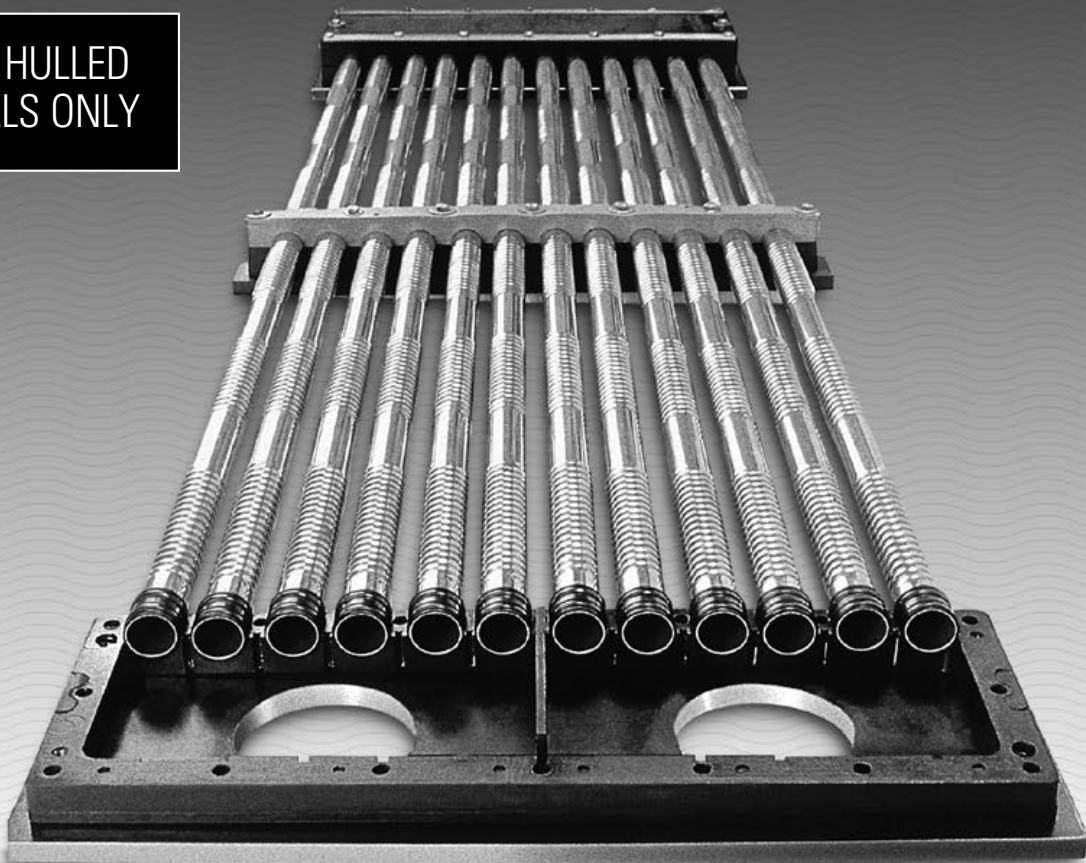


DURAMAX[®]

Demountable Keel Cooler

- ▷ Efficient 90/10 Copper-Nickel Spiral Tubes
- ▷ Replaceable Components Extend Service Life
- ▷ Expandable Cooling Capacity

STEEL HULLED
VESSELS ONLY



Installation Manual

Duramax Marine[®] is an ISO 9001:2015 Certified Company

DURAMAX MARINE[®]



Proper installation for optimal cooling efficiency

CAUTION: It is essential for you to carefully read all of the instructions contained in this manual in order for your Demountable Keel Cooler unit to operate properly.

Designed and built specifically for your vessel

The Demountable Keel Cooler copper-nickel construction provides highly efficient heat transfer, corrosion resistance and strength in all commercial marine operations. All Demountable Keel Coolers are custom designed and built to the engine's specifications and the operating conditions of your vessel.

Duramax Marine® keel cooler experts available for assistance

If you have any questions or need assistance at any stage of the project – from selection and installation to maintenance and troubleshooting – contact Duramax® heat transfer specialists.

**Duramax Marine® recommends inspection of all
Demountable Cooler components whenever you are dry docked**



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Planning for Demountable Keel Cooler Installation – Single and Double Bank Assembly

IMPORTANT: Read all instructions carefully before beginning assembly.

EQUIPMENT NEEDED:

1. Arc Welder
2. Cutting torch
3. Water pipes and valves (including an air bleed system.)
4. Protective shield (to be built) to protect the cooler if cooler will not be recessed into hull (See Step 5.)
5. Coating for hull
6. Socket Torque wrench
7. A light soapy water solution
8. Minimum eight lengths of 3/8" x 8.5" threaded rod plus 2 additional lengths for every mounting bracket (If using optional All-thread Rod installation procedure) (See pg. 15)

TUBE SLEEVE SEALS:

On the ends of each spiral tube, place the rubber sleeve seal. **The seals should be positioned 1/4" from the ends of the tubes.** In order to put the seals on the tubes, coating them with a light soapy water solution may be required to make them slip on easier.

The rubber sleeve seals are manufactured with raised rubber ridges on its ID and OD to create the proper seal.

Proper installation of the seals: 2 ridges on the ID and 4 ridges on the OD of the sleeve seal.



GROUNDING SUPPORT BRACKET ASSEMBLY:

Every cooler is supplied with one grounded support bracket assembly. It grounds the cooler tubes to the hull, reducing the possibility of electrolysis. For best results, the recommended position for the grounded support bracket is at or near, center of cooler. (See pg. 5)

Single Bank Grounded Support Bracket. The top deck of the grounding support bracket assembly for single bank coolers is grey; its bottom deck is black. The grey rubber color identifies the grounded support bracket assembly only.



Double Bank Grounded Support Bracket. The top and bottom decks of the grounded support bracket for double bank cooler assembly are grey; the interdeck is black.



STANDARD SUPPORT BRACKET ASSEMBLY:

Every cooler long enough to require more than a single support bracket is supplied with one or more additional standard support bracket assemblies. The components for each standard support bracket assembly top, bottom and interdecks are always black.



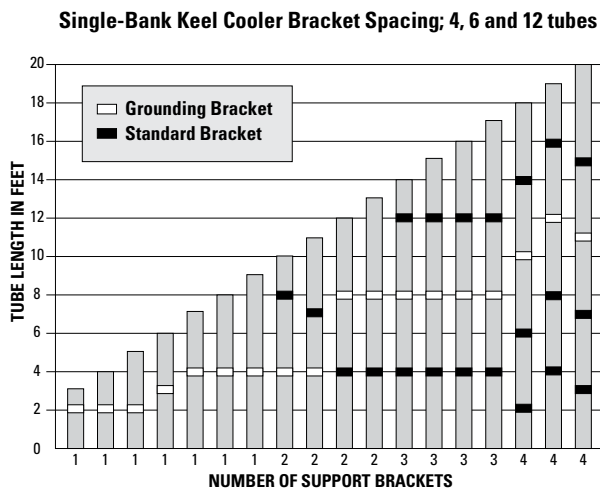
Planning for Demountable Keel Cooler Installation – Single & Double Bank Assembly

SUPPORT BRACKETS RECOMMENDED PLACEMENT :

Single Bank Installations

Single Bank Keel Cooler systems are provided with support bracket assemblies to support cooler tubing at **no greater than four foot intervals*** (Fig. 1)

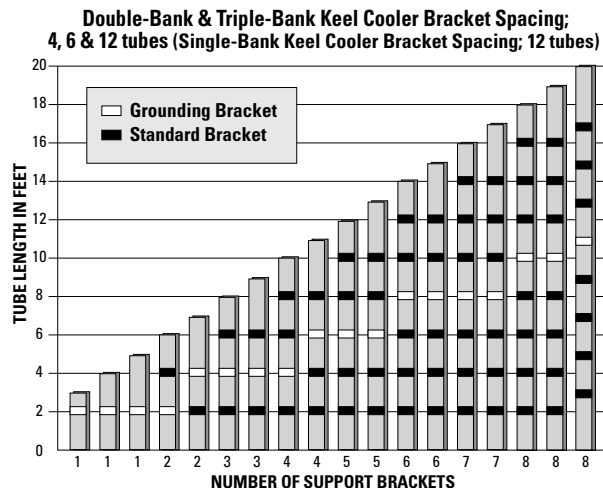
Figure 1



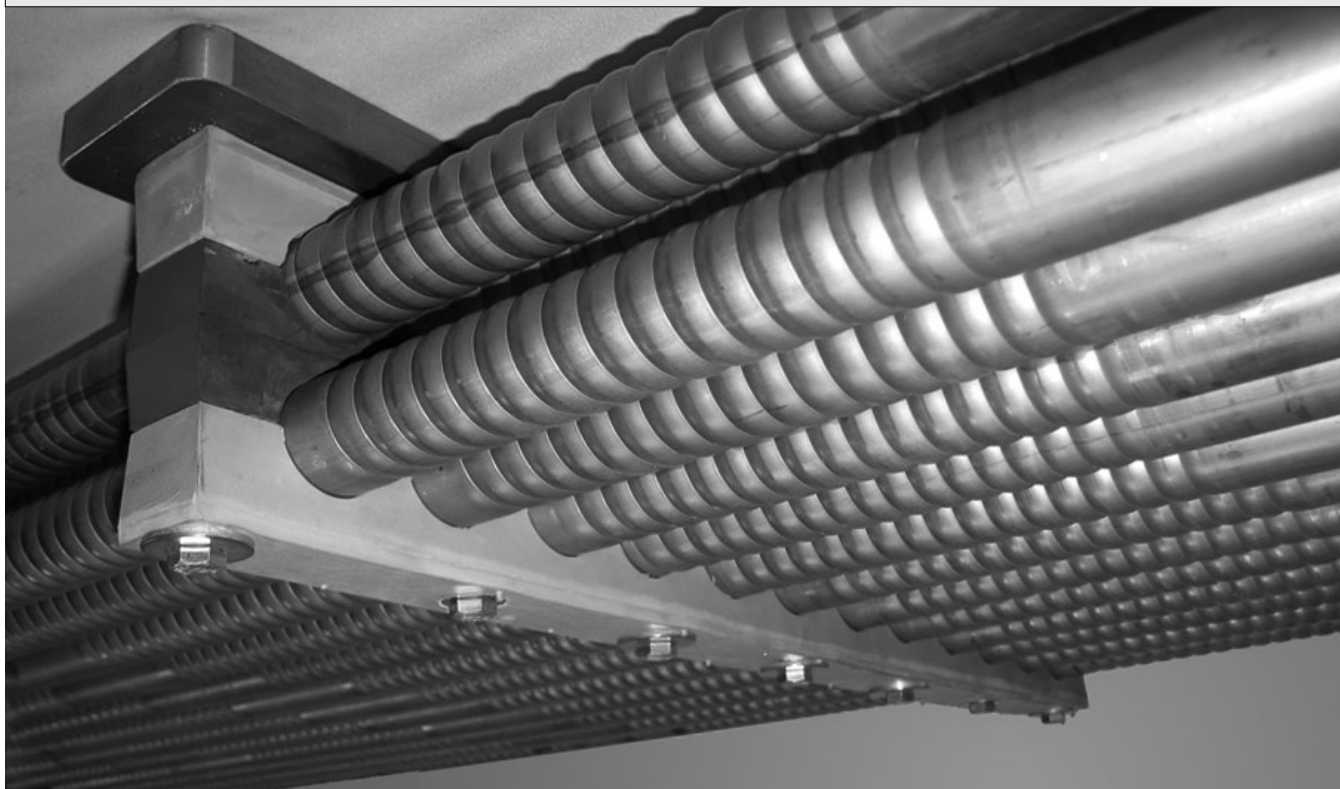
Double Bank, Triple Bank & 12 Tube Single Bank Installations

Double and Triple Bank Keel Cooler systems are provided with support bracket assemblies to support cooler tubing at **no greater than two foot intervals*** (Fig. 2)

Figure 2



CAUTION: Because of certain locations or operating conditions, it shall be the decision of the ship builder whether additional support brackets are required for your vessel.

