

# SERVICE MANUAL

# **MESABI<sup>®</sup>**

## **System Protector<sup>™</sup>**

### **Tube & Shell Cooler**

**Please read and follow  
instructions carefully before  
proceeding with any service  
work and/or repairs.**

**Consult factory before  
proceeding with any possible  
warranty claims.**



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### SPECIAL MESSAGES

This service manual contains special messages to bring attention to potential safety concerns as well as helpful servicing information.

PLEASE READ all the information carefully.



#### CAUTION

Avoid injury! This symbol and text highlight potential hazards.



#### IMPORTANT

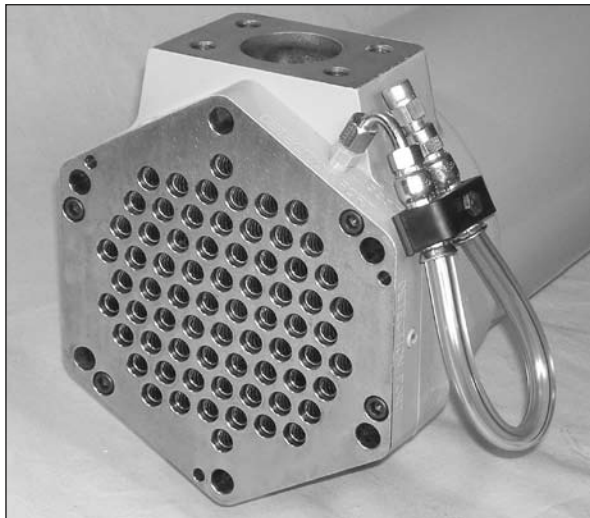
This text is used to tell of actions or conditions that might result in damage to the cooler.



#### HELPFUL HINTS

- Read this manual thoroughly.
- Work in a clean environment.
- Good lighting is a must.
- Use proper tools.  
(see Standard Parts and Tool List on Page 3)
- Use proper lubricant.
- Call L&M Customer Service with questions:  
1-800-346-3500

## Product Description and Operation



**SYSTEM PROTECTOR™** coolers can be made in a variety of configurations of length and diameter for liquid and air heat exchange required by mobile and in-plant equipment. Coolers can also be designed and built to retrofit and use customer's existing end caps and piping.

**The MESABI® System Protector™ Tube and Shell Cooler provides a dependable safeguard for systems under constant operation.**

- Protects equipment from downtime caused by cross-contaminated fluids.
- Alerts operator to leaking.
- Is field repairable.
- Helps preserve the environment.

**THE COOLER** has individual copper tubes held in header plates with flexible rubber seals. Two seals at each tube end absorb thermal and mechanical stresses. A collection chamber between the seals in each header is maintained at atmospheric pressure to isolate the two heat exchanger fluids to avoid cross contamination. The collection chamber connects to external detection ports where a standard sight gauge system or optional electronic sensor can alert the operator to any fluid bypassing seals.

