

SERVICE MANUAL

MESABI[®]

COPPER TUBE

- **RADIATORS**
- **CORES**
- **AIR-TO-AIR COOLERS**
- **LOW PRESSURE OIL COOLERS & FUEL COOLERS (MAXIMUM 50 PSI/345 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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MESABI® Radiator Cores

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

MESABI® 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

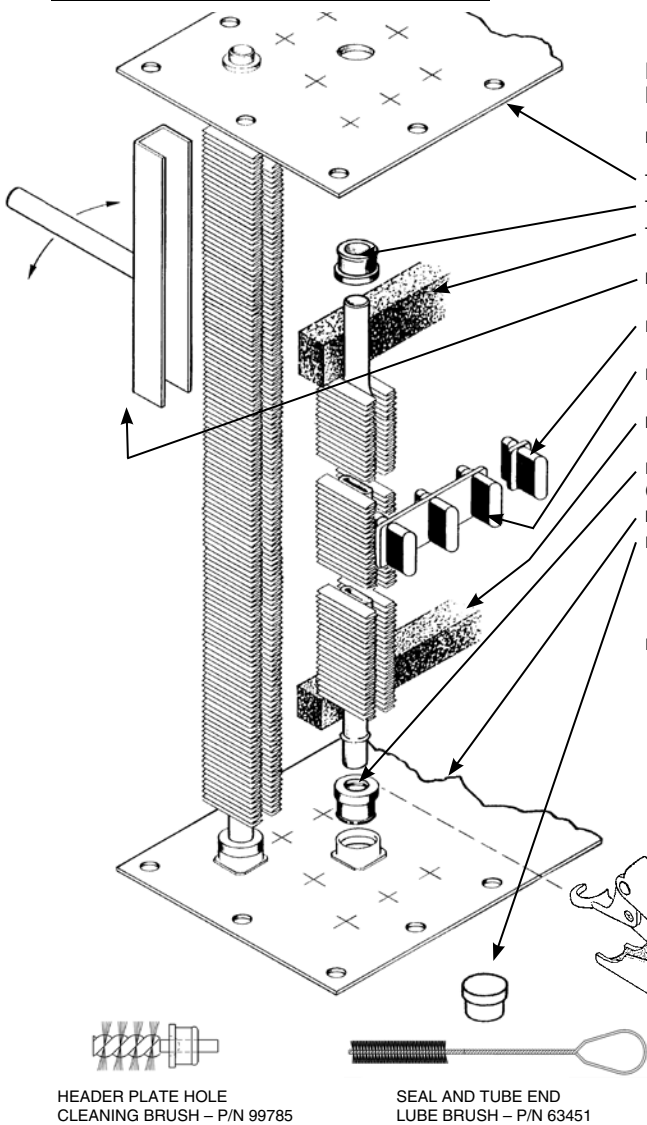
Covers:

- Radiators
- Cores
- Air-To-Air Coolers
- Low Pressure Oil Coolers & Fuel Coolers
(maximum 50 psi/345 kPa)

In addition to the MESABI® General Warranty, L&M Radiator further warrants the MESABI® heat exchangers listed above against seal leakage during normal operation for 48 months from date of invoice.

Standard Parts of a Typical MESABI® Radiator Core

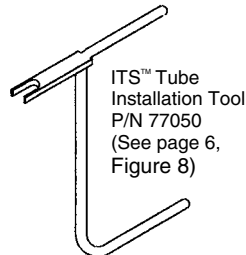
SINGLE UPSET TUBE



Exploded view of a typical MESABI® water jacket core

DESCRIPTION	PART NO.
TOP HEADER PLATE (bolted design)	_____
TOP RUBBER SEAL (see chart below)	
TOP FELT AIR BAFFLE..... (core width)	33082
BREAKER TOOL..... (for freeing tubes from rubber seal)	37239
RUBBER TUBE STAY..... 'F'	33335
(for staggered MESABI Cores only)	'H' 39292
RUBBER TUBE STAY END PIECE	'F' 33085
(for staggered cores only)	'H' 39300
BOTTOM FELT AIR BAFFLE..... (core width)	33083
RUBBER SEAL – LOCKING GROOVE (see chart and section view below)	
BOTTOM HEADER PLATE (bolted design).....	_____
RUBBER PLUG.....	96630
<i>Note: Plugs are for temporary plugging of ferrule holes until replacement tubes can be installed. Plugs must be installed dry and are not recommended for systems operating over 15 P.S.I.</i>	
INSTALLATION TOOL	48350
(for removing and installing tubes)	

Note: Plugs are for temporary plugging of ferrule holes until replacement tubes can be installed. Plugs must be installed dry and are not recommended for systems operating over 15 P.S.I.



