Representaciones e Ingeniería Limitada
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ELECTRO-MOTIVE DIVISION • GENERAL MOTORS CORPORATION
SERVICE DEPARTMENT

MAINTENANCE INSTRUCTION

WATER COOLING RADIATORS

INTRODUCTION

Heat from the engine cooling system water is dissipated through means of a radiator and fan arrangement.

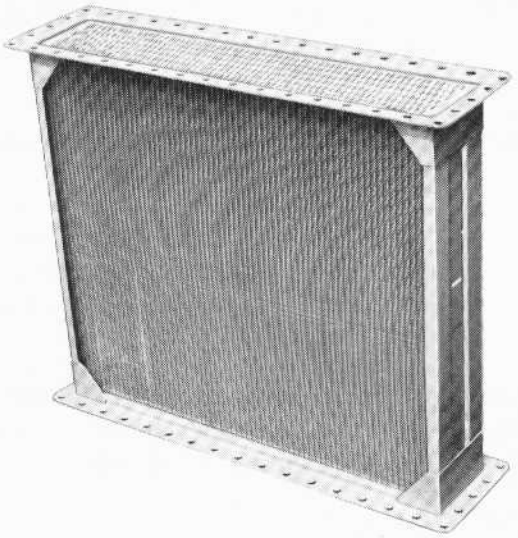
Heat developed by the engine is transfered to the water. The water enters the radiator directly from the engine. Within the radiator the water enters a series of tubes called the core, Fig. 1. Using the tube material as a conductor, a fan draws ambient air between the tubes thus cooling the heated water. Fins attached to the tubes aid in cooling by allowing more air to contact the heated tube surfaces.

This maintenance instruction describes the procedures necessary when cleaning and repairing the radiator.

CLEANING

When it becomes necessary to clean the radiator, use the following procedure:

1. Mark any areas on the air sides of the core that show signs of water treatment color. Discolored areas indicate leaks that will have to be repaired.
2. Remove header, if used.
3. Straighten bent header flanges and comb bent fins to ensure that air flow is not reduced.
4. Blow debris from fins with compressed air.
5. Clean gasket surfaces.



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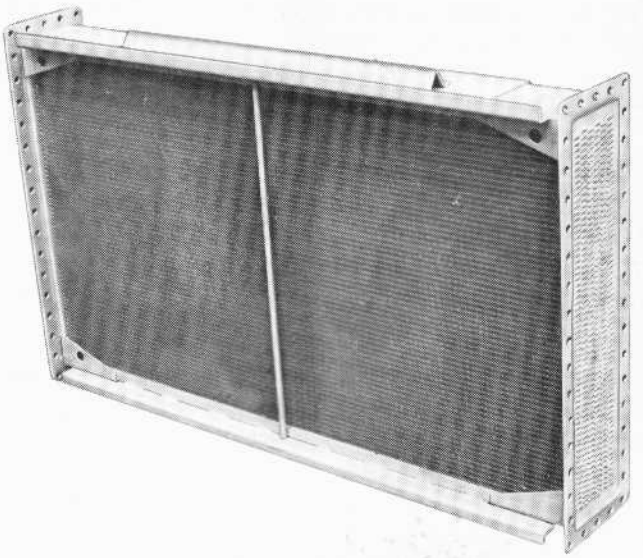

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Fig. 1 – Typical Radiators

*This bulletin is revised and supersedes previous issues of this number.

6. Fill a soak tank with an undiluted non-toxic organic cleaner. See Service Data. Level should be sufficient to allow for complete submersion of the radiator.

CAUTION: Use of caustic cleaners is not recommended. Bonding solder will deteriorate with the use of caustic cleaners, causing leaks and hindering heat transfer.

7. Soak radiator core for three hours in a still tank, with tubes lying horizontally. If cleaning solution is agitated, cut soaking time in half.

NOTE: Cleaning is more effective in an agitated tank.

8. Rinse core using a steam-water mixture.

NOTE: Rinse core as soon as possible to prevent residue from hardening.