# Standard Parts and Tool List

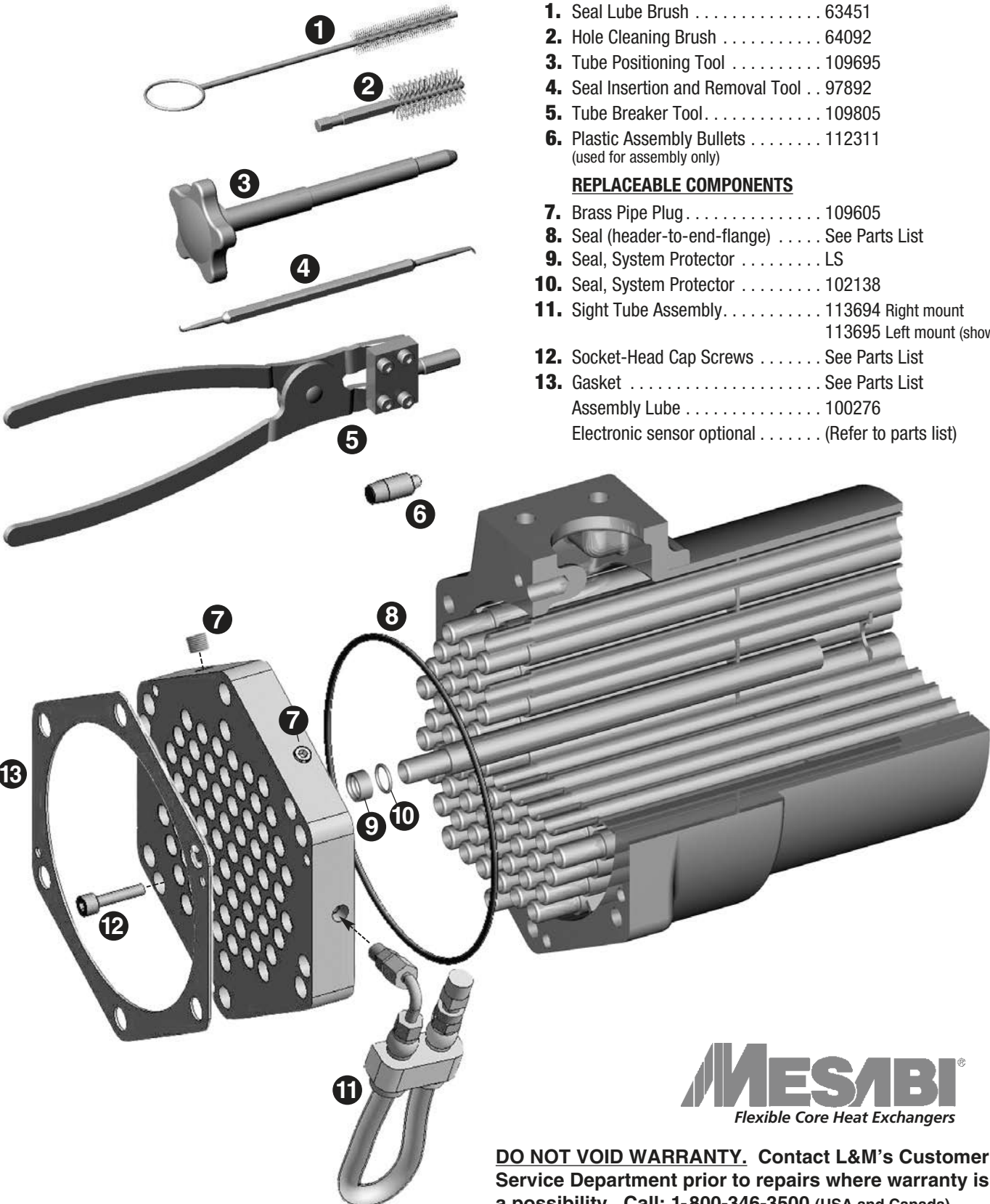
**DESCRIPTION** **PART NO.**

**ASSEMBLY TOOLS**

- 1. Seal Lube Brush . . . . . 63451
- 2. Hole Cleaning Brush . . . . . 64092
- 3. Tube Positioning Tool . . . . . 109695
- 4. Seal Insertion and Removal Tool . . 97892
- 5. Tube Breaker Tool. . . . . 109805
- 6. Plastic Assembly Bullets . . . . . 112311  
(used for assembly only)

**REPLACEABLE COMPONENTS**

- 7. Brass Pipe Plug . . . . . 109605
- 8. Seal (header-to-end-flange) . . . . . See Parts List
- 9. Seal, System Protector . . . . . LS
- 10. Seal, System Protector . . . . . 102138
- 11. Sight Tube Assembly. . . . . 113694 Right mount  
113695 Left mount (shown)
- 12. Socket-Head Cap Screws . . . . . See Parts List
- 13. Gasket . . . . . See Parts List
- Assembly Lube . . . . . 100276
- Electronic sensor optional . . . . . (Refer to parts list)



**DO NOT VOID WARRANTY.** Contact L&M's Customer Service Department prior to repairs where warranty is a possibility. Call: 1-800-346-3500 (USA and Canada)

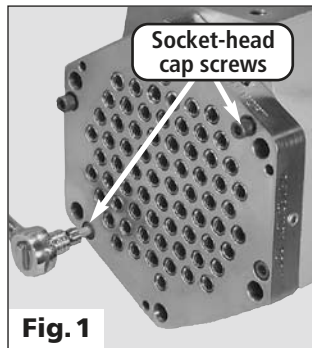
# External Cleaning

For external cleaning and internal flushing, use high-pressure hot water with or without degreaser. Cleaning the cooler before disassembly will make it easier to work on, and also help keep parts clean for reassembly.

