

# SERVICE MANUAL



## **HIGH EFFICIENCY COPPER TUBE AIR-TO-OIL & AIR-TO-AIR COOLERS**

**MAXIMUM 150 PSI (1034 KPA)**

**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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# CONTENTS

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## MESABI® High Efficiency Copper Tube Air-to-Oil and Air-to-Air Cooler

Warranty .....	Page 2
Standard Parts & Tools .....	Page 3
Standard External Cleaning .....	Page 4
Epoxy-Coated Core External Cleaning .....	Page 4
Internal Cleaning .....	Page 4
Tube Removal .....	Pages 4 & 5
Seal Installation .....	Page 5
Cleaning Tube Ends .....	Page 5
Lubrication .....	Page 5
Tube Installation .....	Pages 6 & 7
Pressure Testing .....	Page 7
Manufacturing & Parts Facilities .....	Page 8

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This service manual is available to print online at [www.MESABI.com](http://www.MESABI.com). A service video is also available for viewing online, or request a DVD from L&M Radiator. The service video does not replace the information contained in this service manual.

**CONTACT L&M'S CUSTOMER SERVICE DEPARTMENT PRIOR TO REPAIRS WHERE WARRANTY CLAIM IS A POSSIBILITY. FAILURE TO DO SO MAY VOID WARRANTY.**

### L&M RADIATOR GENERAL WARRANTY

Consult L&M before proceeding with warranty claims or repairs. Failure to do so may void this limited warranty. This limited warranty allocates the risk of failure of the product(s) between the buyer and L&M and is reflected in the purchase price.

L&M warrants that MESABI® products will conform to L&M's written quotation specifications and drawings. MESABI® framework components are warranted for 18 months from the date of invoice against defects in materials and workmanship during normal usage. L&M warranty against seal leakage during normal operation is stated in individual product literature.

L&M's liability is limited to the rework or replacement (at L&M's sole option) of products or parts manufactured by L&M that are determined by L&M to be defective in workmanship or material or do not meet L&M's quoted specifications.

L&M product warranty does not apply if the product has been subjected to abnormal use or conditions, unauthorized modifications or repair, corrosion, misuse, neglect, abuse, accident, improper installation, or other acts which are not the fault of L&M, including damage caused by shipping.

L&M does not warranty products incorporated into L&M products that are not manufactured by L&M. Buyer's sole recourse with respect to such products will be subject to the warranty of the individual manufacturer.

OTHER THAN AS STATED HEREIN, L&M MAKES NO REPRESENTATION OR WARRANTY OF ANY KIND, EXPRESSED OR IMPLIED, AS TO MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, OR ANY OTHER MATTERS WITH RESPECT TO THE SALE OF L&M PRODUCT(S) AND ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. IN NO EVENT WILL L&M'S LIABILITY INCLUDE ANY SPECIAL, INCIDENTAL, CONSEQUENTIAL OR PUNITIVE DAMAGES, EVEN IF L&M KNEW OF THE LIKELIHOOD OF SUCH DAMAGES.

Any action or lawsuit for breach of the limited warranty in these L&M terms and conditions must be commenced in Minnesota. This warranty supersedes all previously published warranties.