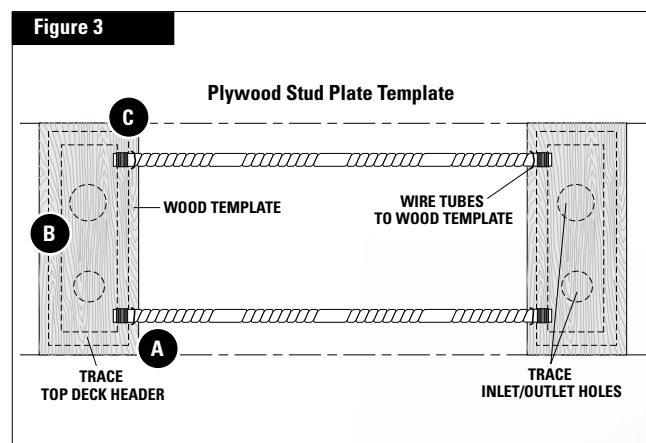


Positioning the Keel Cooler on Hull

Keel cooler stud plates are relatively heavy and are therefore, difficult to hold against the hull for marking keel cooler position. It is, therefore, recommended that a plywood cooler assembly template or prototype be made as follows:

CREATE A COOLER ASSEMBLY TEMPLATE:

1. Cut two plywood rectangles the same size as the cooler stud plate. (Fig. 3 – A).
2. Trace the stud plate and inlet and outlet holes on the plywood;
3. Place a top deck header on each wooden stud plate (Fig. 3 – B), line them up with the hole marks, and trace the shape of the header onto each plate and remove;
4. Then, tape or wire two tubes (or substitutes) directly to the wooden plates so that the rubber seals are centered on the header outlines. (Fig. 3 – C).



MARK HEADER LOCATIONS ON THE HULL USING TEMPLATE:

1. After determining the location of the keel cooler from the production drawings, the prototype assembly is positioned against the hull, so that proper markings can be made for subsequent welding of stud plates.
2. In case of retrofit installation, the proposed cooler location should be checked to insure no interference with the ship's internal structure.
3. Then, remove prototype assembly, replace with stud plates and block in place for welding.

Mounting the Stud Plates To the Hull

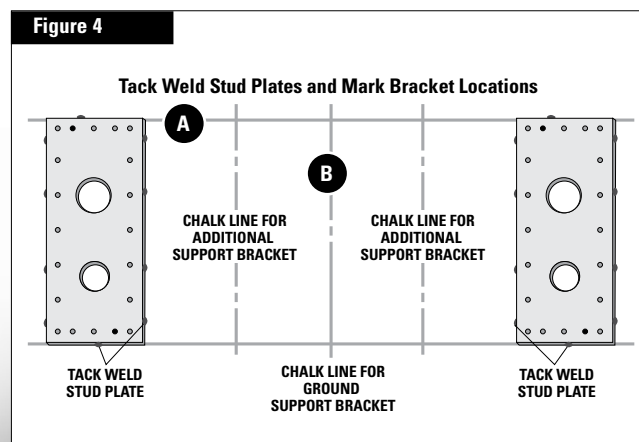
CAUTION: When welding or cutting, care must be taken not to distort the stud plates and to protect all other keel cooler parts from weld and burn spatters or accidental arcing. Stud plate surfaces where headers will rest must also be free from spatters.

Tack Weld Top Deck Header Stud Plates

1. Tack weld one header stud plate into marked position on the hull.
2. Next step is to tack weld the second header stud plate in marked location.

Position Grounding & Support Bracket Stud Plates

3. Lay chalk lines between the ends of each top deck header stud plate. They will be used in determining the mounting position for the grounded support bracket assembly and the additional support bracket assemblies required, depending on keel cooler length. (Fig. 4 – A)
4. Mark the grounding & support bracket intervals (on page 5) required for cooler along the chalk lines. (Fig. 4 – B)

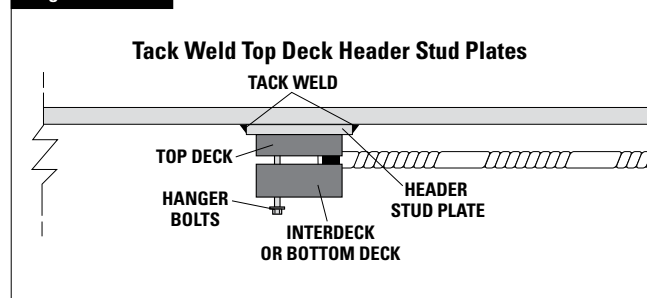


Planning for Demountable Keel Cooler Installation – Single & Double Bank Assembly

Tack Weld Grounding & Support Bracket Stud Plates

5. Temporarily fasten the header top deck to the stud plate using hanger bolts.
6. Loosely fasten the interdeck (for double bank) using hanger bolts to the top deck header, or bottom deck header (for single bank) using assembly bolts to the stud plate. (Fig. 5) & (Fig. 5a)

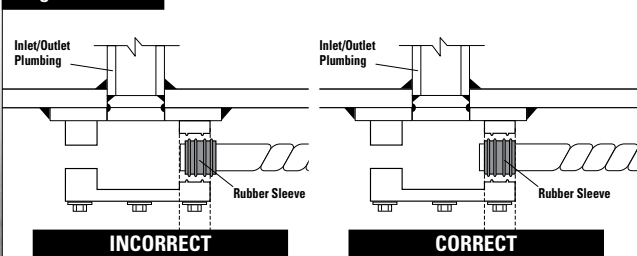
Figure 5



7. Hang two tubes between the headers and position the grey grounded support bracket assembly (bracket top and stud plate) across the spiral tubes at the interval nearest the center of the cooler. Make certain that the bracket top and stud plate position is at the desired or non-spiraled portion of the tubes.

NOTE: Support brackets must be located at non-spiraled areas of tubes.

Figure 5a



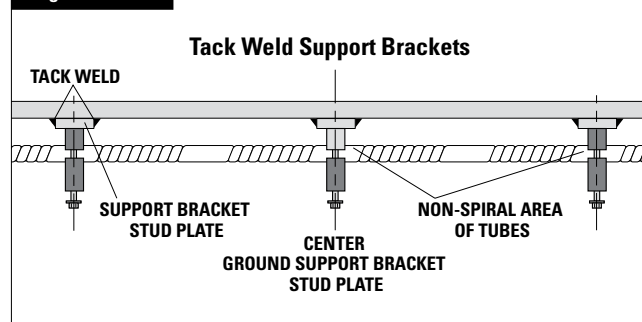
NOTE: BOSTIK MARINE-GRADE NEVER-SEEZ® can be used on outside of sleeve seals which will provide longer working time than soap & water.

8. Mark the grounding support bracket stud plate location on hull, then tack weld the stud plate. (Fig. 6)

NOTE: Care should be taken to protect tubing from weld.

9. Repeat this procedure with standard black support bracket assemblies (bracket top and stud plate) at other intervals, if any (depending on cooler length). Again, make certain that those positions are at the desired flat or non-spiraled portions of the tubes. Care should be taken that support brackets do not rub against spiral portions of tube causing unneeded wear.

Figure 6



10. Mark the black support bracket stud plate location on hull, then tack weld the stud plate. (Fig. 6)

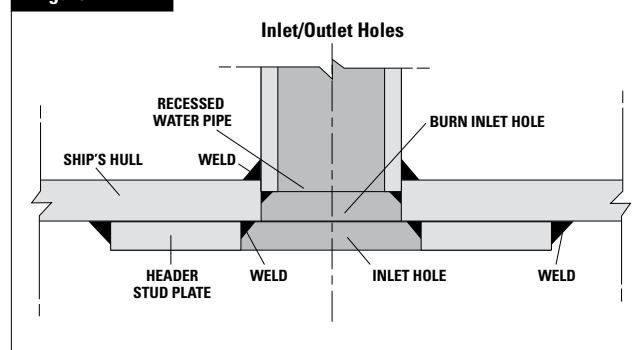
Finish Welding Header and Support Bracket Stud Plates

11. First check the fit of the second bank of tubes (double bank systems only).
12. Take down the whole keel cooler assembly and finish welding all the stud plates (header and support plates).

Inlet/Outlet Plumbing Holes

13. Burn inlet/outlet holes in hull after stud plates have been welded to prevent warping of plates. Insert and recess water pipes and weld in place. (Fig. 7) Do not get weld or spatters where headers and/or partitions (separators) will rest.