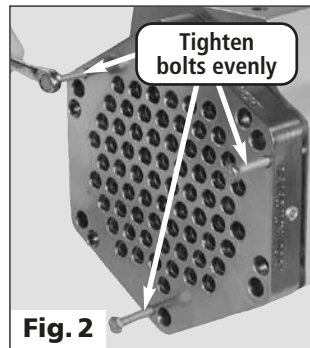
## Disassembly

**! IMPORTANT:** System Protector cooler components require close tolerances and must be disassembled carefully as described below.

1. Before you begin disassembly, mark the location of the sight tube assemblies for reinstallation. Remove the sight tube assemblies from both ends of the cooler.
2. Remove both end tanks if present. Remove and clean the old gaskets off the tank flanges and the header plates, being careful not to scratch the sealing surfaces. Socket-head cap screws and threaded holes around the perimeter of the header plate will now be exposed. The threaded holes will be used to back the header plate away from the shell, exposing the tubes.
3. Remove the socket-head cap screws that secure header plate to the shell flange. **Fig. 1** (Note: also see parts list diagram).



**Fig. 1**

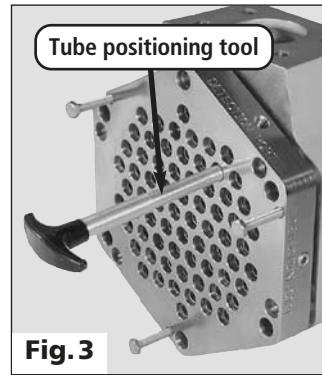


**Fig. 2**

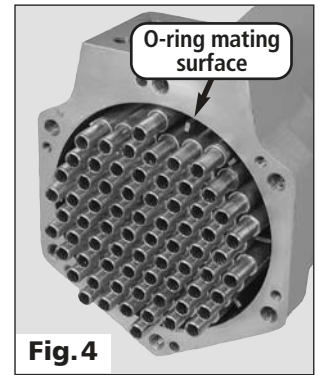
4. Install the appropriate back-out bolts into the threaded header holes (requires 3" of thread). Finger tighten each bolt until uniformly snug against the shell flange. Then use a wrench to turn in each bolt 1/2 turn at a time separating the header evenly from the shell. **Fig. 2**

**! IMPORTANT:** Tube damage may occur if the header plate is not backed away evenly.

5. Some tubes may pull out with the header plate as it separates and must be pushed back into the opposite header plate. When the header has separated 1/4" from shell flange, use the tube positioning tool P/N 109695 to push any attached tubes back into the opposite header. **Fig. 3.**



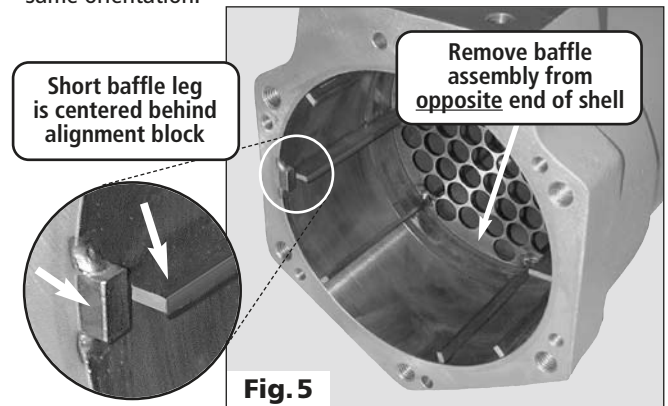
**Fig. 3**



**Fig. 4**

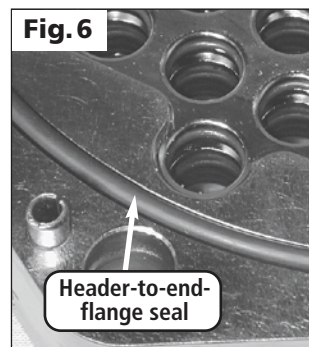
If the header is being removed during testing to repair a leak, it is **important to keep the tubes engaged in the LS seals in the opposite header**. Remove first header being careful not to scratch or dent O-ring mating surface on shell. **Fig. 4**

6. Remove the second header at the opposite end of the shell repeating steps 3 through 5 of this section.
7. Remove all the tubes from the baffle assembly. Check tube ends for any damage.
8. Remove the baffle assembly. Note its orientation in the shell. See **Fig. 5**. It will have to go back into the shell in the same orientation.