### MESABI® PRODUCT SPECIFIC WARRANTY COPPER TUBE AIR-TO-OIL AND AIR-TO-AIR COOLER

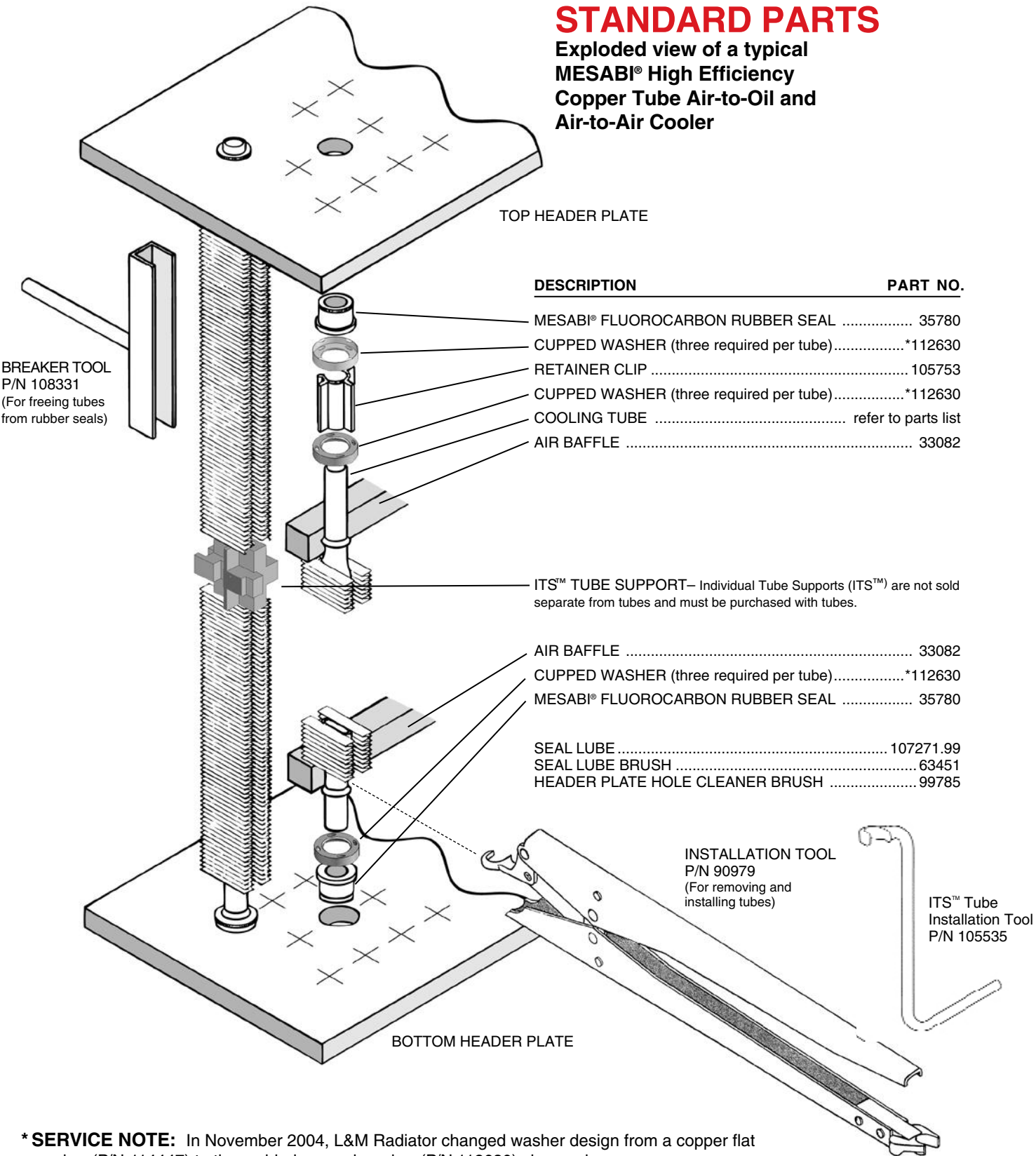
MESABI® Copper Tube Coolers are covered by the L&M General Warranty along with the following Product Specific Warranty:

L&M Radiator warrants MESABI® Copper Tube Coolers against seal leakage during normal operation for 48 months from date of invoice on new coolers.

# MESABI® High Efficiency Copper Tube Air-to-Oil and Air-to-Air Cooler

## STANDARD PARTS

Exploded view of a typical MESABI® High Efficiency Copper Tube Air-to-Oil and Air-to-Air Cooler



DESCRIPTION	PART NO.
MESABI® FLUOROCARBON RUBBER SEAL .....	35780
CUPPED WASHER (three required per tube).....	*112630
RETAINER CLIP .....	105753
CUPPED WASHER (three required per tube).....	*112630
COOLING TUBE .....	refer to parts list
AIR BAFFLE .....	33082
ITS™ TUBE SUPPORT– Individual Tube Supports (ITS™) are not sold separate from tubes and must be purchased with tubes.	
AIR BAFFLE .....	33082
CUPPED WASHER (three required per tube).....	*112630
MESABI® FLUOROCARBON RUBBER SEAL .....	35780
SEAL LUBE .....	107271.99
SEAL LUBE BRUSH .....	63451
HEADER PLATE HOLE CLEANER BRUSH .....	99785

**\* SERVICE NOTE:** In November 2004, L&M Radiator changed washer design from a copper flat washer (P/N 114447) to the molded cupped washer (P/N 112630) shown above. These parts are completely interchangeable. PART NO. 114447 MAY STILL BE USED IN HIGH TEMPERATURE APPLICATIONS. CONTACT L&M FOR DETAILS.