Figure 7

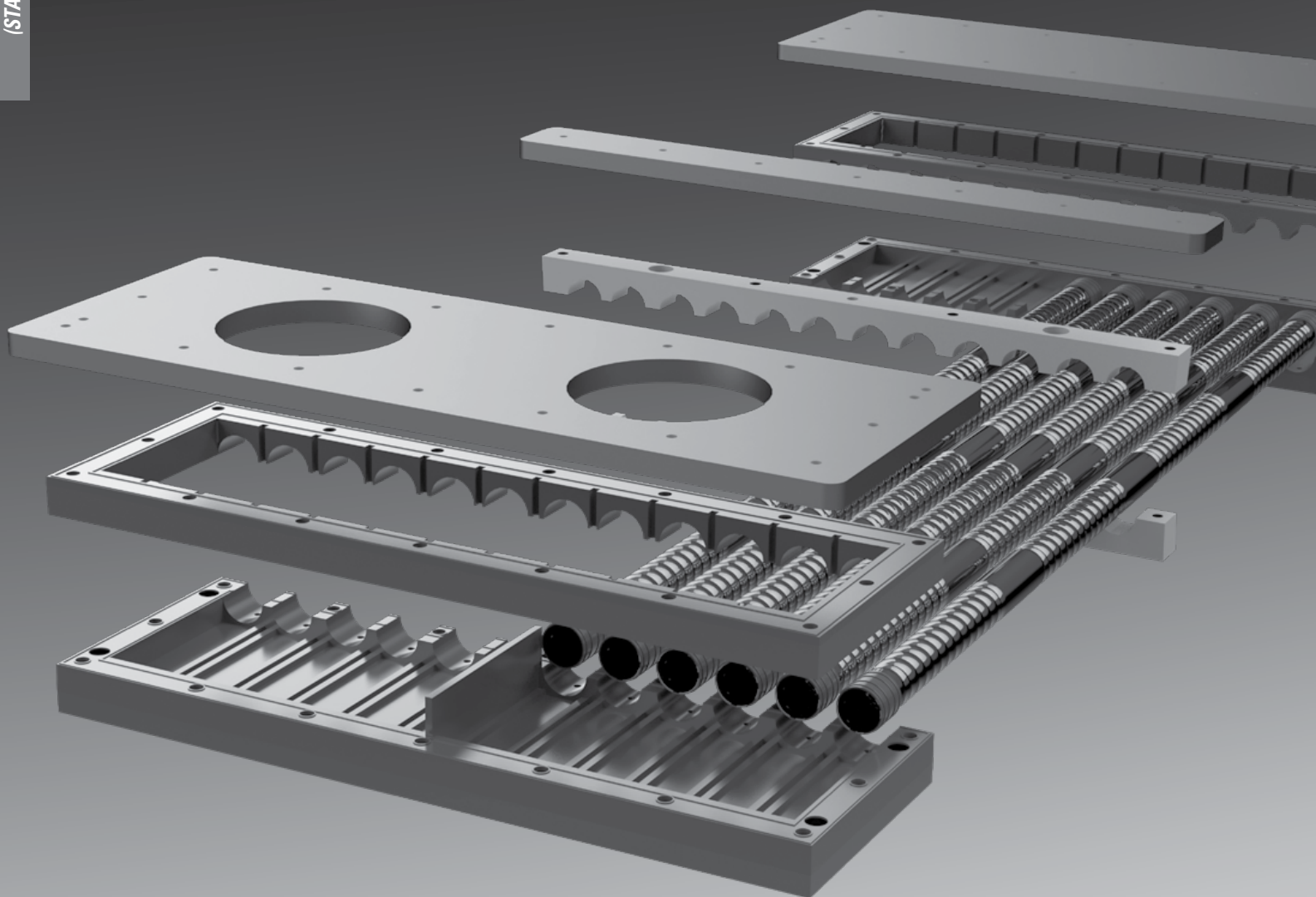


YOU ARE NOW READY TO ASSEMBLE THE KEEL COOLER.

SINGLE BANK MOUNTING *(Standard Installation)*

The demountable tube construction of the cooler makes it quick and easy to install or repair.

Before installing your Demountable Keel Cooler you must select the appropriate hull location for your unit. Make sure you have read the Demountable Keel Cooler Planning Section located at the beginning of this guide.



SINGLE BANK MOUNTING: Standard Installation *(continued)*

IMPORTANT: Thoroughly coat the hull area under the tubes and the surfaces of the stud plates with a protective coating to reduce the possibility of electrolysis. All electrical equipment on board the vessel should be properly grounded.

Mount Top Deck Heads

1. Fasten all header top deck heads to the welded stud plates using 2 hanger bolts in each top deck head. **Torque hanger bolts to 25 ft. lbs. (Fig. 8)**

Figure 8



Hang Grounding & Support Brackets

2. Position the one grounded support bracket assembly over its stud plate at or near center of keel cooler and secure with assembly bolts. Place three washers on one assembly bolt before inserting into grounding bracket hole that is recessed and cleared of rubber coating. Then place three more between the grey top deck of support bracket and its stud plate. Washers in contact with solid brass core will ensure a good grounding connection. (Fig. 9)

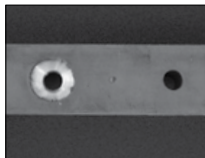
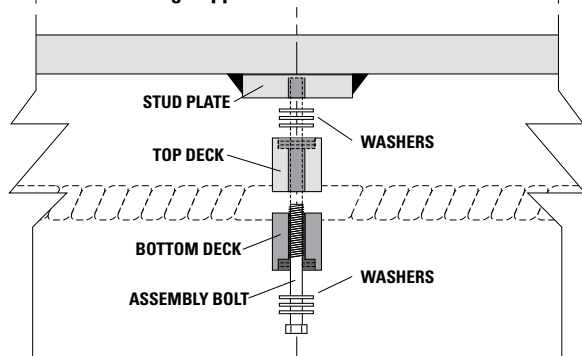


Figure 9

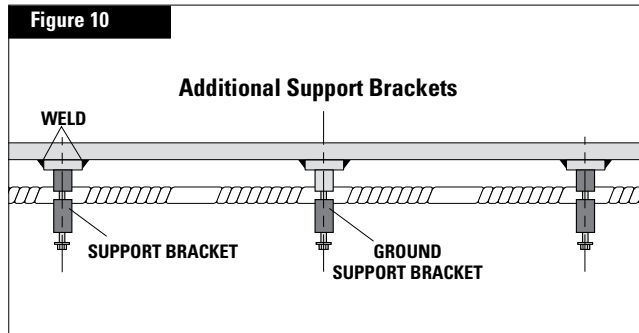
Grounding Support Bracket Washer Placement



IMPORTANT: The bolt with washers is to be placed at the end hole from which the rubber has been faced off.

3. Loosely fasten additional standard support bracket assemblies as required to their stud plates. (Fig. 10)

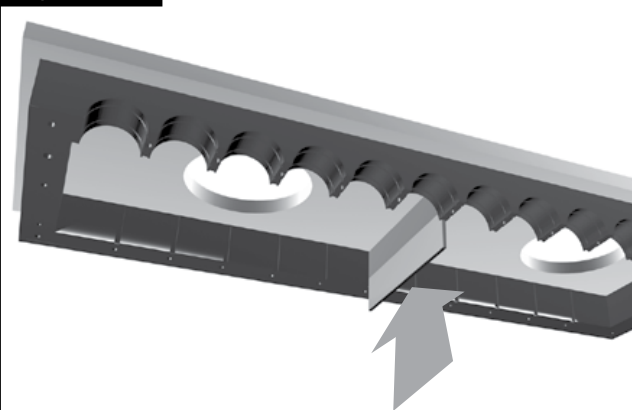
Figure 10



Install Separators

4. The inside walls of the headers are provided with grooves. **Separators (rubber clad partitions)** can be slid (using soap solution to lubricate) into the grooves between tubes to direct the flow of water. In this way, one keel cooler can become several cooling units, or multiple pass system. (Fig. 11)

Figure 11



IMPORTANT: Refer to the plumbing diagram or cooler drawing specific to your application for proper location of separator plates.

SINGLE BANK MOUNTING: Standard Installation *(continued)*

Fitting Keel Cooler Tubes Between Decks

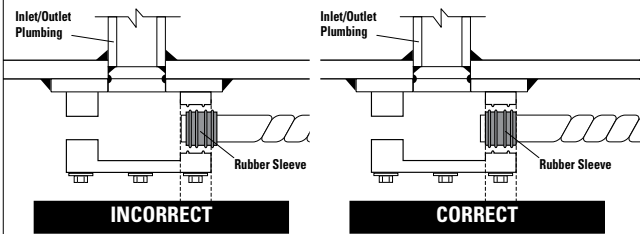
5. Loosely fasten all bottom decks using 4 assembly bolts and 2 washer strips along length of bottom deck (leave room for tubes). (Fig. 12)

Figure 12



6. Slide tubes through supports and into position between top header decks and bottom decks.
7. Fit tube seals into top header deck grooves (a light soapy water solution on the seals will help seat them). To seal properly, it is important that the sleeve seals on tube ends are positioned so the outside edge of each sleeve seal is even with the outside edge of the headers. (Fig. 13)

Figure 13

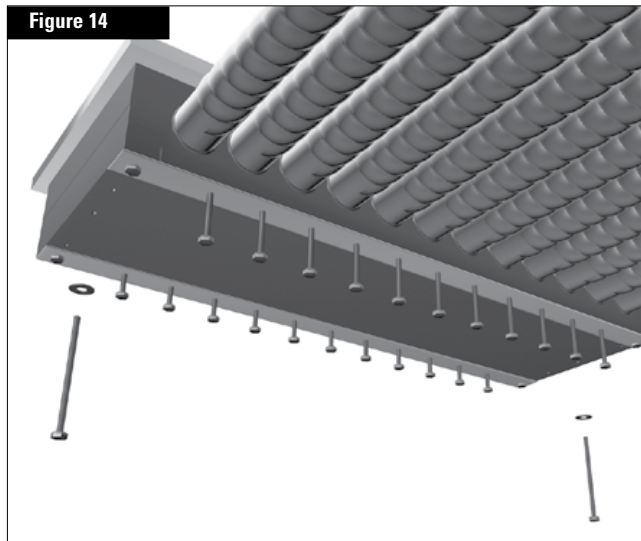


NOTE: BOSTIK MARINE-GRADE NEVER-SEEZ® can be used on outside of sleeve seals which will provide longer working time than soap & water.

Finish Tightening Assembly

8. Tighten assembly bolts at 4 corners of bottom deck,
9. Insert additional assembly bolts along washer plate, then insert assembly bolts with round washer between washer strips at end of bottom deck. (Fig. 14)

Figure 14



10. Tighten down all bottom deck and support brackets assembly bolts, torque to 25 ft. /lbs.

IMPORTANT: Re-torque all bolts after one hour as the rubber will have taken a compression set by then.

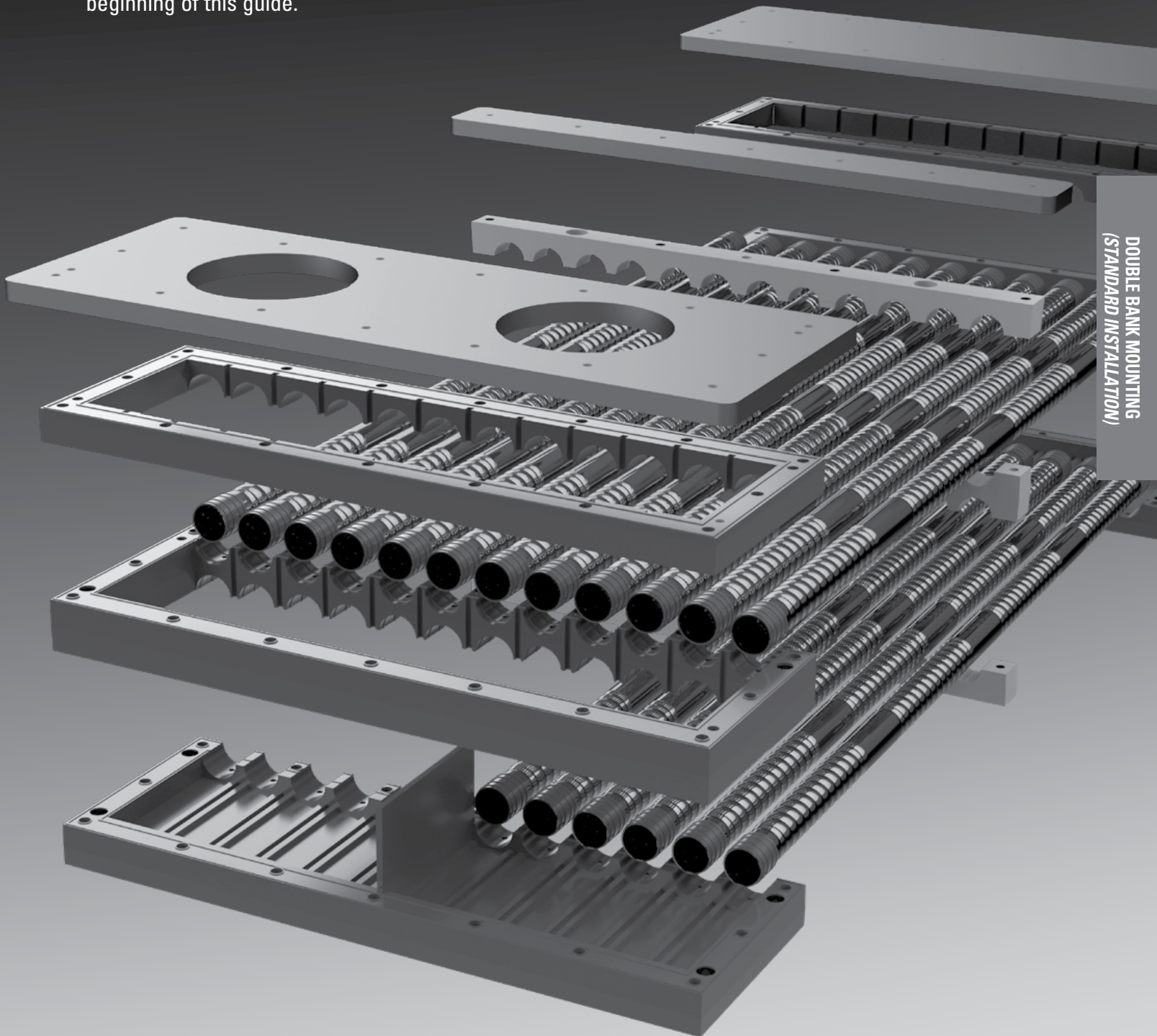
11. Connect water lines according to your engine requirements. Pressurize system to 30 psi and check for leaks.