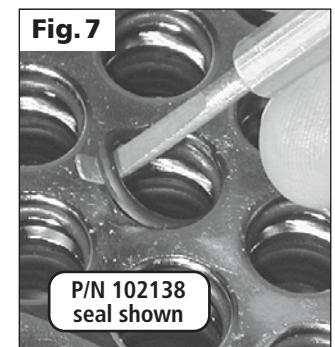


**Fig. 5**

9. Remove the header-to-end-flange seal and clean all sealing surfaces. Be very careful not to mar any of these surfaces. **Fig. 6**



**Fig. 6**



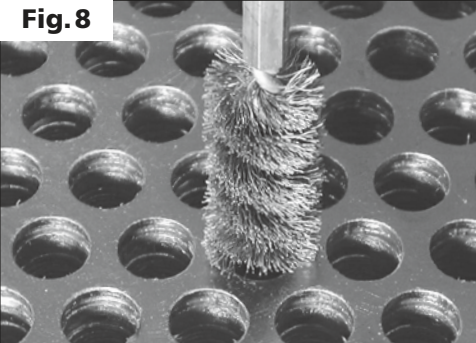
**Fig. 7**

10. Use seal insertion and removal tool P/N 97892 to remove all seals from headers. This includes both the seal P/N LS and seal P/N 102138 (shown). **Fig. 7**



# Internal Cleaning

- 1. Prior to reinstalling original tubes, the tubes must be cleaned of all foreign material. A buffing wheel may be used to clean the tube ends but precaution must be taken when buffing to avoid marring the tubes sealing surfaces. Make sure tube ends are wiped clean prior to lubrication.
- 2. Also clean the header plates, shell, and baffle assembly. This can be done with a high pressure washer. Dry parts thoroughly when done.
- 3. If needed, clean the header plate holes with the hole cleaning brush P/N 64092 in a drill. At full rpm, run the brush through all the header plate holes. **Fig. 8**



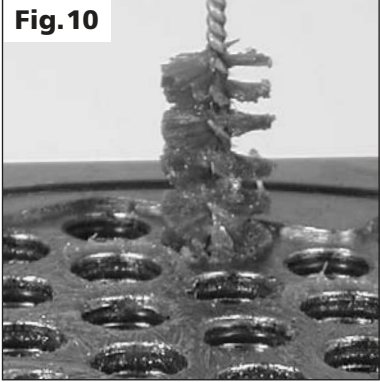
**! IMPORTANT**  
 Use only the hole cleaning brush P/N 64092, otherwise you may damage the sealing surfaces. After wire brushing all the holes, clean the plates and holes thoroughly with compressed air.

# Assembly

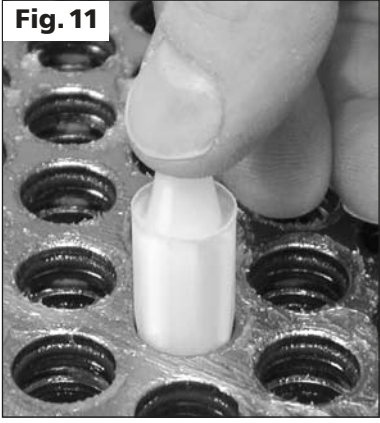
- 1. Carefully install new seals into the clean header plate holes. Seal P/N LS goes into the wide seal grooves and seal P/N 102138 goes into the narrow inner seal grooves. Closely inspect the seals for proper seating in the grooves and for any debris that might prevent sealing. **Fig. 9**