## Cleaning

### Standard External Cleaning

To assure maximum life of a MESABI® Core, reasonable care must be taken when cleaning.

Most radiator shops use a hot alkaline soap, caustic soda or chemical additives in their boil-out tanks, which attacks solders. If a MESABI® tube is soaked in such a solution, the solder bond between the finning and tube will be adversely affected. It must be known that the solution used is not harmful to solder so that it will not attack the solder used on the MESABI® tube. Be sure to completely rinse the cleaned tube/core in clean water after removing from the boil-out tank.

In most cases, it may be best to blow out any dry dirt with a high-pressure air gun prior to washing core with the high-pressure, hot-water washer.

For general external cleaning, a high-pressure, hot-water washer (with or without soap) can be used at pressures up to 1200 psi (8268 kPa). **(CAUTION! To prevent fin damage, stay a few inches away from the core and you must spray straight into the core – not at an angle.)**

If the cooler is still in the machine, you may have to use an offset angled nozzle so that you can spray straight into the core. If there is any doubt, try your cleaning method on a small portion of the core first.) It is important to start on the air exit side. Work from the top to the bottom. Concentrate on small areas and work slowly. Wash until the water exiting the opposite side is free from dirt and debris. Complete this side and then repeat the process from the other side.

### Epoxy-Coated Core External Cleaning

Epoxy-coated cores must be cleaned with care to ensure the coating is not damaged.

1. A high-pressure, hot-water washer can normally be used. Use a “fresh” water supply. Water temperature should not exceed 180° F (82.2° C). Do not steam clean. The nozzle should be kept approximately 12 inches (30.48 cm) away from the core.

**CAUTION:** We do not recommend a pressure rating because as epoxy ages the coating becomes brittle and might be damaged at higher pressures. We recommend that you try your cleaning method on a portion of a single tube first.

2. Wash the core thoroughly and methodically, starting at the top and working towards the bottom. Do not wash in one area for extended periods. The core will be clean when the water exiting the core is clean.
3. Blow off excess water with air. Epoxy coatings are not meant for submerged duty. L&M Radiator does not warrant against corrosion, but this coating, properly cared for, will help increase the service life and efficiency of your cooling system.

### Internal Cleaning

The MESABI® copper tube coolers have an internal stainless steel turbulator that **CANNOT** be removed from the tube. In cases where it is necessary to clean the inside of the cooler, before removing any tubes or pumping any chemicals through the cooler, contact L&M Customer Service. See back page for contact information.

## Tube Removal

### HELPFUL HINTS:

- If all tubes are to be removed, pull out the air baffle prior to washing the core.
- Clean the core prior to removing tubes.
- To avoid bending or kinking tube ends, reduce the angle of the tube as it is being pulled from the top seal.
- If the core has a center tank, remove the top core tubes and seals first.
- If the core has an ITS™ (Individual Tube Support) system, mark the bars front and back before removing to ease re-assembly. Also note the position of the front tabs on the ITS™ – tubes support relative to the face of the cooler.
- To assist in the removal process, spray light oil on the top end of the tubes.
- If tubes are difficult to remove, try using the breaker tool and removal tool simultaneously.



Fig. 1

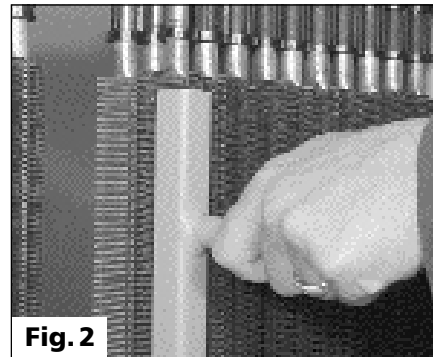


Fig. 2

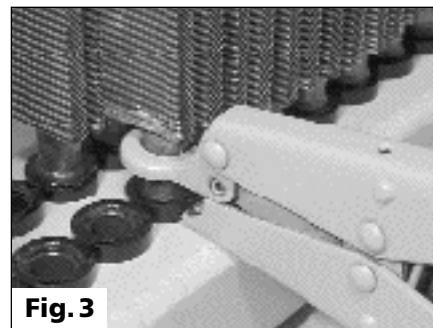


Fig. 3

### STEP 1.

Use a pair of pliers to remove the retainer clip from the top of the tube, as shown in **Fig. 1**.