HEADER PLATE HOLE CLEANING BRUSH – P/N 99785

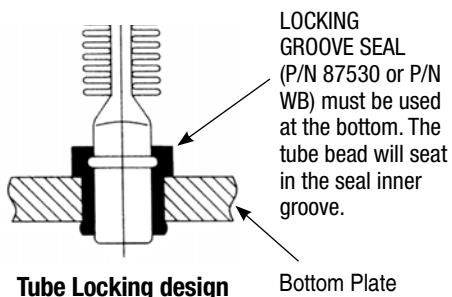
SEAL AND TUBE END LUBE BRUSH – P/N 63451

SEAL & LUBE CHART

If you are not sure of your core style, contact L&M Customer Service.

Core Style	Top Seal	Bottom Seal	Lube P/N
F (coolant)	WT	WB	113230.99
H (coolant)	WT	WB	113230.99
L (coolant)	WT	WB	113230.99
M (coolant)	WT	WB	113230.99
V (coolant)	WT	WB	113230.99
Locomotive*	35780	87530	113230.99
Air-to-Air*	35780	87530	107271.99
Oil Cooler*	35780	87530	107271.99

*Air-to-Air, Oil Cooler and Locomotive can be any style of core above (F, H, L, M, V)

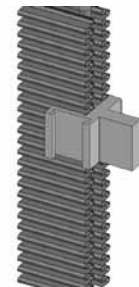


Additional Tube Styles

(Sold As Assemblies Only)



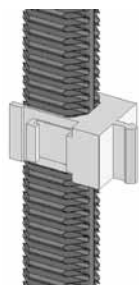
ITS™ (Individual Tube Support) Used on H, L, and V style cores



STAY Used on "L" style cores



STAY Used on "M" style cores



STAY Used on "V" style cores

Cleaning

STANDARD EXTERNAL CLEANING

To maintain efficiency and 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. If it is known that the particular solution used is not harmful to solder, then it will not hurt 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 the core with a 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 (8274 KPa). **(CAUTION! To prevent fin deformation, you must stay a few inches away from the core and 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 CORES

Epoxy-coated cores must be cleaned with care to assure 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. Do not steam clean. The nozzle should be kept approximately 12 inches away from the core.

CAUTION! We do not recommend a pressure rating because as epoxy ages the coating does become 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 submergent 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

In most cases just flushing the inside of the tubes with a high pressure hot water washer, with soap, will do the job. Rinse thoroughly with clean water.

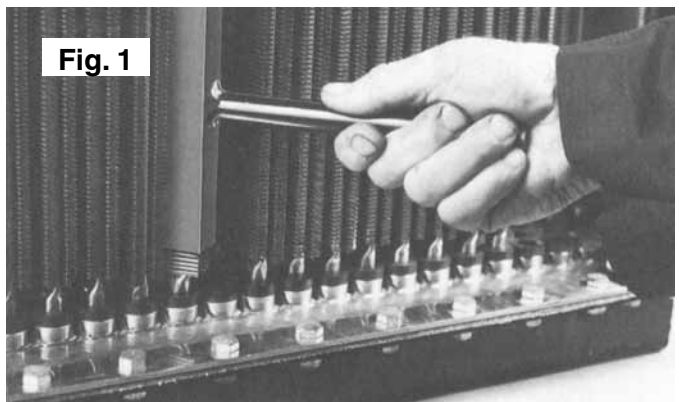
Tube Removal

HELPFUL HINTS:

- Clean the core prior to removing tubes.
- To avoid bending or kinking tube ends, reduce the angle of the tube as it's 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) or stay system with support bars, mark the bars front and back before removing, to ease reassembly.
- To assist in the removal process, spray WD-40 on the top end of tubes.
- If tubes are difficult to remove, try using the breaker tool and removal tool simultaneously.