**YOUR KEEL COOLER IS NOW INSTALLED,
FOLLOW INSTRUCTIONS FOR
PROTECTIVE SHIELDING**

DOUBLE BANK MOUNTING *(Standard Installation)*

The demountable tube construction of the cooler makes it quick and easy to install or repair.

Before installing your Demountable Keel Cooler you must select the appropriate hull location for your unit. Make sure you have read the Demountable Keel Cooler Planning Section located at the beginning of this guide.



DOUBLE BANK MOUNTING
(STANDARD INSTALLATION)

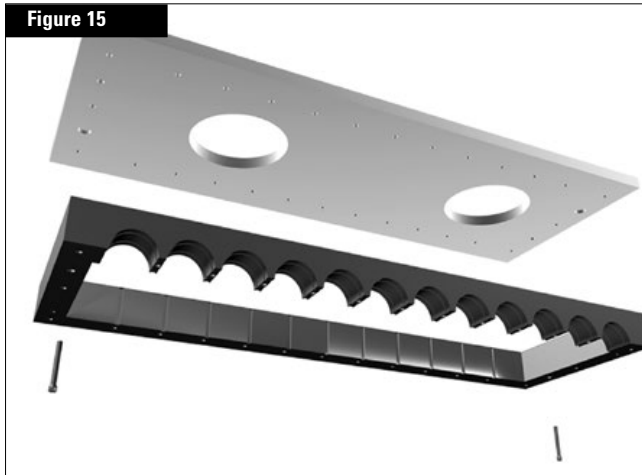
DOUBLE BANK MOUNTING: Standard Installation *(continued)*

IMPORTANT: Thoroughly coat the hull area under the tubes and the surfaces of the stud plates with a protective coating to reduce the possibility of electrolysis. All electrical equipment on board the vessel should be properly grounded.

Mount Top Deck Heads

1. Fasten all header top deck heads to the welded stud plates using 2 hanger bolts in each top deck head. **Torque hanger bolts to 25 ft. lbs.** (Fig. 15)

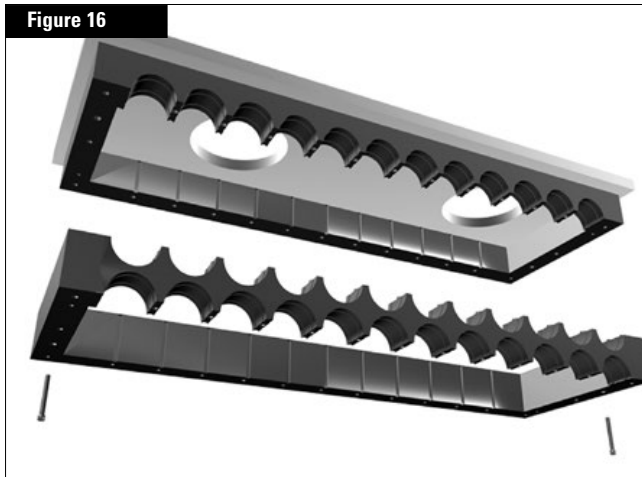
Figure 15



Fasten Interdecks

2. Loosely fasten all header interdecks using 2 hanger bolts in each interdeck. (leave room for tubes). (Fig. 16)

Figure 16



Hang Grounding & Support Brackets

3. Position the one grounded support bracket assembly over its stud plate at or near center of keel cooler and secure with assembly bolts. Place three washers on one assembly bolt before inserting into grounding bracket hole that is recessed and cleared of rubber coating. Then place three more between the grey top deck of support bracket and its stud plate. Washers in contact with solid brass core will ensure a good grounding connection. (Fig. 17)

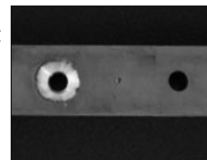
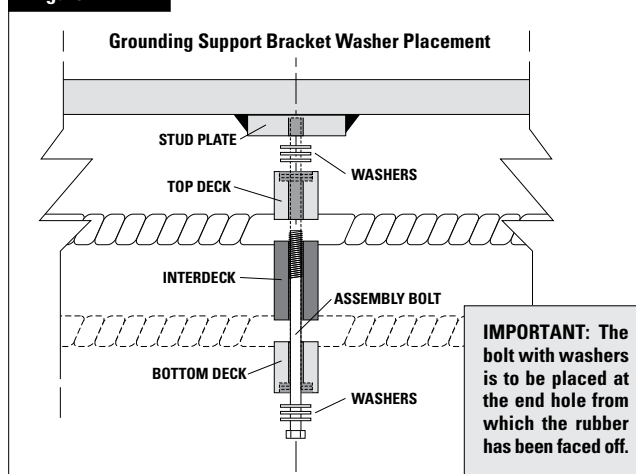
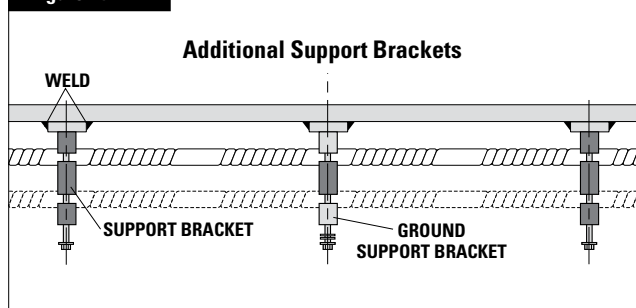


Figure 17



4. Loosely fasten additional standard support bracket assemblies as required to their stud plates. (Fig. 18)

Figure 18



DOUBLE BANK MOUNTING: Standard Installation *(continued)*

Fit Upper Bank Tubes

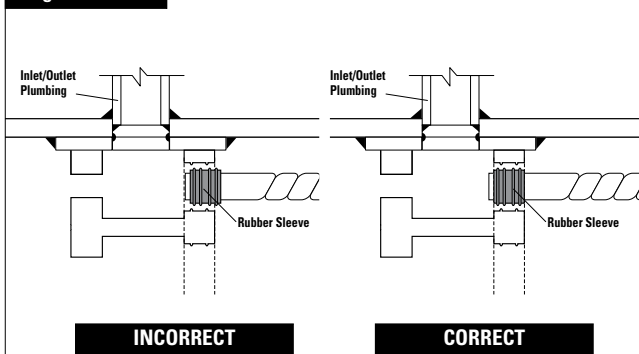
5. Slide upper tubes through support bracket(s) and into position between top header deck and interdeck. (Fig. 19)

Figure 19



6. Fit tube seals into top header deck grooves (a light soapy water solution on the seals will help seat them). To seal properly, it is important that the sleeve seals on tube ends are positioned so the outside edge of each sleeve seal is even with the outside edge of the headers. (Fig. 20)

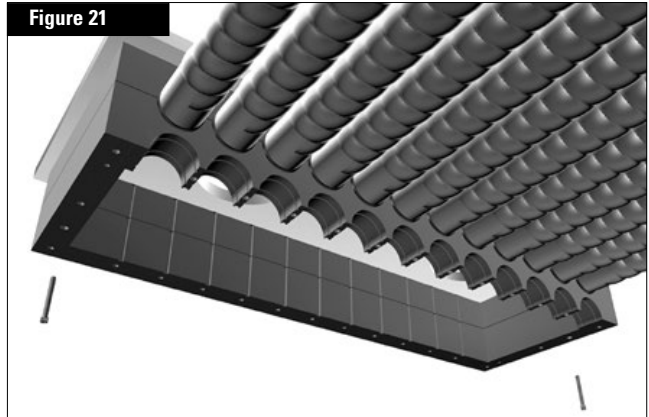
Figure 20



NOTE: BOSTIK MARINE-GRADE NEVER-SEEZ® can be used on outside of sleeve seals which will provide longer working time than soap & water.

7. Tighten down all interdecks using 2 hanger bolts per interdeck. (Fig. 21)

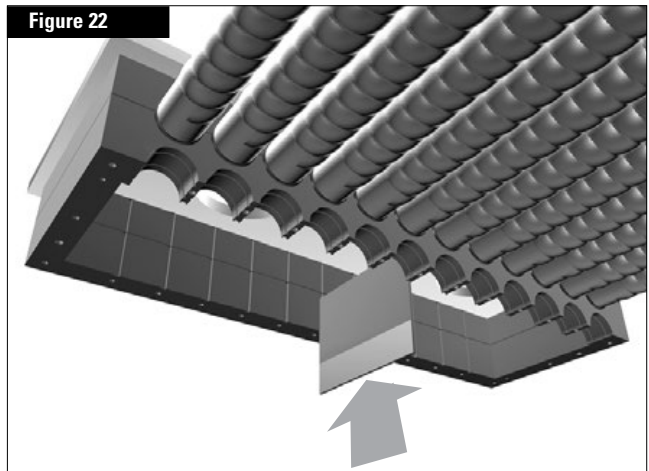
Figure 21



Install Separators

8. The inside walls of the headers are provided with grooves. Separators (rubber clad partitions) can be slid (using soap solution to lubricate) into the grooves between tubes to direct the flow of water. In this way, one keel cooler can become several cooling units, or multiple pass system. (Fig. 22)

Figure 22



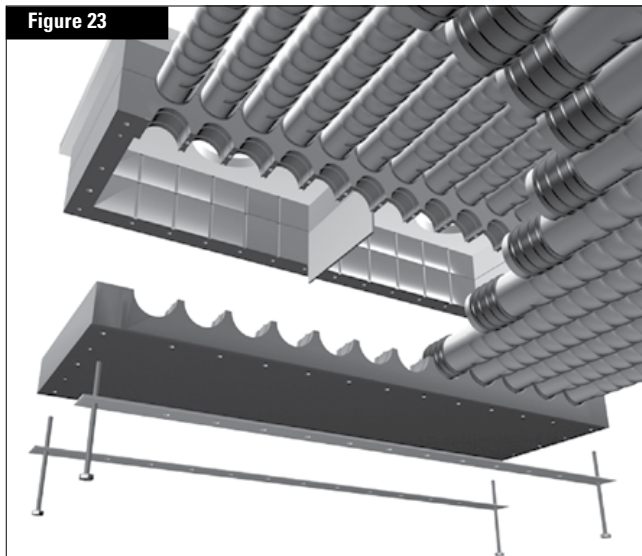
IMPORTANT: Refer to the plumbing diagram or cooler drawing specific to your application for proper location of separator plates.