### STEP 2.

Loosen the tube by using Breaker Tool L&M P/N 108331, as shown in **Fig. 2**. The Breaker Tool should be placed at top or bottom, not at middle, when freeing tube from seal. Lightly twist the tube back and forth, to loosen tube from seals.

### STEP 3.

After tube is free, place upper jaw of Installation Tool, L&M P/N 90979, around the round portion at the bottom end of tube. Place lower jaw so that it rests on the header plate, just in front of the rubber seal, as shown in **Fig.3. DO NOT allow the lower jaw to rest on the washer.**

Squeeze handles of tool together and raise tube up as far as possible.



## Tube Removal (continued)

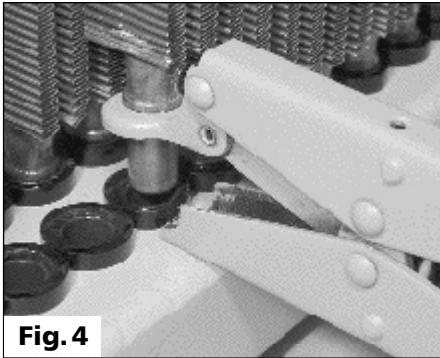


Fig. 4

### STEP 4.

Reposition tool, so the upper jaw is between the upset on the tube and the cupped washer as shown in **Fig. 4**. Raise tube until bottom end clears the washer and seal.

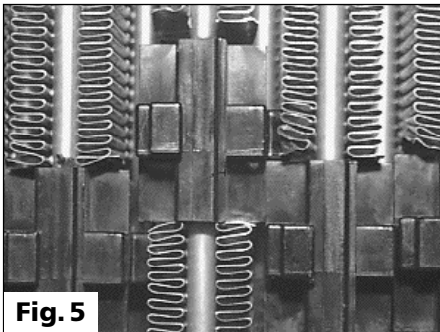


Fig. 5

If you are working with an ITS™ core, the tube should be raised high enough so that the interlocking tab clears the adjacent dovetail groove as shown in **Fig. 5**. **Raising a second tube will help the removal process on simple repairs.**

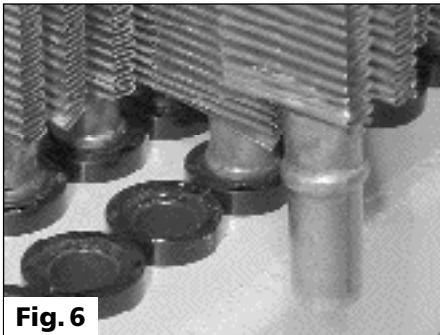


Fig. 6

### STEP 5.

Use a minimum of angle to swing the tube out, just far enough to allow it to be pulled down and out of its top seal, as shown in **Fig. 6**.

## Cleaning Tube Ends

Before the original tubes are reinstalled, the tube ends must be clean of foreign material. L&M recommends polishing the tube ends with a polishing wheel (Grainger #5A725 – use Qty. 5 together) and a copper polishing compound (Grainger #3W769).

If the debris cannot be removed by polishing, L&M recommends using a piece of fine grit emery cloth or steel wool. If there is a lot of debris on the tube ends, use a 6 in. or 8 in. (15.24 cm or 20.32 cm) diameter wire wheel brush with a wire size of .006 in. or .008 in. (.152 mm or .203 mm). Larger diameter wire sizes could damage the tube ends. Try installing a tube. If it does not slide easily into the top and bottom seals, try polishing the tube ends as per above.

## Seal Installation

### HELPFUL HINTS:

- L&M recommends installing new MESABI® seals any time tubes are removed.
- After removing the old seals, clean the plate holes of any foreign debris. We recommend using L&M P/N 99785 header plate hole cleaning brush in an electric or air drill.
- Clean inside of tanks and blow out plate holes with air.
- **Install new seals in clean, dry holes.**
- If the core has a center tank, do not install seals at the bottom of the top core until all the tubes are installed in the bottom core.

