flange end, it is usual to use a metal strip tack welded or bolted around the flange and sealed. If there are flange bolt holes, plug them with greased wood, steel rod or ”Armaflex” foam.

12. Fit riser pipes to the fill and vents; about 38mm (1-1/2 inch) inside diameter for the fill and 20mm (3/4 inch) inside diameter for the vent. The vent line must be as far forward as possible so that air cannot be trapped at the top of the void and the top of the vent pipe must be higher than the top of the fill funnel.

13. If the sterntube area is exposed to the weather, a canopy or tent arrangement should be erected for protection. If ambient temperatures will be below 13°C (55°F), heated air should be blown into the area and the temperature allowed to rise for minimum 24 hours.

14. Thoroughly mix the Chockfast resin and hardener using a Jiffy Mixing Blade for 3 to 4 minutes at no more than 300 rpm.

IMPORTANT: When mixing Chockfast Orange for sterntube applications, **always use a full hardener reduction.** See instructions packed with material

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15. Fill the cavity with Chockfast. This is done in one of two ways, by pumping or by gravity filling.

a. **By pumping** — The filling connection should be made at the lowest point of the cavity, typically the bottom of the aft end. The pump is connected using approximately 25mm (1 inch) inside diameter flexible hose and a disposable 1/4-turn valve, mounted right at the sterntube. The pump should be a positive displacement type with a pumping rate anywhere from 1 liter/minute (0.25 gpm) to 12 litres/minute (3 gpm) depending on the total amount of Chockfast required. One person mixing will keep a 1 l/min. pump at capacity while it takes 3 people mixing in series to keep a 12 l/min. pump at capacity. Equip the discharge line with a discharge pressure gauge to monitor back-pressure in the hose. Keep the length of both the suction line and discharge hose to an absolute minimum.

A hopper providing a flooded suction is preferred as in Figure 7. If a flooded suction is not possible, a fill can similar in size to a 6.8 kg unit can be used. Be aware that the pump might need to be primed. Stand the pump in the fill can and pour the mixed units into it. DO NOT KEEP THE FILL CAN FULL. Allow the level to go down and to be almost at the bottom before filling it again. This is to prevent the Chockfast in the fill can from getting hard.

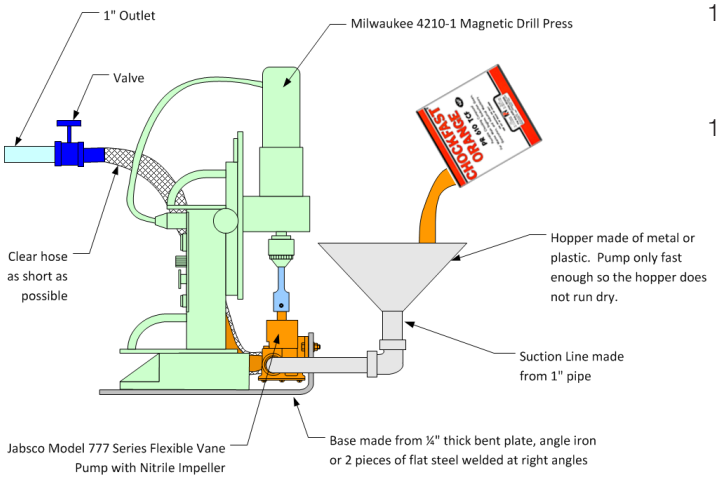

Figure 7

Start pumping. Add mixed Chockfast units to the can in which the pump stands, as required. Do not move the pump from can to can. Keep count of the units used, and as the total approaches the required quantity, slow the pumping rate to avoid over-pressurizing the resin cavity.

b. **By Gravity Filling**— the pouring connection should be on the top at the low end (usually aft) of the cavity. The filling connection should be equipped with a funnel and made from 36mm (1-1/2 inch) inside diameter pipe at least 150mm (6 inches) above the vent hole to provide head pressure.

Pour the Chockfast at a high enough rate to keep the level up to the bottom of the fill funnel. This will help to avoid trapping slugs of air in the pipe

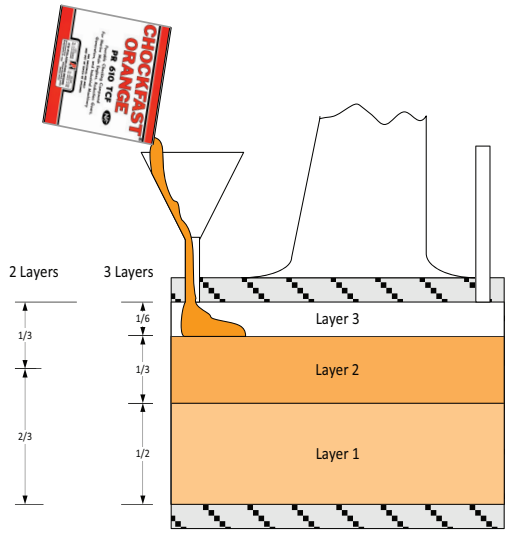

Figure 8

16. To prevent the Chockfast from overheating in large diameter and large annulus bearing applications, pour it in stages or layers allowing it to cool between layers as shown in Figure 8.

17. The Chockfast should be allowed to rise in the vent until it is almost full. If pumping, close the valve and disconnect the tubing. If the pump will not be immediately used again, clean it.