DOUBLE BANK MOUNTING: Standard Installation *(continued)*

Install Bottom Deck and Tubes

9. Loosely fasten all bottom decks using 4 assembly bolts and 2 washer strips along length of bottom deck (leave room for tubes). (Fig. 23)

Figure 23



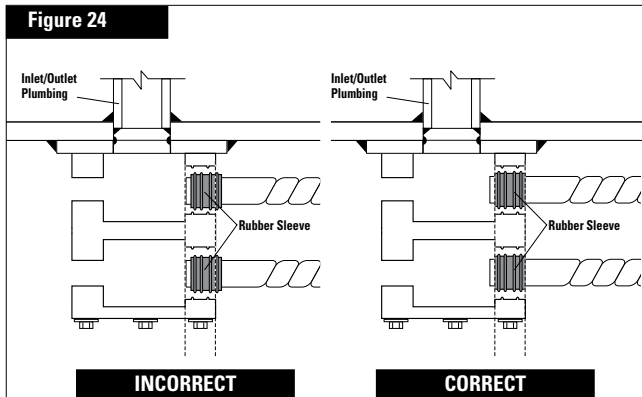
NOTE: BOSTIK MARINE-GRADE NEVER-SEEZ® can be used on outside of sleeve seals which will provide longer working time than soap & water.

10. Slide tubes through supports and into position between header decks and bottom decks.

11. Fit tube seals into bottom deck header deck grooves

(a light soapy water solution on the seals will help seat them). To seal properly, it is important that the sleeve seals on tube ends are positioned so the outside edge of each sleeve seal is even with the outside edge of the headers. (Fig. 24)

Figure 24

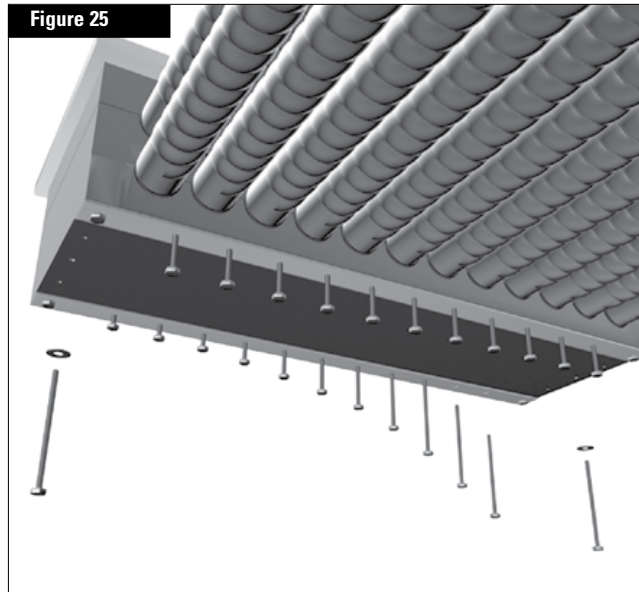


NOTE: BOSTIK MARINE-GRADE NEVER-SEEZ® can be used on outside of sleeve seals which will provide longer working time than soap & water.

12. Tighten assembly bolts at 4 corners of bottom deck,

13. Insert additional assembly bolts along washer plate, then insert assembly bolts with round washer between washer strips at end of bottom deck. (Fig. 25)

Figure 25



14. Tighten down all bottom deck and support brackets assembly bolts, torque to 25 ft. / lbs.

IMPORTANT: Re-torque all bolts after one hour as the rubber will have taken a compression set by then.

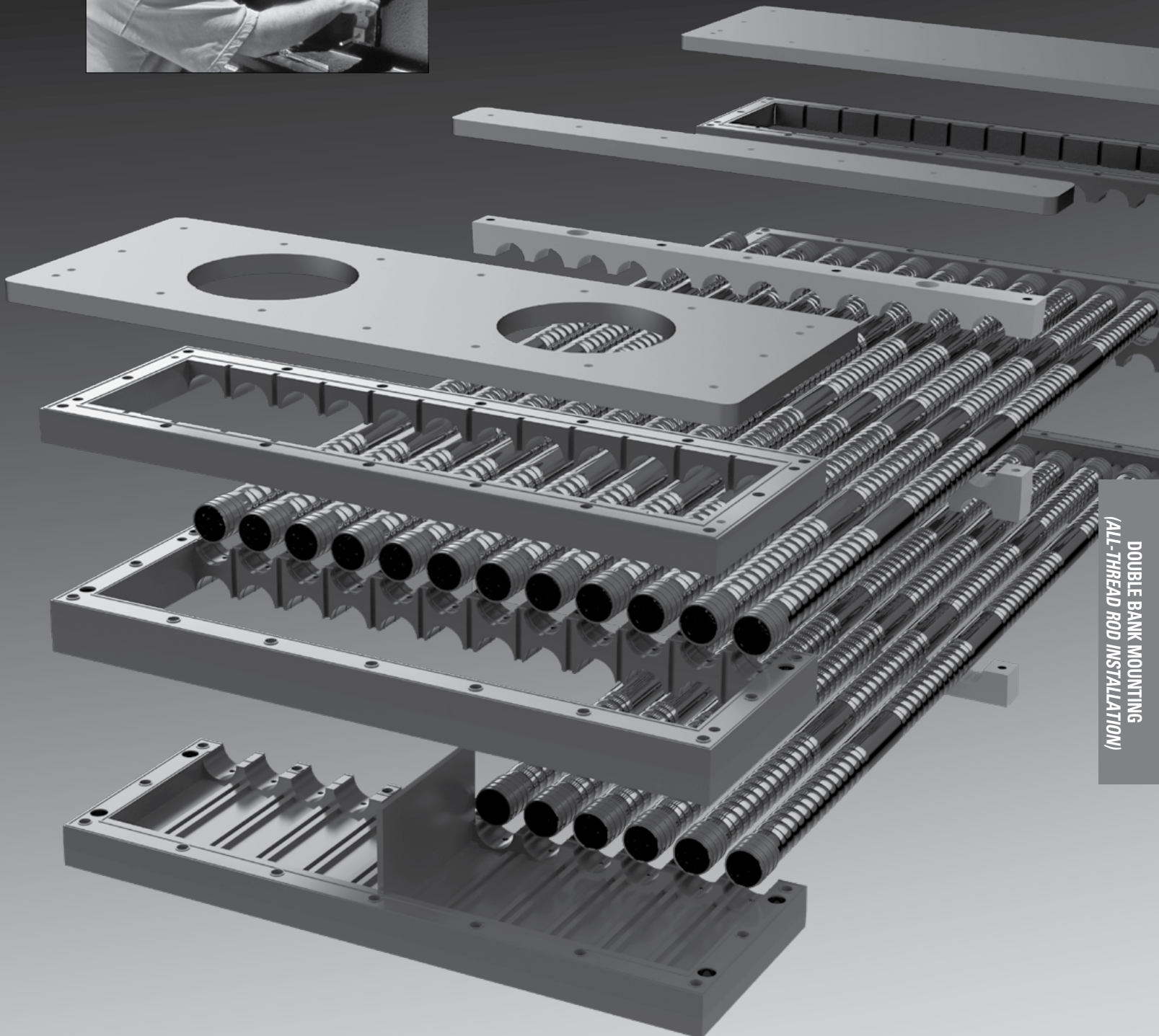
15. Connect water lines according to your engine requirements. Pressurize system to 30 psi and check for leaks.

YOUR KEEL COOLER IS NOW INSTALLED,
FOLLOW INSTRUCTIONS FOR
PROTECTIVE SHIELDING

DOUBLE BANK MOUNTING *(All-Thread Rod Installation)*



The 3/8" All-Thread Rod temporarily hangs the cooler components from the top deck. This method facilitates adjustment of assembly parts to their exact location before tightening and securing to final torque values. This mounting procedure makes handling and positioning the cooler parts easier.



DOUBLE BANK MOUNTING
(ALL-THREAD ROD INSTALLATION)

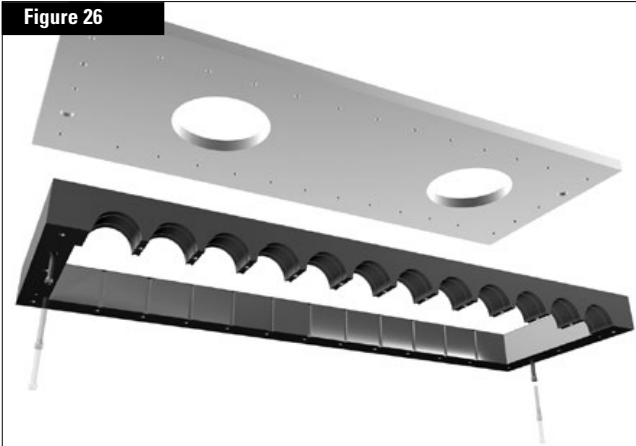
DOUBLE BANK MOUNTING: All-Thread Rod Installation *(continued)*

IMPORTANT: Thoroughly coat the hull area under the tubes and the surfaces of the stud plates with a protective coating to reduce the possibility of electrolysis. All electrical equipment on board the vessel should be properly grounded.

Mount Top Deck Heads

1. Fasten all header top deck heads to the welded stud plates using 2 hanger bolts in each top deck head. Torque hanger bolts to 25 ft. lbs. (Fig. 26)

Figure 26

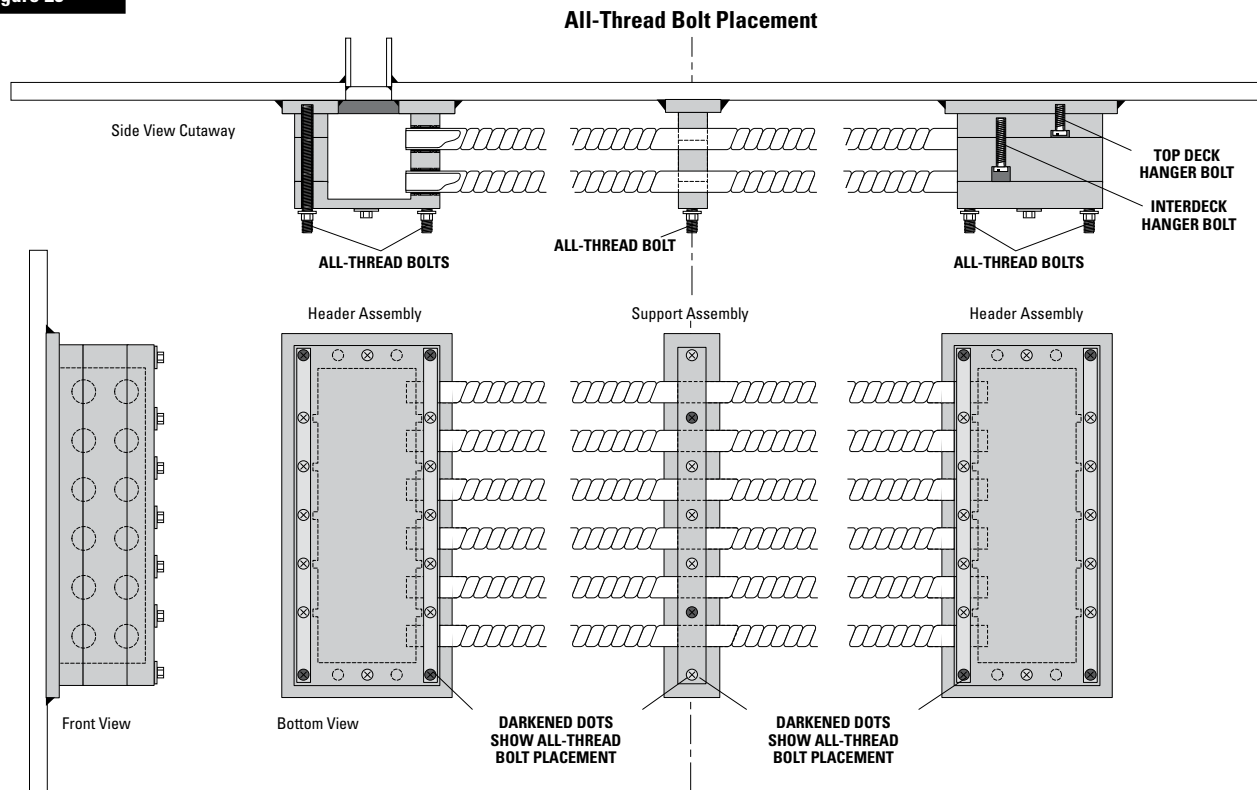


2. Insert the 8.5"x 3/8" All-Thread rods into four corners of each top deck head and two ends of each support stud plate. (Fig. 27, Fig. 28)