**+ HELPFUL HINTS**  
 Look closely for seals that could have rolled on installation and are not seated properly.

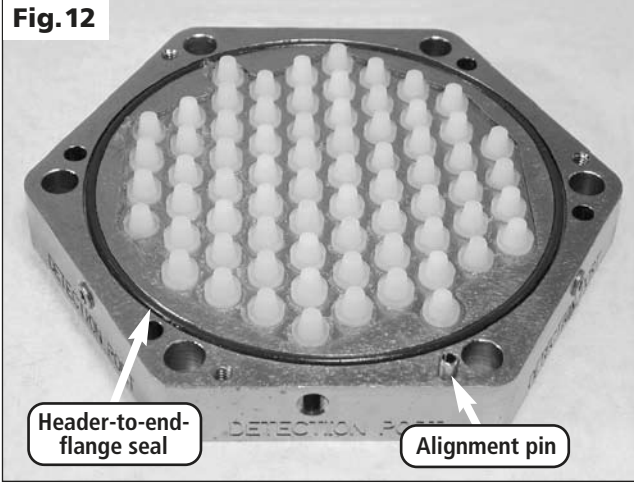


- 2. After seals are installed in the headers, lube the seals with assembly lube P/N 100276 using seal lube brush P/N 63451. **Fig. 10** Seals should be adequately lubed, however do not use excessive amounts of lubricant.



- 3. Lay the header plate down on a clean surface with the alignment pin facing up. **Fig. 12** Install lightly lubricated plastic assembly bullets P/N 112311 into all of the tube holes. Tapered ends of the bullets should go into the holes first. **Fig. 11**

- 4. Install a new header-to-end-flange seal into the header plate. Apply a small amount of assembly lube P/N 100276 to hold the seal in place. **Fig. 12**



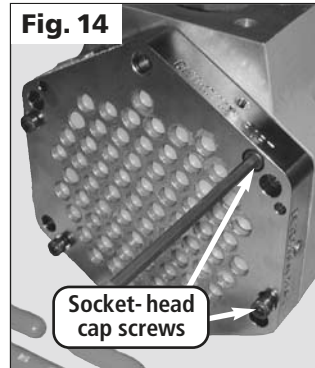
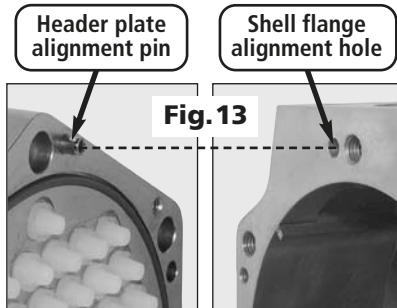
- 5. Properly orientate and install the baffle assembly into the shell.

**! IMPORTANT:**  
 The short leg of the longitudinal baffle bars must be centered behind the alignment block on the inside of the shell. See page 4, Fig. 5

# Assembly (continued)

**!** **IMPORTANT:** The header plate alignment pin mates with the alignment hole in the shell flange, Fig. 13.

**6.** Properly orientate and position the first header plate onto the end of the cooler. Secure the first header to shell flange using the socket-head cap screws and torque to the recommended specification. Fig. 14.



**7.** Proceed to tube installation by applying a light coat of assembly lube P/N 100276 to both ends of each tube. Fig. 15

**8.** From the open end of the cooler, install the tubes through the baffle assembly. Push the tubes all the way into the baffle and through the seals on the opposite end until the tube shoulders bottom out on the first header plate.

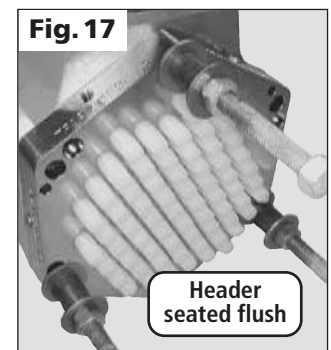
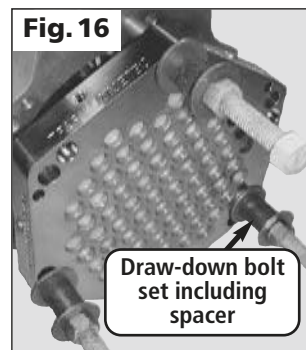
**+** **HELPFUL HINT:** Install 4 tubes first. One at the top, one at the bottom and one on both the right and left side. This will align baffle.

**9.** Collect, clean and relubricate the assembly bullets. Prepare the second header for installation by following the same assembly procedure as the first header, steps 1–4, page 5.