RADIATOR CORE TESTING

Radiator core failures, other than damage, can be categorized under three headings: fin-to-tube bond failures, tube failures, or tube-to-header bond failures. Repair limits for fin-to-tube bond and tube failures are specified under Service Data. If the failure is within the repair limits the core can be repaired, if not, repair is not feasible and the core should be scrapped.

FIN-TO-TUBE BOND CHECK

Loose fins will hinder heat transfer and allow the tube to expand with water pressure. This expansion-contraction cycle will eventually result in a tube fracturing. Use the following steps to check fin-to-tube bond.

1. Using a suitable tool or probe, check fin-to-tube bond by gently pressing against the fin collar. A loose fin will move relative to the tube it supports, Fig. 2.

2. Repeat Step 1 for each fin and measure loose fin area. The radiator should be scrapped if loose fin area exceeds limits specified under Service Data.

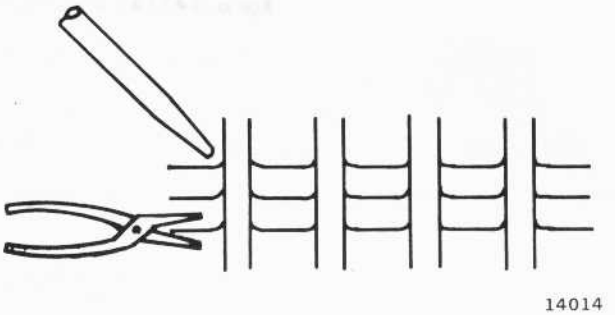


Fig. 2 – Checking Fin-To-Tube Bond

NOTE: If loose fins leave more than 25.4 mm (1") of a tube length unsupported, that tube should be removed from service, see Tube Repair.

LEAK TEST

Tube leaks or tube-to-header bond leaks can be accurately located using the following procedure:

1. Install a sealing plate or tank on each header-flange of the core.

2. Apply 345 kPa (50 psi) air pressure on the tube side with the core immersed in clean water at room temperature.

CAUTION: Avoid exceeding 345 kPa (50 psi) air pressure, higher pressures may damage core tubes.

3. Mark tubes and areas of the tube-to-header bonds that are emitting bubbles.

4. Qualify the core by using the repair limit information given under Service Data. The core should be scrapped if tube failure exceeds repair limits.

5. For repair procedures, refer to either Tube Repair or Tube-To-Header Bond Repair sections, depending on nature of leak.

TUBE REPAIR

Tube leaks are repaired by sealing each end of the defective tube with solder, thus eliminating it from service. When loose fins leave more than

25.4 mm (1") of a tube unsupported it also should be sealed using this method. Experience has shown that up to 2% of the total tubes can be sealed by this method without adversely affecting efficiency. Use the information given under Service Data as a guideline in determining whether the core is scrapped or repaired. Use this procedure for both solder and mechanical tube-to-header type bonds. Solder tubes closed using the following procedure:

NOTE: The recommended heating tip for melting out old solder and applying new solder is listed under Service Data.

1. Thoroughly dry inside of tubes to be repaired.

2. Pinch one end of each tube to be repaired closed.

NOTE: Use brass plugs to close tubes on mechanical tube-to-header type bonded cores.

3. Clean tube with zinc chloride flux. See Service Data. When applying flux, play a medium flame on the fluxed surfaces. The heating will boil the flux thus improving its cleaning ability. Use a soft wire brush to scrub and clean the areas which are being prepared for soldering.

4. When the tube is thoroughly cleaned, solder pinched (plugged) end with a 50% tin, 50% lead soft solder, and a 243° C (470° F) flame. See Service Data.

5. Flush each soldered tube to avoid trapping unused flux inside.

6. Thoroughly dry inside of tube.

7. Turn core and solder opposite end of tube as described above.

8. Clean and flush both headers with water.

9. Repeat Leak Test to assure that all leaks have been eliminated.

10. Spray all external surfaces with one coat of black radiator paint. See Service Data. Avoid spraying gasket and water swept surfaces.