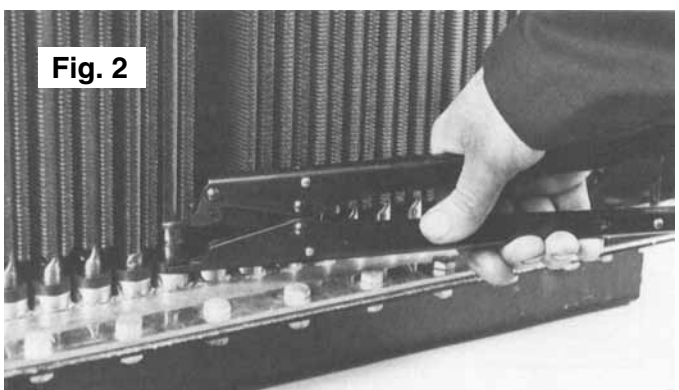
STEP 1.

Loosen the tube by using Breaker Tool, L&M P/N 37239, as shown in **Fig. 1**. 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 2.

After tube is free, place upper jaw of Installation Tool P/N 48350 around the round portion of tube, just below the flattened portion. Place lower jaw on top of bottom seal, see **Fig. 2**. Squeeze handles of tool together and raise tube only enough to clear bottom seal.

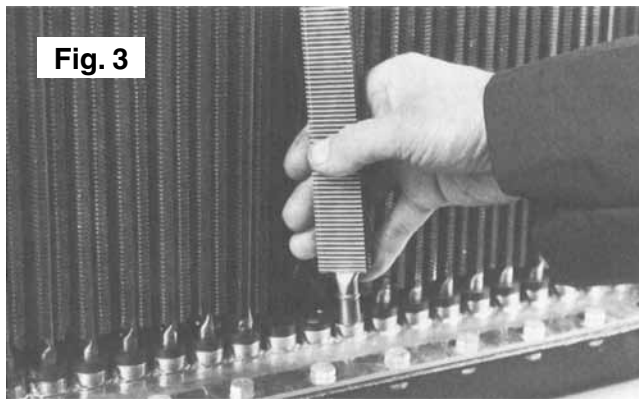


Tube Removal (continued)

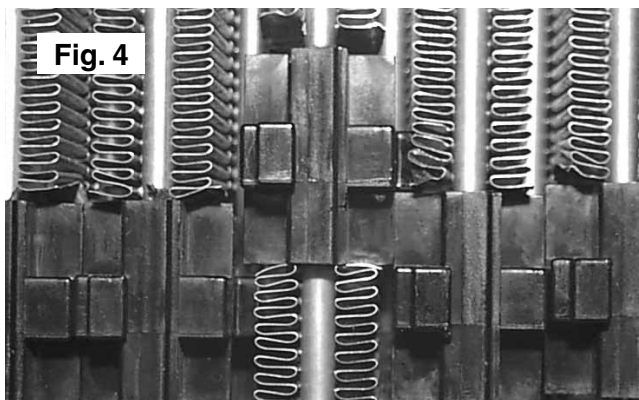
STEP 3.

Put down tool and swing tube out just far enough to allow it to be pulled down and out of its top seal, as shown in **Fig. 3**.

Remove all tubes in the row, repeating the above procedure.



If you are working with any of L&M's ITS™ or stay systems with interlocking tabs, the tube must be raised high enough so that the interlocking tab clears the adjacent groove, as shown in **Fig. 4**.



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" or 8" diameter wire wheel brush with a wire size of .006 or .008. 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 when tubes are removed.
- After removing the old seals, clean the plate holes of any foreign debris with L&M P/N 99785 header plate hole cleaning brush placed in an electric or air drill.
- Clean out inside of tanks and blow out plate holes with air.
- Install new seals in clean dry holes. **Do not apply any lubricant to header plate 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.
- For ease of seal installation, soak seals in hot water just prior to installing.
- Make sure you use proper seal part number (see Seal & Lube Chart on page 3).

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. 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.5**. Over-installed seals will make tube installation more difficult and are much more likely to be damaged during tube installation.

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" x 3" x 6" placed over the seals. Hitting with a rubber mallet will allow the seals to be properly installed.

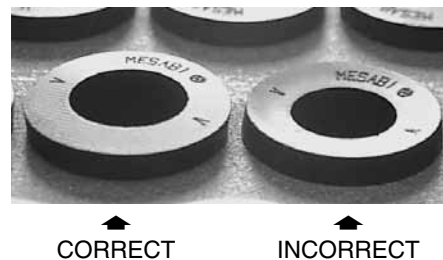


Fig. 5

ON THE LEFT:
Properly installed seal.

RIGHT:
Seal installed too far into header.