**10.** To install the second header plate, you must provide three draw-down bolt sets. To assemble the sets you will need the following components: 3 bolts with 5" of thread and 3 nuts with the same thread type as the shell flange bolts, 6 flat washers and 3 one-inch long spacers. The spacers will allow the wrench to clear the assembly bullets. Fig. 16.

To prepare each bolt set, screw a nut on far enough to accommodate the spacer and two flat washers with 3 1/2" of free thread available to go through the header and into the shell flange.

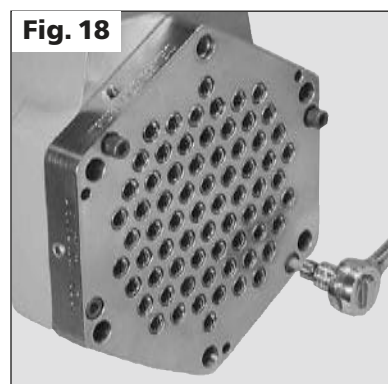
**11.** Align the second header plate so that the alignment pin mates up with the alignment hole in the shell flange and the tubes mate properly with the assembly bullets. To hold the header in position, loosely install one draw-down bolt set into the uppermost shell flange bolt location. Next, loosely install the remaining two sets evenly around the perimeter. Using a wrench, tighten the bolts all the way into the shell flange. Then finger tighten the nuts until the spacers and washers are uniformly snug. Fig. 16



**12.** The nuts on the draw-down bolts must now be uniformly wrench tightened by alternately tightening each nut around the perimeter exactly 1/2 turn at a time. Tighten until the second header is seated flush to the shell flange. Fig. 17

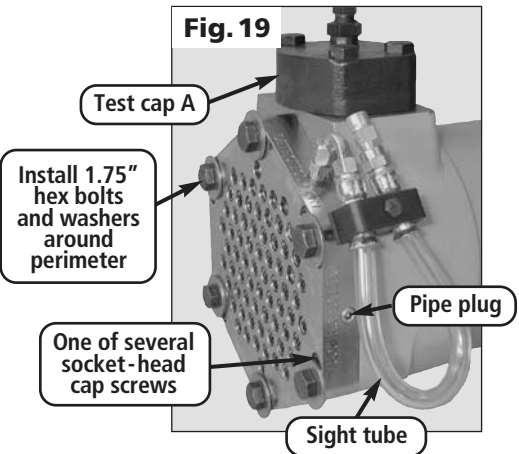
**!** **IMPORTANT:** Tube damage may occur if draw-down-nuts are not tightened evenly to maintain the header parallel to the shell.

**13.** BEFORE removing draw-down bolts and nuts, thread the socket-head cap screws into the exposed holes in the header and into the shell flange to secure the header. Remove the draw-down bolts and install the remaining socket-head cap screws. Torque to recommended specifications. Fig. 18



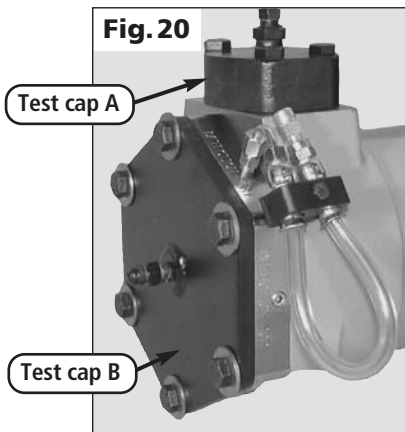
**!** **IMPORTANT**  
Inspect tube holes in header for torn rubber seals. If there is a torn seal, it must be replaced.

# Testing Procedure



**CAUTION**

- Full-face protection must be worn when working on pressurized units.
- Use only appropriate pressure fittings.
- Pressure must be applied slowly.
- If a leak is detected, the pressure must be released safely prior to repair.