With your thumb start the new MESABI® seals into the holes and push them part way in. Care must be taken not to install seals too far into the header plate.

The use of a hammer directly on the seal can easily cause seals to be installed too far into the header plate. L&M recommends the use of a flat plate, 3/8 in. x 3 in. x 6 in. (9.53 mm x 76.20 mm 152.40 mm), placed over the seals and hitting with a rubber mallet will allow the seals to be properly installed.

A properly installed seal has a crowned or convex top surface, and the tube hole is slightly flared at the opening. A seal that is installed too far into the header has a concave top surface and the tube hole is noticeably smaller in diameter as shown in **Fig. 7**. **Seals installed too far will make tube installation more difficult and are much more likely to be damaged during tube installation.**

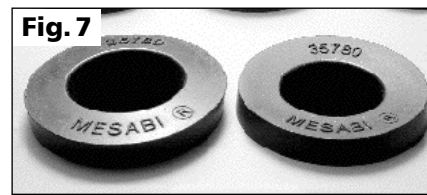


Fig. 7

ON THE LEFT:  
Properly installed  
P/N 35780 seal.

RIGHT:  
P/N 35780 seal  
installed too far into  
header (concave).

CORRECT

INCORRECT

**Cupped Washer Installation** – After the seals have been installed, place the cupped washers P/N 112630 over the seals. The washers should be pressed firmly onto the seal so that they encompass the seal flange. **If you are servicing with the old style flat copper washers see service note, page 3.**

**Seal Lubrication** – After all the cupped washers are in place, lubricate all the seals. Use L&M lube brush P/N 63451 and assembly lube P/N 107271.99.

**Tube End Lubrication** – It is important to visually inspect both ends of each tube for damage prior to lubrication. Correct any problems or replace tubes. Lubricate both ends of each tube using the 63451 lube brush and 107271.99 lubricant.

## Tube Installation

### HELPFUL HINTS:

- If you are working with a center tank core, the bottom core must be assembled before the top core. **DO NOT install seals at the bottom of the top core (top side of the center tank).**
- Minimize the angle of the tube as it's being installed into the top seal.
- Make sure the tube is centered in the bottom seal before any force is applied to pull or push into place.

**A vertical cooler position** with the bottom header of the section being worked on at a comfortable height for the assembler is recommended.

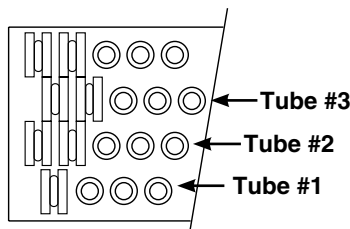
**CAUTION! If a tube seems difficult to install into a seal, STOP and figure out WHY! One of the following reasons could be the answer.**

1. A tube or seal has inadequate lubrication.
2. Seal improperly installed (may be pushed too far into the header plate hole).
3. Damaged tube end.
4. Trying to insert the tube into the seal at too steep of an angle.
5. Tube is not centered in seal.

**NOTE:** If for any of the above reasons a tube is difficult to install, the seal should be removed and inspected for any scuffing marks, tears or cuts. If there is any doubt, replace the seal.

### Recommended Tube Installation Pattern:

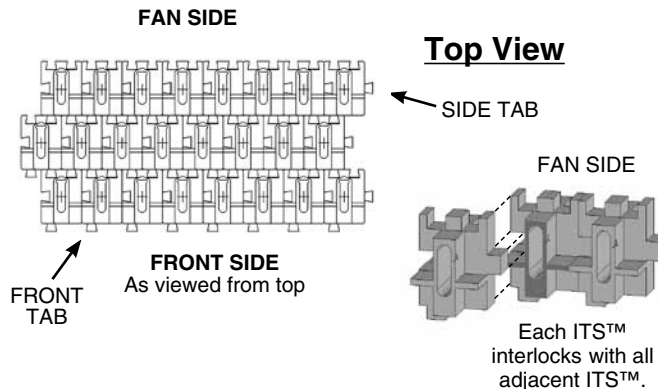
- It is recommended that tubes be installed outwardly from each side member or tension tie across all rows in a "diagonal pattern" as indicated in the sketch. This pattern will provide better control of the tube and allows a 100% view of the seal during tube installation and seal inspection.
- The diagonal pattern should be continued until there is not enough room at which point the centermost row should then be completed, followed by the remaining rows.
- The diagonal pattern can slope right or left, but each tube installed should be the outermost tube compared to adjacent rows to allow for the best grip on the tube and maximum visibility of the washers and seals.