Lubricating Seals and Tube Ends

For ease of tube installation and to minimize the chance of scuffing or tearing rubber seals during tube installation, both top and bottom seals and both tube ends must be thoroughly lubricated, using L&M lube (see Seal & Lube Chart on page 3 for proper lube part number). Using a 1/2" diameter brush (L&M P/N 63451) and a minimal amount of lubricant, apply a thin film into each seal hole and onto each tube end.

Tube Installation

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 with inadequate lubrication.
2. Improperly installed seal that could 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.

HELPFUL HINTS:

- If you are working with a center tank core, the bottom core must be assembled before the top core.
- 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.
- For ease of tube installation, install the tubes behind the side member gussets in each row first. Install the tubes behind the left side gussets, working towards the core center. Then, going to the far right hole, in the same row, install the tubes working towards the core center.
- Individual rubber tube stays and, in some cases, tube stay ends are necessary to interlock the tubes. For part numbers see page 3. If more detailed information is required for proper assembly of cores using tube stays and tube stay ends, contact one of the L&M manufacturing facilities listed on back page.
- If your core style includes plastic tube supports, see page 7 for ITS™ or stay orientation prior to starting.

STEP 1.

To minimize installation angle, tubes in any given row must be installed from the closest header plate edge.

Use a minimum of angle and a slight twisting, pushing motion, to push the top end of the tube into the top seal. Push it far enough in so the bottom of the tube clears the top of the bottom seal.

If you are working with any of L&M's ITS™ or stay systems, you will need to insert the tube far enough into the top seal to allow clearance for the tabs to be aligned with the grooves when the tube is pulled down into the bottom seal (see **Figs. 4. and 6.**). Please note that when ITS™ or stays with interlocking tabs and grooves are present, the bottom end of the tube should be centered in the seal and then pulled down slightly into the seal so that the tabs engage the adjacent grooves.

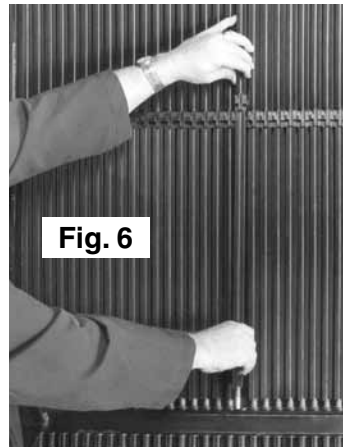


Fig. 6

NOTE: See page 7 for ITS™ or stay orientation in the core.

STEP 2.

Center bottom end of tube into respective seal in the bottom header plate. Then, push tube

down and into seal until the formed bead is seated into the locking groove of the bottom seal.

This may be done by grasping tubes by hand and pulling the tube downward until seated, or by using Installation Tool, L&M P/N 48350.

This tool has a semicircular form on the end of the handle. Place this end on the formed bead of the tube and push downward until seated, as shown in **Fig. 7.**

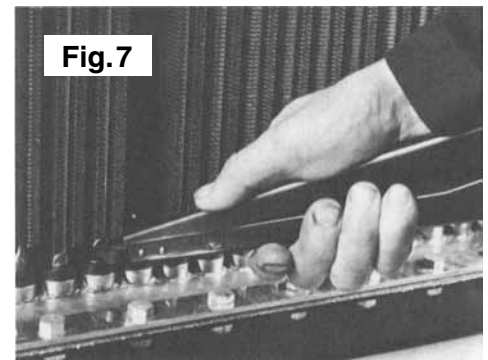


Fig. 7

Now, complete the row of tubes. Precaution should be taken to make sure formed bead is seated into bottom seal, and that the tubes are straight and aligned to assure maximum air flow.

If you are working with an ITS™ system (refer to page 3 and page 7, **Fig. 9,** for identification), use L&M tube installation tool P/N 77050 to pull the tube into the bottom seal. (See **Fig. 8.**) Hook the slotted end of the tool behind the front tab on the ITS™ tube support. Using the tool and your free hand, center the bottom end of the tube into the bottom seal. At the same time guide the dovetail slots into the tabs on the ITS™ tube support. Once in place, and with the tool P/N 77050 still hooked onto the ITS™ tube support, pull the tube into the bottom seal until the formed

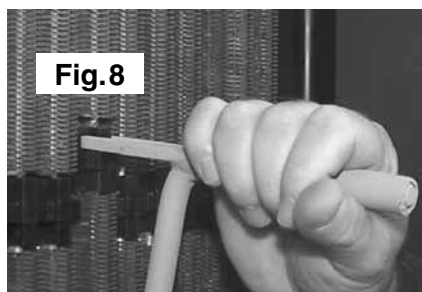


Fig. 8

bead is seated into the locking groove of the bottom seal. Push the remaining tubes in this row. Use the same procedure on all remaining rows except the front side row.