## TESTING THE SHELL SIDE OF THE COOLER (Typically the oil side – see chart below)

This test will determine if one of the following conditions exists:

- Seal P/N 102138 is twisted, chipped, missing, or contaminated.
  - Cooling tube is damaged in the finned area.
  - Cooling tube sealing surface is scratched or deformed.
1. Confirm that all socket-head cap screws are in place in both header plates and properly torqued.
  2. Install sight tube assembly into desired detection port and install pipe plugs into all remaining detection ports. **Fig. 19**
  3. Install **test cap A** (See **NOTE 1**) on both side ports. **Fig. 19**
  4. Install 1.75" long hex bolts with flat washers in all locations on both header plates. These bolts will provide clamping during testing. **Fig. 19**
  5. With the cooler under water, begin the shell side test sequence shown in the chart below. Check for leaks from the ends of the cooling tubes and the sight tube.
    - If a leak is detected coming from a cooling tube end, mark the tube and remove the header plate following steps 3, 4 and 5 on page 4. Replace the damaged tube.
    - If a leak is detected in the sight tube, the source will be the seal PN 102138 or a tube with a damaged sealing surface or tube end. Remove the header plate following steps 3, 4 and 5 on page 4. Replace the defective part.
  6. Lubricate parts replaced, install the assembly bullets and the header plate following appropriate assembly instructions.
  7. After any repair, restart the test sequence. Continue the test sequence until no leaks are detected.

### SHELL SIDE TEST SEQUENCE – TEST UNDER WATER

Step	Pressure Cycle to be Applied to the Shell	Time (Min.)
1	Raise to 110 PSI	As needed
2	Cycle 0-450	10 min. at 450
3	Cycle 0-450	5

## TESTING THE TUBE SIDE OF THE COOLER (Typically the water side – see chart below)

This test will determine if one of the following conditions exists:

- Seal P/N LS was damaged, is missing, or contaminated.
  - Cooling tube sealing surface is scratched or deformed.
1. Keep **test cap A** in place and make sure there is no pressure in the unit. Remove all hex bolts that hold the header plates on.
  2. Install **test cap B** (See **NOTE 1**) on both ends of cooler using appropriate length hex bolts and flat washers and tighten to proper specifications. **NOTE:** End tanks may be used for this purpose. **Fig. 20**
  3. With the cooler under water, begin the tube side test sequence and check for leaks at the sight tubes.
  4. If a leak is detected at a sight tube, remove the pressure and remove the **test cap B**.
  5. Remove the sight tube and apply pressure to the detection port. Using soapy water, determine which seal is leaking and mark that seal and tube end.
  6. Remove the header plate following steps 3, 4 and 5 on page 4 and replace the leaking seal or damaged tube.
  7. Lubricate parts replaced, install the assembly bullets and the header plate following appropriate assembly instructions.
  8. Replace header plate, **test cap B**, and the sight tube and continue test sequence until no leaks are detected.

### TUBE SIDE TEST SEQUENCE – TEST UNDER WATER

Step	Pressure Cycle to be Applied to the Shell	Time (Min.)
1	Raise to 110 PSI	As needed
2	Cycle 0-110	1
3	Cycle 0-110	5

**NOTE 1:** Call L&M customer service for information on test caps or if there are any questions. 1-800-346-3500



# We solve big heat transfer problems around the world.



## Parts shipped within 48 hours from four plants around the world.

MESABI® Flexible Core Heat Exchangers are marketed on a factory-direct basis from four L&M Radiator plants around the world.

L&M Radiator is able to give exceptional service to users and OEMs because all service is controlled at the manufacturer level. In emergencies, we can ship complete radiator cores or parts within 48 hours.

On-site technical and engineering assistance is available nearly anywhere in the world within a few days notice.

L&M Radiator is proud to provide both old and new customers around the world with products known for quality and dependability since 1957.

L&M Radiator manufacturing facilities and parts depots are located in the countries listed below:

## 18-month Warranty

### MESABI® System Protector™ Tube and Shell Cooler

L&M Radiator warrants the MESABI® System Protector™ Tube & Shell Cooler manufactured by L&M for a period of 18 months from date of invoice. Under this warranty, our obligation is limited to the repair or replacement (at our option) of products or parts manufactured by L&M that are proven to be defective in workmanship or material. Damage or leakage due to accidents, misuse, or corrosion is not warranted.

Warranty on components not manufactured by L&M Radiator shall be that of the individual manufacturers.

L&M is not liable for consequential or incidental damages or costs.

**Consult factory before proceeding with warranty claims. This warranty supersedes all previously published warranties.**



Manufactured and distributed by:

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