Figure 27



Figure 28



CAUTION: ON THE GROUNDED SUPPORT BRACKET DO NOT USE THE BOLT HOLE THAT WILL BE REQUIRED FOR GROUNDING THE COOLER. The grounding location is identified with a bolt area that has had the rubber removed and has exposed the bronze core. Proper assembly of this grounded bracket must be followed.

DOUBLE BANK MOUNTING: All-Thread Rod Installation (continued)

Hang Interdecks

3. Hang the interdecks by sliding them over the All-Thread Rods and loosely secure with 3/8" nuts. Leave plenty of room for tubes. (Fig. 29)

Figure 29



Hang Grounding & Support Brackets

4. Position the one grounded support bracket assembly over its stud plate at or near center of keel cooler and hang loosely with all-thread rods. Place the washers on one assembly rod before inserting into grounding bracket hole that is recessed and cleared of rubber coating. Then place more between the grey top deck of support bracket and its stud plate.. Washers in contact with solid brass core will ensure a good grounding connection. (Fig. 30)

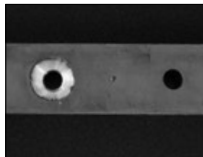
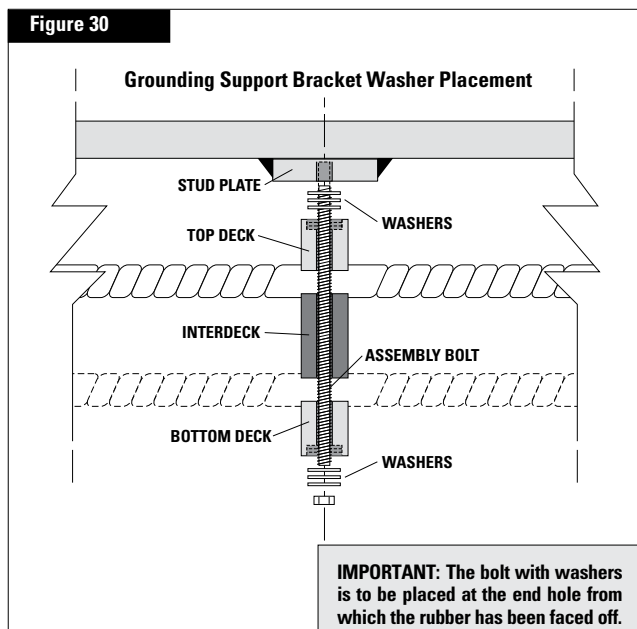
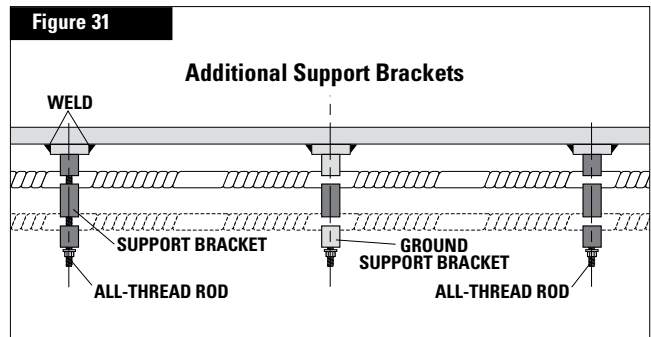


Figure 30



5. Loosely fasten additional standard support bracket assemblies as required to their stud plates. (Fig. 31)

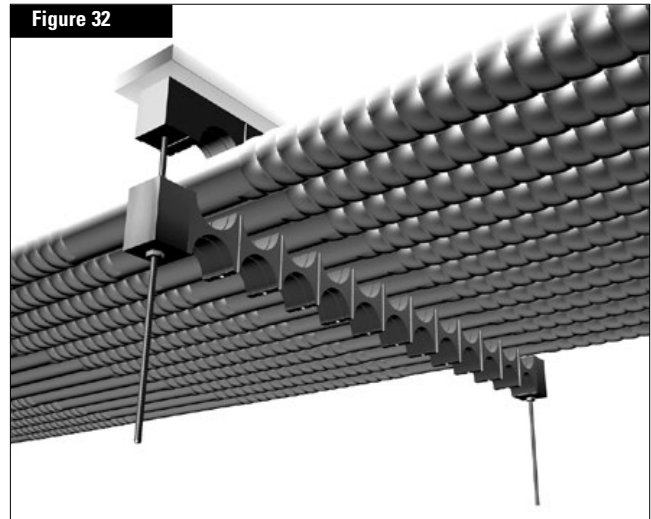
Figure 31



Install Upper Bank Tubes

6. Slide upper tubes through support bracket(s) and into position between top header deck and interdeck. (Fig. 32)

Figure 32



DOUBLE BANK MOUNTING: All-Thread Rod Installation *(continued)*

7. Fit tube seals into top header deck grooves

(a light soapy water solution on the seals will help seat them). To seal properly, it is important that the sleeve seals on tube ends are positioned so the outside edge of each sleeve seal is even with the outside edge of the headers. (Fig. 33, Fig. 34)

Figure 33

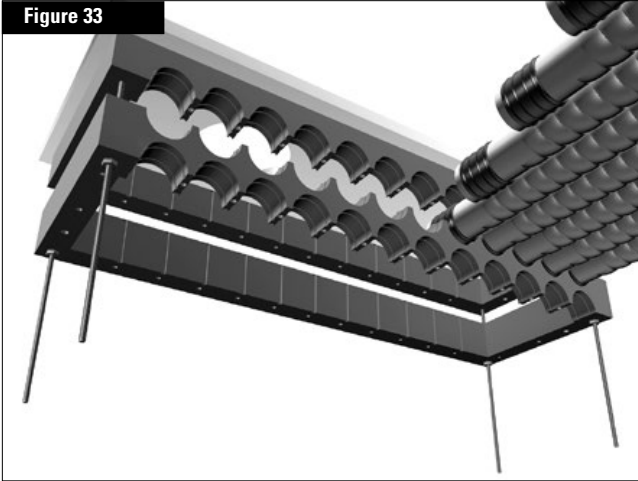
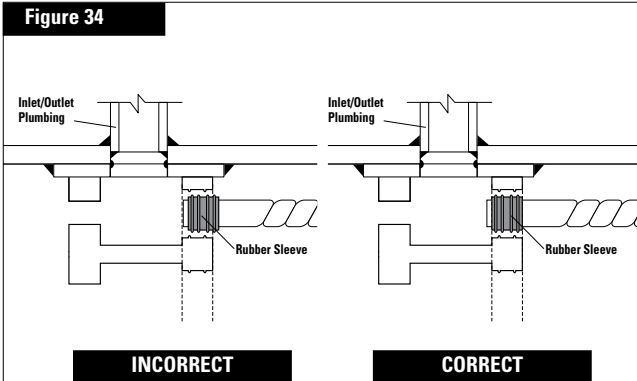


Figure 34

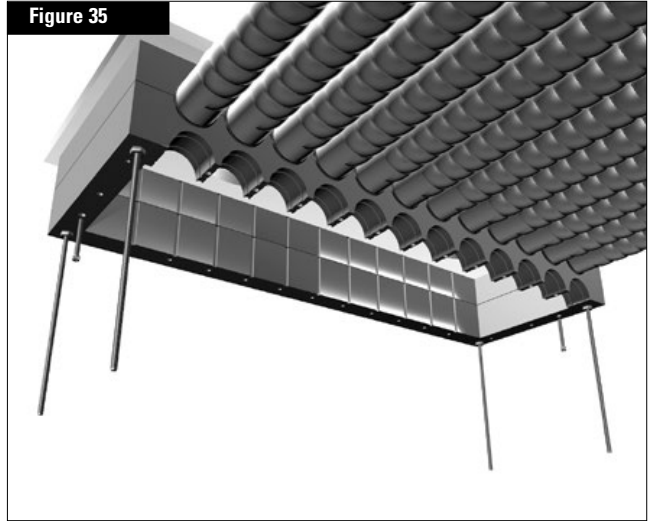


NOTE: BOSTIK MARINE-GRADE NEVER-SEEZ® can be used on outside of sleeve seals which will provide longer working time than soap & water.

Tighten Interdecks

8. Tighten down all interdecks using 2 hanger bolts on each interdeck. (Fig. 35)

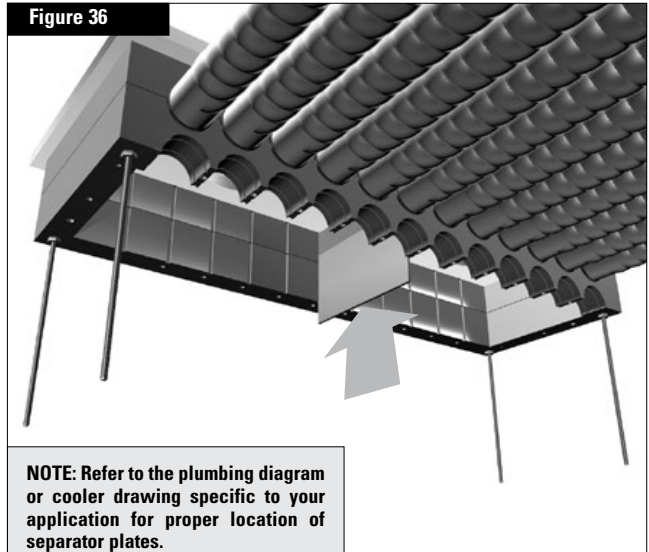
Figure 35



Install Separators

9. Install separators. The inside walls of the headers are provided with grooves. Separators (rubber clad partitions) can be slid (using soap solution to lubricate) into the grooves between tubes to direct the flow of water. In this way, one keel cooler can become several cooling units, or multiple pass system. (Fig. 36)

Figure 36



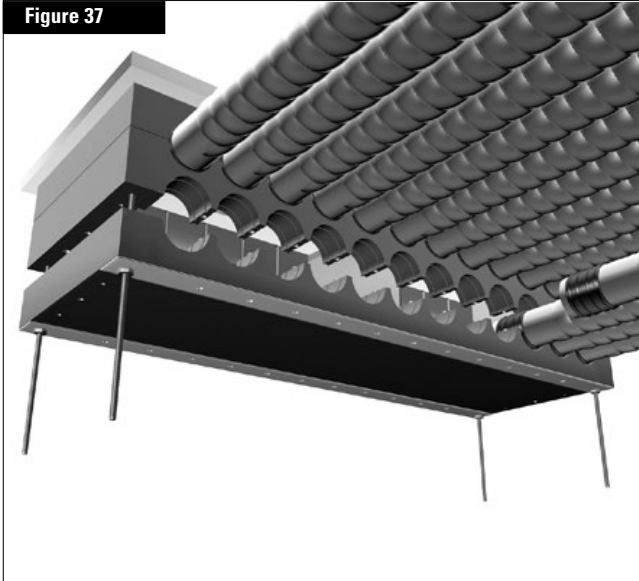
NOTE: Refer to the plumbing diagram or cooler drawing specific to your application for proper location of separator plates.