NOTE: Mix equal parts of radiator paint and U.P.M. naptha.

TUBE-TO-HEADER BOND REPAIR

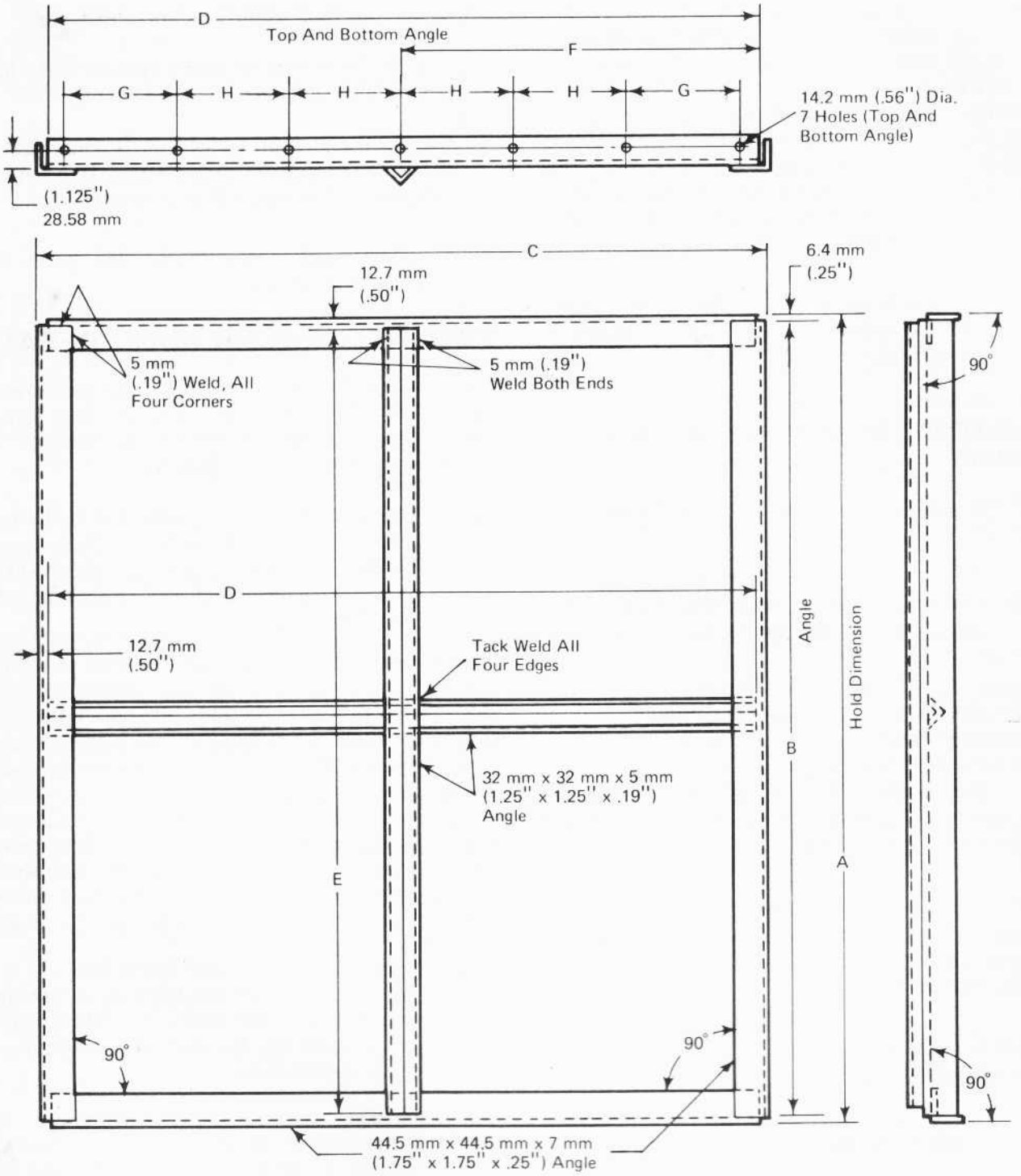
The majority of tube-to-header bond leaks occur in the outer two tube rows along the long side of the header. Although less common, leaks at the middle tube rows are also possible.