**Air baffles** can be pulled into place using a heavy string or a wire after final pressure testing. Air baffles are not required behind gussets. Before the last tube is installed in the outside row adjacent the air baffle, a wire or heavy string can be installed where the air baffle is required.

## ITS™ - Individual Tube Support Installation

Make sure the tabs on the ITS™ tube supports are facing to the front and to the right.



**STEP 1. Before installing tubes,** place one cupped washer P/N 112630 on the top end of each tube making sure that the flat face of the washer faces upward towards the top of the tube. This will allow the retainer clip P/N 105753 to slide into position properly. (see page 3).

### STEP 2. Installing the tube in the top seal:

Carefully insert the tube into the top seal. The cupped washer will help keep the tube centered in the top seal. Keeping the tube at a minimum angle, with a slight twisting forward motion, push the tube into the seal far enough to clear the bottom washer/seal. To minimize installation angle, tubes in any given row should be installed from the closest header edge.

### STEP 3. Installing the tube in the bottom seal:

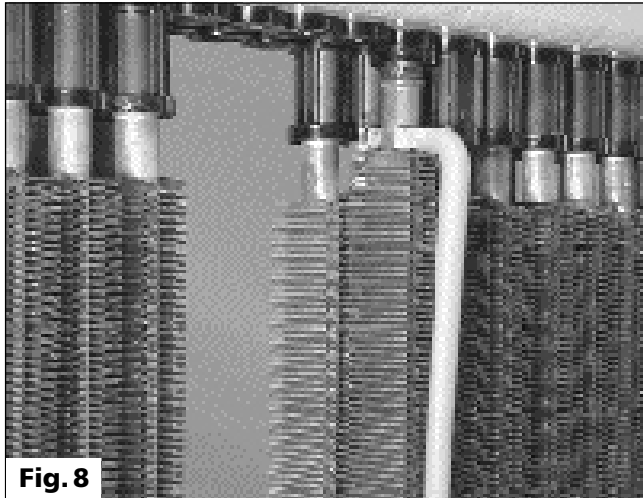
Hold the tube with one hand near the center of the tube (above the ITS™ if there is one present) and the other hand near the bottom end of the tube.

- Holding the tube at the center allows you to easily deflect the tube sideways enough to allow a full grip on the tube with your upper hand and eliminate any interference when ITS™ systems are used.
- Holding the tube close to the bottom provides the best control of the tube end and lowest force on both hands.

Looking below your lower hand to see the washer/seal, slowly insert the tube about 1/4 to 3/8 inch (6.35 mm to 9.53 mm) into the bottom seal.

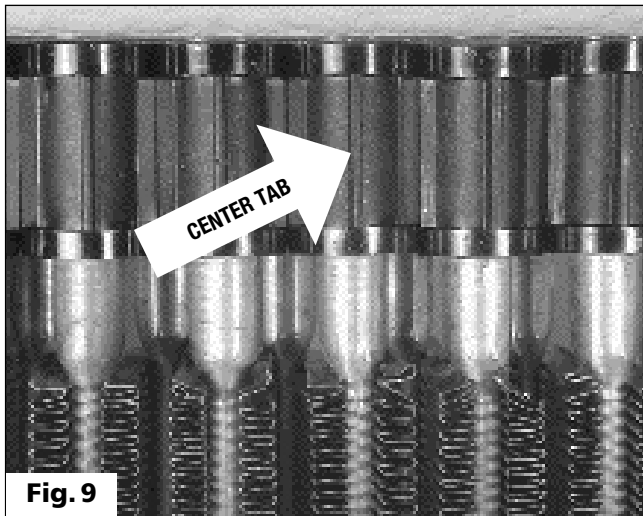
**NOTE: When ITS™ systems are present, there is no need to worry about engaging the ITS™ until the tube is 1/4 to 3/8 of an inch (6.35 mm to 9.53 mm) into the bottom seal.**

**STEP 4.** Fully seat the tube into the bottom seal, engaging the ITS™ when present. Tool P/N 105535 can be used at this point to help pull the tube into the bottom plate. Tool is positioned at top of tube as shown in **Fig. 8**.