DOUBLE BANK MOUNTING: All-Thread Rod Installation *(continued)*

Install Bottom Deck Head

- 10. Remove nuts from 3/8" All-Thread Rods and hang bottom deck head and metal washer strip by sliding both over All-Thread Rods and temporarily secure with nuts. Leave room to insert tubes. (Fig. 37)**

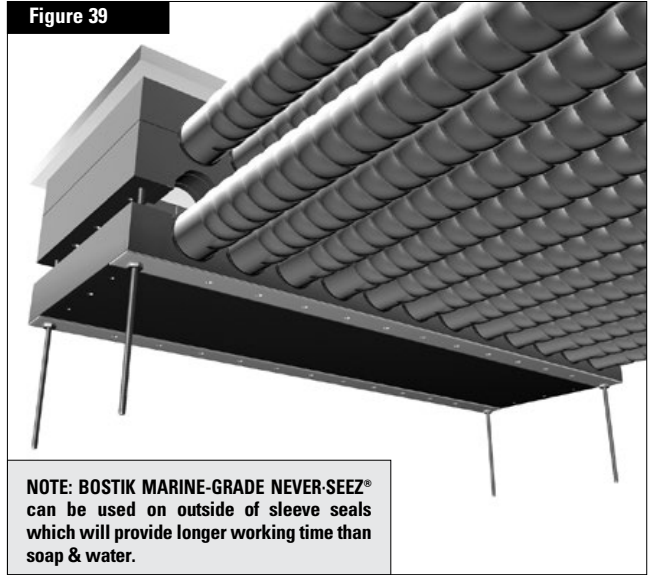
Figure 37



- 12. Fit tube seals into bottom deck header deck grooves**

(a light soapy water solution on the seals will help seat them). To seal properly, it is important that the sleeve seals on tube ends are positioned so the outside edge of each sleeve seal is even with the outside edge of the headers. (Fig. 39, Fig. 40)

Figure 39



Install Bottom Deck Tubes

- 11. Slide bottom tubes through support bracket(s) and into position between interdeck and bottom header deck. (Fig. 38)**

Figure 38

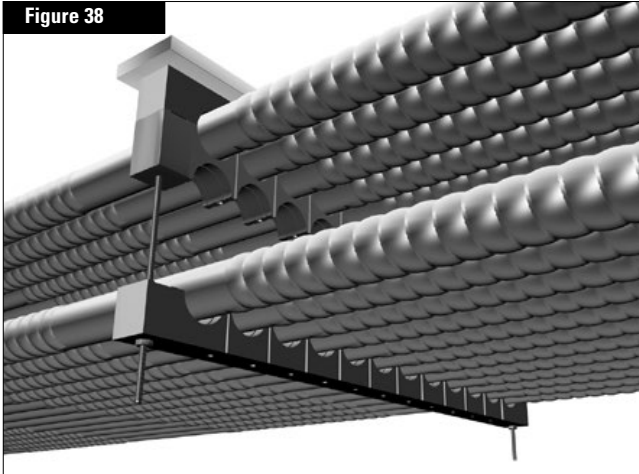
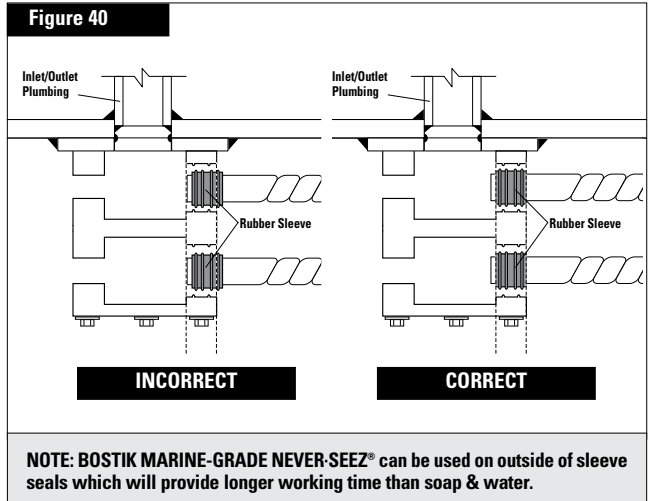


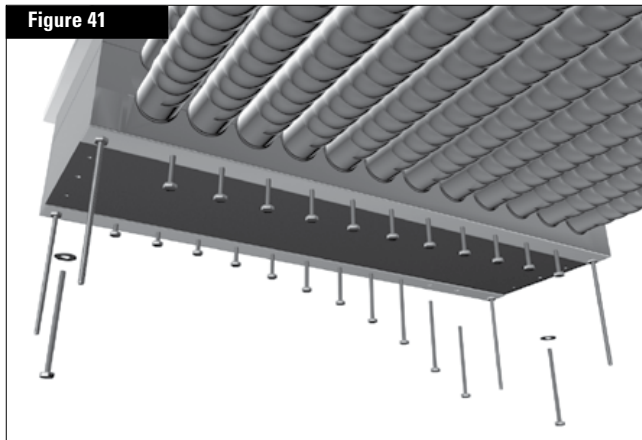
Figure 40



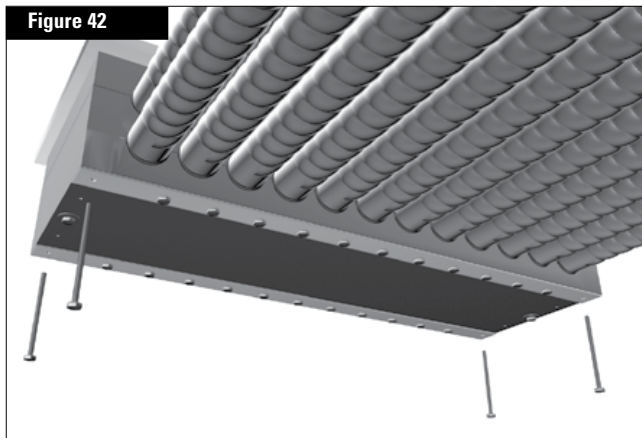
DOUBLE BANK MOUNTING: All-Thread Rod Installation *(continued)*

Finish Installation; Bottom Deck and Support Brackets

13. Fasten bottom deck heads to header assemblies using unused assembly bolt openings in bottom deck. *(Fig. 41)*

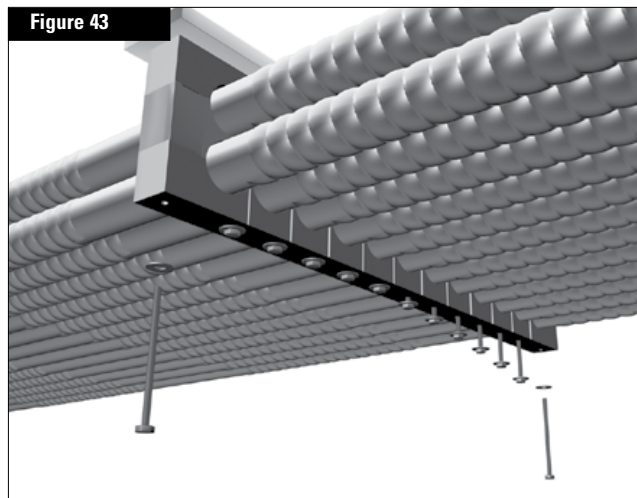


14. Remove All-Thread rods and replace with assembly bolts. Tighten assembly bolts and torque to 25 ft./lbs. *(Fig. 42)*



Tighten assembly bolts and torque to 25 ft./lbs. *(Fig. 41 and Fig. 42)*

15. Tighten bottom support brackets using unused assembly bolt openings and torque to 25 ft. lbs. *(Fig. 43)*



IMPORTANT: Re-torque all bolts after one hour as the rubber will have taken a compression set by then.

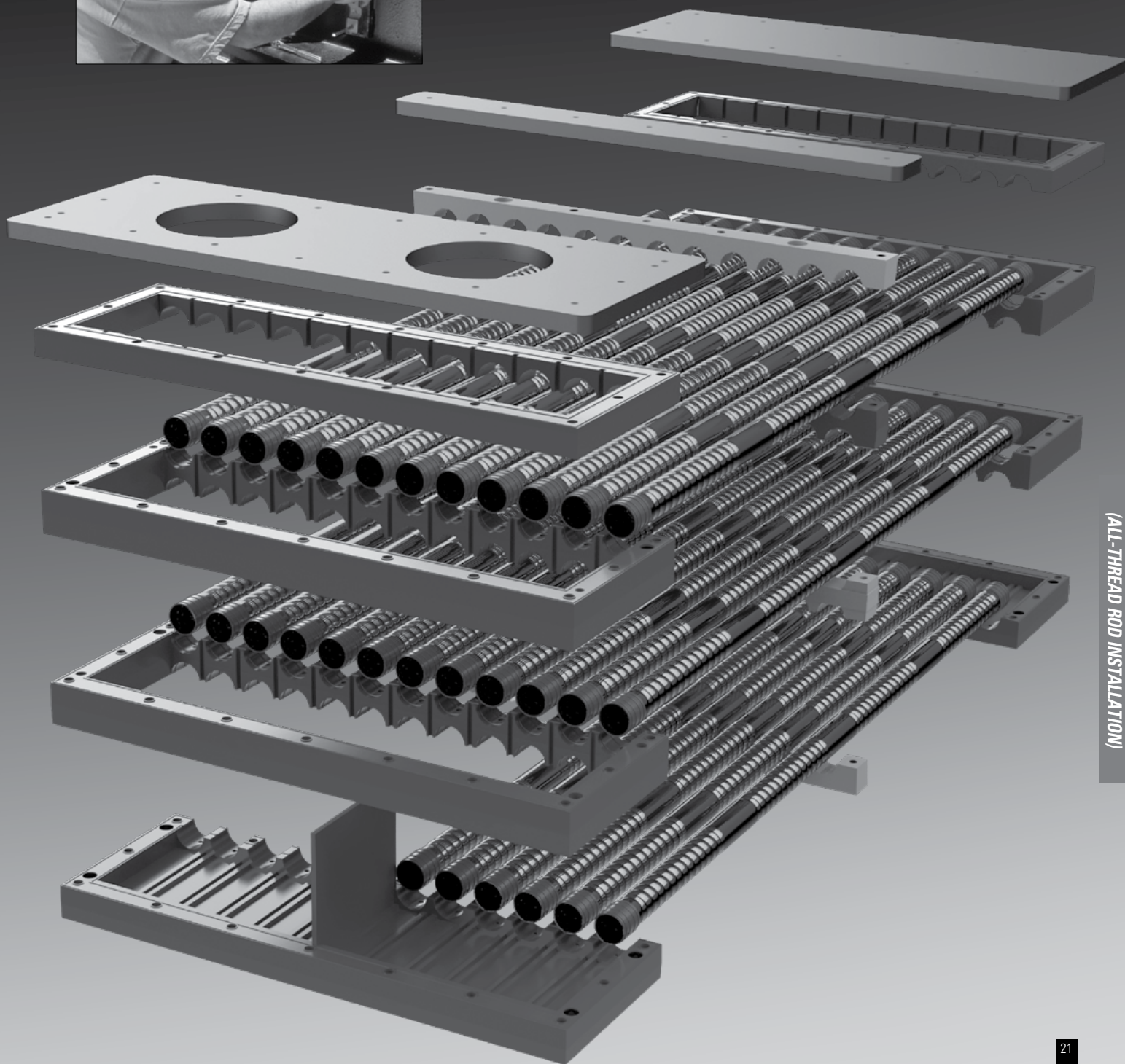
16. Connect water lines according to your engine requirements. Pressurize system to 30 psi and check for leaks.