NOTE: These procedures are intended to be used only on solder bond type radiator cores. Cores which have a mechanical tube-to-header bond are not repairable using this method.

Repair procedures are similiar for both outer and middle tube rows. The primary difference being the area from which the old solder is melted out. Repair of outer tube rows requires solder removal from only the two outer tube rows on each side of the core, a total of four tube rows. Middle tube row failures require that the entire area of solder in the header be melted out. The recommended heating tip for melting out old solder and applying new solder is listed under Service Data.

While repairing tube-to-header bond failures, it is critical that the header be kept in a position which is square with the tubes. A cocked header will cause a load on the tube-to-header bond, causing premature failure.

When repairing an outer tube row failure, the header is held square by the solder which has not been removed from the middle tube rows. To repair a middle tube row failure a clamping fixture, Fig. 3, should be constructed to hold the header square while repairs are made.



DIMENSION CHART								
CORE	A	B	C	D	E	F	G	H
8-Row	1162 mm ± .3 (45.75" ± .01)	1149.4 mm (45.25")	990.6 mm (39")	965.2 mm (38")	1136.7 mm (44.75")	482.6 mm (19")	154.8 mm (6.093")	154.8 mm (6.093")
6-Row (double length)	1400.2 mm ± .3 (55.125" ± .01)	1387.5 mm (54.625")	889 mm (35")	863.6 mm (34")	1374.8 mm (54.125")	431.8 mm (17")	103.2 mm (4.062")	154.8 mm (6.093")
6-Row (single length)	697.2 mm ± .3 (27.45" ± .01)	684.5 mm (26.95")	889 mm (35")	863.6 mm (34")	671.8 mm (26.45")	431.8 mm (17")	103.2 mm (4.062")	154.8 mm (6.093")

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Fig. 3 – Header Clamping Fixture (2 Required)

OUTER TUBE ROW REPAIR

A leak detected within the first two outer tube rows may be repaired using the following procedure:

1. With the core resting on both header flanges and the tubes in the horizontal position:

   a. Melt the solder from the first two outer tube rows nearest the surface the core is resting on. The cross hatching in Fig. 4 indicates the area from which solder is to be removed. Melt solder out by playing a 327° C (620° F) flame over the area. The melted solder will run out of the dish, over the header flange, and out.

   b. Turn core over so that the two unmelted rows which were at the top are now nearest the surface that the core is resting on. Repeat Step a.

   c. Clean all surfaces that are to be resoldered with zinc chloride flux. See Service Data. Use a syringe to ensure that all cracks, tubes and header surfaces have been cleaned with flux.

   NOTE: When applying flux, play a medium flame on the fluxed surfaces. The heating will boil the flux thus improving its cleaning ability. Use a soft wire brush to scrub and clean the areas which are being prepared for resoldering.

   d. Repeat Step c using clean flux. This will remove any remaining dirty flux.

2. With the core resting on one header and the tubes in the vertical position:

   a. Run a length of No. 7, 3.2 mm (1/8") diameter silver wire solder along each tube row. See Service Data. Use a 327° C (620° F) flame to sweat this solder into the tube-to-header joints. See Fig. 5.