18. Monitor the level of the Chockfast in the fill and vent pipes and top off, if necessary, as the resin gels.

19. Allow the resin to solidify.

20. Remove any temporary damming and the filling and vent tubes. Clear any oil connections that were plugged. Remove any plugs in the flange bolt holes.

21. The alignment screws may be removed and replaced with set screws to assist in locking the sterntube or bearing in place, if desired. (If this is done. a drawing in the ship's file should indicate the fact.) See Figure 9.

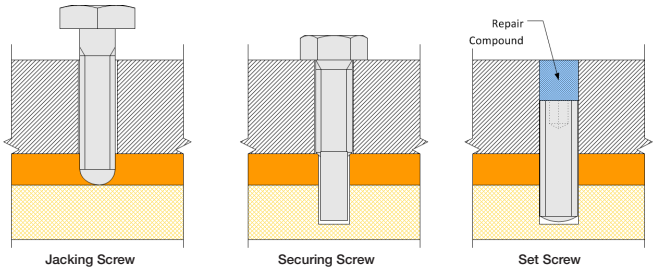

Figure 9

22. Exposed edges of Chockfast should be coated with a sealing compound such as Phillybond Orange or Repair Compound.

TESTING

Make Certain There Are No Leaks

Sterntube assemblies are normally required to be leak-tight. In order to ensure no leaks after the Chockfast has been installed and allowed to cure, an air test should be conducted. This test can be done either before or after the propeller shaft and seals have been installed. In the case of oil-lubricated bearings, the test should take place before filling the sterntube cavity with oil.

If the test is done before the propeller shaft is installed, seal off the inside diameter of the bearing with heavy blanks. A positive air pressure of 0.14 and 0.2 Bar (2 to 3 psi) is placed on the O.D. of the bearing. A leak detector solution can be used to detect any leakage around the Chockfast. Any leaks can be locally corrected with an epoxy sealing material such as Phillybond Orange.

WARNING: Compressed air testing is dangerous. Ensure the blanks used for testing are strong enough to withstand the forces which will be placed on them by the air pressure.

WATERTIGHT INSTALLATIONS

Watertight Installations

Although Chockfast Orange combines a high degree of structural security with superior maintenance of alignment, it does not always provide a watertight installation.

As is the case with pressed-in bearings, a primary sealing arrangement must be included in the design and installation of a sterntube assembly.

Sealing arrangements can consist of, but not necessarily limited to, the following:

- O-rings
- Closed-cell foam
- Foam with a backing ring
- Flat-bar sealing strip
- Epoxy sealing compound such as Phillybond Orange
- A combination of these methods

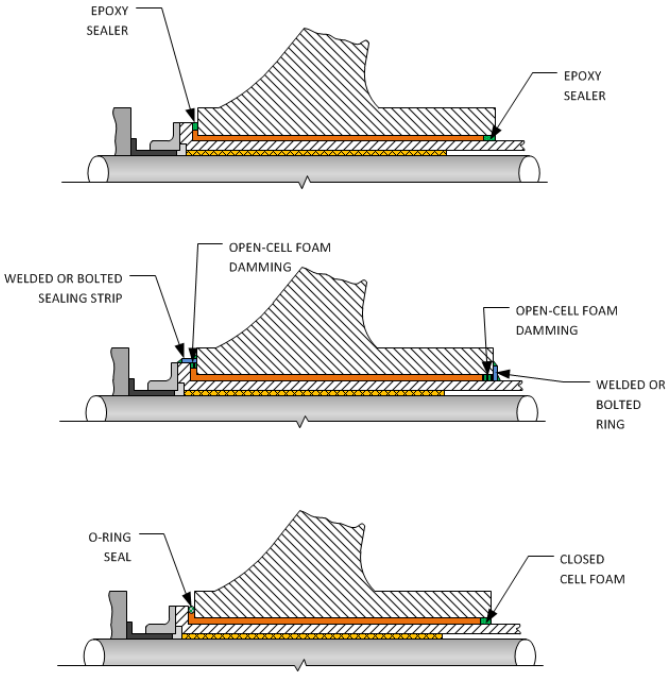

Figure 10

CRACKS

Because it is a hard material, there is always the potential for cracks in the Chockfast Orange. A crack is just the Chockfast relieving the tensile stress that has built up inside due to the high temperatures and rapid cooling. Once Chockfast has cracked, the stress inside the Chockfast has dissipated and no more cracking will occur. A crack does not indicate a failure of the Chockfast. Neither the strength of the Chockfast nor its ability to hold the shaft in perfect alignment is compromised. If the Chockfast should develop a crack, we recommend that the end of the crack be opened up using a small pencil grinder to a dimension of 5 mm wide x 3 mm deep (3/16 inch x 1/8 inch deep). Clean any dust from the area and fill with Phillybond Orange.

The way to prevent cracks in Chockfast is to make sure that it cures slowly, at a low temperature and evenly throughout its mass. Techniques that help with this are:

1. Taking a Full Reduction in the amount of hardener used.

2. Maintaining the strut or stern tube housing at or above an average temperature of 13°C (55°F) both before and after filling with Chockfast. Avoid spot heating using rose bud or other torches to heat the housings. Instead, tent over the housing and use a gentle means of raising the temperature of the steel.

3. Fill the housing in layers, as shown in Figure 8.

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