**STEP 5.** Using a pair of pliers, reinstall the tube retainer clips P/N 105753 on the inner rows of tubes positioning the center tab towards the front of the cooler. The retainers on the outermost (front) row of tubes can be installed after all the tubes are in place. **See Fig. 9** for proper positioning of the retainer clips.

**NOTE:** The tabs on our older style retainer clips, P/N 33567 are wider and must be rotated slightly so that they overlap.

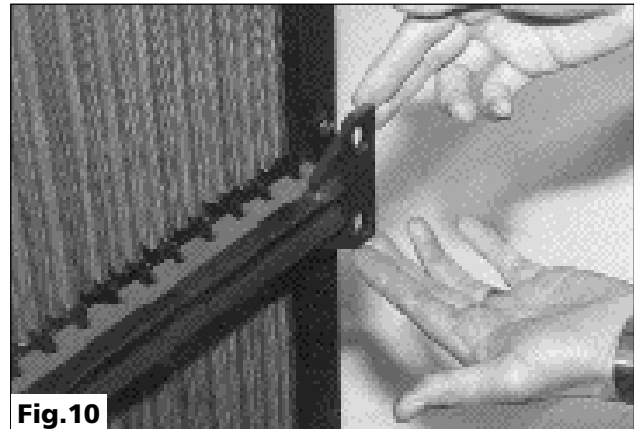


Picture shows retainer clips in place with center tabs facing outwards towards the front of the cooler.

**STEP 6.** Repeat the previous steps for the subsequent diagonal groups of tubes.

**STEP 7.** (If applicable)

If you are working with the ITS™ support system, install the appropriate support bar as shown in **Fig. 10**.



The support bar part number has been stamped on the outside face. Use the L&M Radiator Assembly Drawing and Parts List (on page 3) for proper installation. Using a rubber mallet, gently tap the bar into place and secure to the side member with bolts.

**STEP 8.** The air baffles can be installed after pressure testing as indicated earlier.

## Pressure Testing

Pressure testing procedure that follows recommends testing to 150 psi (1034 kPa). You should test to pressure rating specified on tag attached to your cooler. If there is no pressure rating specified, please contact L&M Customer Service with the part number of your cooler.

**Caution: Always bring pressure up slowly and use personal protection gear. Tube retainer and support bars (if applicable), must be installed prior to testing.**

1. Install fittings or cover plates in or over all ports. One port to have an air supply connector.
2. Pressurize with line pressure not exceeding 150 psi (1034 kPa) and submerge in water. Repair or tighten fittings to eliminate leaking. Note that air bubbles from trapped air in exterior pockets could appear for 10 to 15 minutes. This is normal. Repeat as needed until no leaks are detected.
3. After successful pre-testing to find and repair major leaks, cycle testing can begin. Pressurize with compressed air or nitrogen to 150 psi (1034 kPa) and hold submerged for 15 minutes. Repair any leaks that occur and repeat until you have reached a 15 minute time period successfully. Then cycle to 0 psi and pressure back to 150 psi (1034 kPa) and hold for 1 minute. Repeat this process three more times and hold the last cycle for 5 minutes. After any repairs in this stage, start the cycling testing over from the beginning until you have a successful test.



# MESABI<sup>®</sup> heat exchangers are the world standard for heat exchanger reliability



## L&M RADIATOR FACTORY-DIRECT SALES AND SERVICE

Because so many of our radiators and heat exchangers are a custom design, all sales are on a factory-direct basis. This assures that our customers receive a product that meets their cooling/heating requirements, offered to them at the least possible price.

We ship most parts within 24 hours. On-site technical and engineering assistance is available almost anywhere in the world within a few days notice.



## L&M QUALITY POLICY

*"The Quality Policy of L&M Radiator is to produce a quality engineered, quality manufactured product through continuous improvement that we deliver to the customer's satisfaction."*



Manufactured and distributed by:

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