YOUR KEEL COOLER IS NOW INSTALLED,
FOLLOW INSTRUCTIONS FOR
PROTECTIVE SHIELDING

TRIPLE BANK MOUNTING *(All-Thread Rod Installation)*



The 3/8" All-Thread Rod temporarily hangs the cooler components from the top deck. This method facilitates adjustment of assembly parts to their exact location before tightening and securing to final torque values. This mounting procedure makes handling and positioning the cooler parts easier.



TRIPLE BANK MOUNTING
(ALL-THREAD ROD INSTALLATION)

IMPORTANT

For Triple Bank Mounting - Follow the Double Bank Mounting Instructions (All-Thread Rod Installation) on pages 16 to 20.

Complete steps 1-8. Then repeat steps 3-8 for the Triple Bank section before proceeding to steps 9-15 to complete the full Triple Bank Installation.



Protective Shielding

Protective shielding is recommended on all keel cooler installations. The type of protective shield required depends upon conditions of the vessel's service and cooler location. Any basic protective shield must always allow generous flow around the spiral tubes.

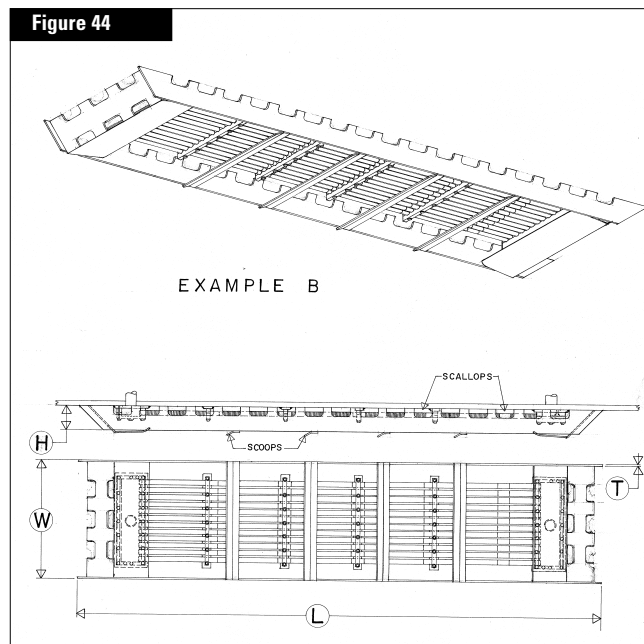
Highlighting the "basic" protection shroud, we might see large slots or scallops, insuring excellent heat flushing while "angled" protection slits located at both ends of the cooler "catch" and circulate sea flow around the headers and tubes. These openings are spaced several inches apart and leave ample clearance between themselves and the headers.

If vessel service requires it, expanded metal screen may be added to the basic shroud along with solid plates, allowing several inches of clearance below the headers.

BASIC COOLER SHIELD:

If a basic cooler shield is decided upon (we recommend such an installation) it should be installed to the hull prior to the installation of the keel cooler. However, do not weld screening or cavitation plates in position until after cooler installation is completed and checked out. **When installing expanded metal screening or cavitation plates, be sure to leave room for tube removal and access to support bracket assemblies.** (Fig. 44)

Figure 44



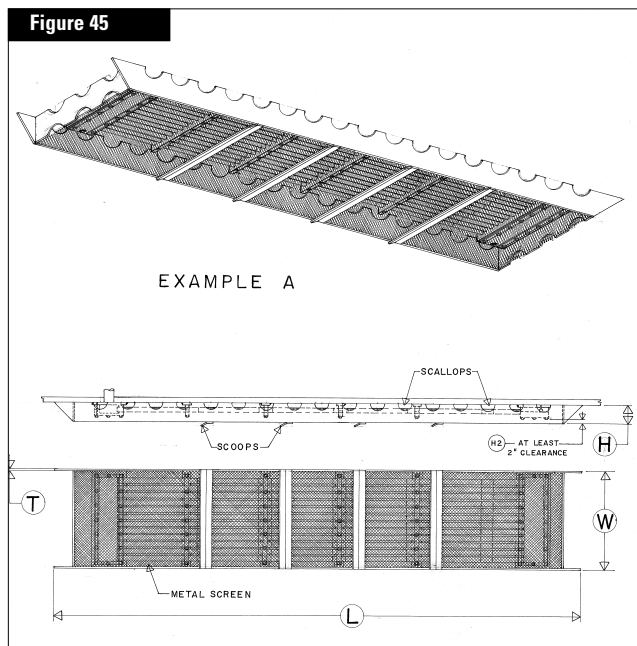
POPULAR COOLER SHIELDS:

Most of the popular shields are variations in the expanded metal screen and the thickness of the shield walls seen in the basic shield. **When coolers are located in protective areas of the hull (rake for example) shield thickness is no more than 1/4" plate.** Where coolers are exposed to tremendous abuse (for example, mounted on sides or bottoms of river boats) 1/2" plate has become quite popular while replacing the expanded metal screen with subway grating or a metal sheet with numerous holes burned out.

The plate sheet (Fig. 45) is supported by latches on one side and spot welds on opposite and adjacent sides for easy access to tubes without total removal of plate. There is no less than two inches of clearance between base of support brackets and protective sheet. This insures good flow. Scallops are rectangular cuts, six inches long, three to four inches deep, separated by two inches.

Other popular protective shield systems include scoops located after support brackets which catch sea water and force it up into dead spots where flow is restricted.

Figure 45



NOTE: It is not recommended that keel coolers be located in bow areas of ship's hull unless they are completely protected from pounding seas. If coolers are needed on bow (bow thrusters for example), do not cut out scallops on the inside shield walls. (Outside scallops remain). Pounding seas can cause damage to the tubes as the result of jet-like streams of water shooting through the scallops at thousands of pounds of pressure.

DURAMAX MARINE® DEMOUNTABLE KEEL COOLER COMPONENT INSPECTION POINTS

Duramax Marine® recommends inspection of all Demountable Cooler components whenever you are dry docked

HEADERS - BOTH STERN AND AFT:

Cracks - If cracks are found anywhere on the headers they should be replaced right away.

Leaks - When checking for leaks during pressurized test, if leak is detected replace the headers. Never reseal.

Separated Rubber - If separated rubber/bubbles are detected replace the headers.

Separation from Brackets/Tubes - This means there is not a tight seal. The headers should be replaced right away. Never reseal.

Gaps - Check for gaps between the top and bottom of the headers. Re-tighten all bolts and check gap again. If gap is still there, new headers are needed. Any gap found would mean there is not a tight seal and would need to be replaced.

EPDM RUBBER ON HEADERS - BOTH STERN AND AFT:

Bubbles - If bubbles are detected on the rubber please contact Duramax Marine for assistance.

Cracks/Tears - Check all rubber for cracks and tears. If detected, the header will need to be replaced. Do not reseal. Resealing instead of replacing could cause the cooler to not perform as designed.

IMPORTANT - If any know oil was introduced into the system - replace the headers right away. Oil will attack the rubber and damage the headers.

90/10 COOPER NICKEL TUBES:

Dents/Bends/Cracks - Check for dents, bends and cracks. If any defects are found the tubes should be replaced.

Separation - Check for tube separation from any brackets and headers. If any separation is found the tubes should be replaced.

EPDM TUBE SLEEVE SEALS:

Sleeve Seals - Check tube seals for bubbles, cracks, tears and separation from the tube.

IMPORTANT - Whenever the headers are taken apart the tube sleeve seals should be replaced to ensure proper seal.

EPDM SUPPORT BRACKETS:

Support Brackets - Check for dents, bends, loose connections and rubber separation. If loose connections are discovered re-tighten the brackets.

GROUNDING BRACKETS:

Brackets - Check for dents, bends and loose connections. If loose connections are found, re-tighten the brackets.

IMPORTANT - Tighten the grounding bracket to secure connection to make sure cooler is grounded.

BOLTS:

Bolts - Check for loose bolts and make sure to re-tighten. Max torque 25ft./lbs.
Also check for corrosion and replacing each bolt and plug when necessary.

LEAKS:

Always check for leaks! Follow start up procedures for all engines. When water is circulating through the system make sure to take the time to check all areas of the Duramax Marine Demountable Cooler.

CLEANING:

Sea Growth - Check for barnacles, algae and any other type of sea growth.

Cleaning - Clean, scrape or brush all sea growth off of the coolers to help maintain performance and longevity.

IMPORTANT:

Power Wash - When cleaning a Duramax Marine Demountable Cooler with a 13 HP, 4,000psi pressure washer, only use nozzle tips sized 0, 15, 25 and 40 degrees on the 90/10 Tubing to get rid of any barnacles, algae or sea growth. When cleaning the rubber covered headers, only use the 15, 25 and 40 degree nozzle tips at a distance no closer than 100mm to the rubber surface. DO NOT USE THE 0 DEGREE TIP ANGLE WHEN CLEANING ANY RUBBER COMPONENTS. Doing so may burn or cut the rubber.

Notes:

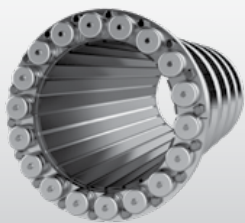
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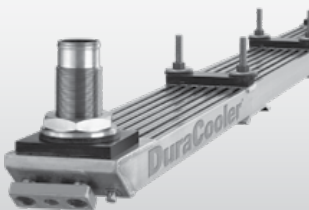
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Johnson Cutless® Sleeve and Flanged Bearings



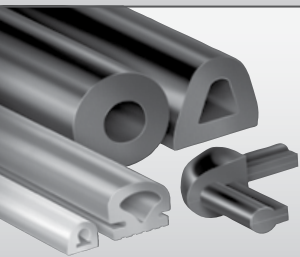
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17990 Great Lakes Parkway
Hiram, Ohio 44234 U.S.A.

PHONE 440.834.5400
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info@DuramaxMarine.com
www.DuramaxMarine.com

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DM-1025.114 DEMOUNTKI 12-05-24