Tube Installation (continued)

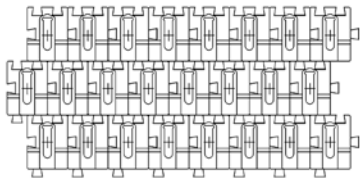
STEP 2. (CONTINUED)

Tube Support Orientation

All illustrations front side as viewed from top.

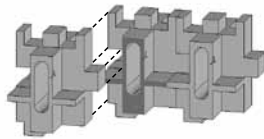
A. ITS™ (can be used on H, L, or V style cores)

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

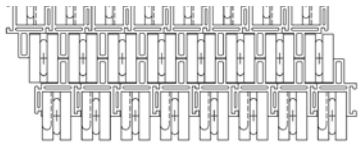


FRONT

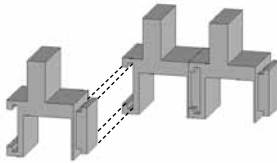
Fig. 9



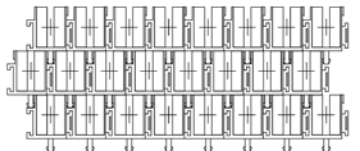
B. "L" Stay



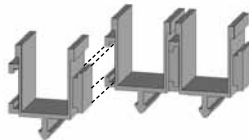
FRONT



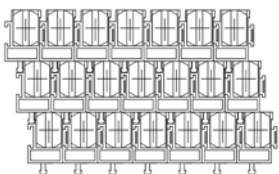
C. "M" Stay



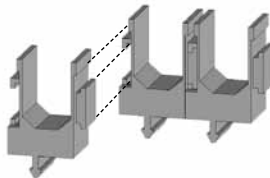
FRONT



D. "V" Stay



FRONT



NOTE: If you are working with an older stay style that has rubber tube stays (see Exploded View page 3) and need assembly assistance, please contact L&M Customer Service.

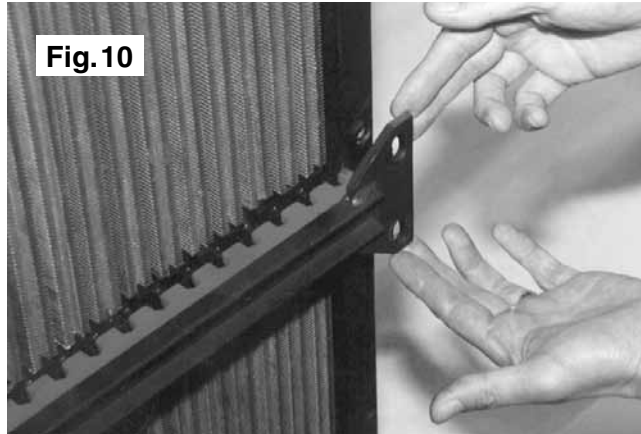
STEP 3.

Before you install the front side row, install the felt air baffles.

Caution! To prevent seal leaks, do not allow the felt baffles to be pushed (top) or pulled (bottom) into the seal hole when installing the front row of tubes.

STEP 4. (If applicable)

If you are working with the ITS™ or stay 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 Technical Drawing and Parts List for proper installation. Using a rubber mallet, gently tap the bar into place and secure to the side member.

PRESSURE TESTING

Pressure testing procedure that follows recommends testing to 15 psi (103 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 air pressure up slowly and always wear protective gear)

1. Pressurize with compressed air to 15 psi (103 kPa) and submerge in water.
2. Seal any leaks at the test fittings and/or cover plates.
3. Repair any other leaks as needed.
4. Cycle test after successful initial test. Hold pressure at 15 psi (103 kPa) for 15 minutes. Note that the time starts after all leaks are fixed and air bubbles have subsided. Cycle to zero psi and pressure back up to 15 psi (103 kPa). Hold at 15 psi (103 kPa) for one minute. Repeat three more times and then hold the last cycle pressure at 15 psi (103 kPa) for five minutes. Should any leaks appear, fix them, and start the cycle test over.

If you have any questions regarding the procedures described in this Service Manual, please contact L&M Radiator and ask for Customer Service. See back page for contact information.

MESABI® is 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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