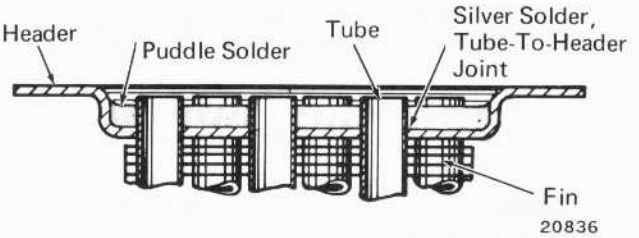

Fig. 5 – Radiator Core Cross-Section

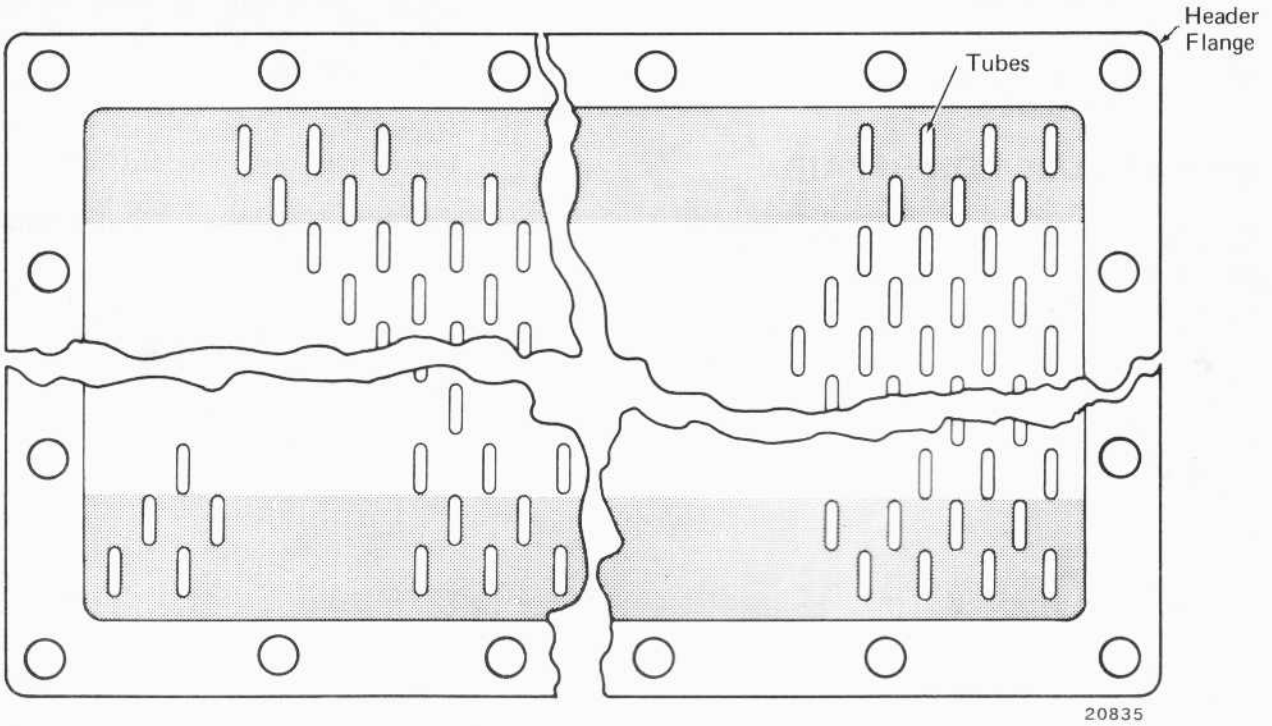

Fig. 4 – Radiator Core Schematic

b. When solder stops running, use a small amount of flux and a wire brush to reclean the area. Reapply solder for the gap between the header and the first tube row.

c. Using 9.5 mm (3/8") TRIBAR puddle solder, see Service Data, and a 260° C (500° F) flame, build up a puddle with a minimum depth of 4 mm (5/32"). Blend it with increasing depth up to 6.4 mm (1/4") at the edge of the header dish.

d. Solder space between rows using a 3.2 mm (1/8") wire puddle solder, see Service Data, and a 260° C (500° F) flame.

e. Blend excess solder with a 260° C (500° F) flame carefully so that it runs and levels out. Make certain that the old and new puddle solder is well blended.

f. Remove all traces of flux by immersing core several times in cold water.

3. Repeat Leak Test to assure that all leaks have been eliminated.

4. Spray all external surfaces with one coat of black radiator paint. See Service Data. Avoid spraying gasket and water swept surfaces.

NOTE: Mix equal parts of radiator paint and U.P.M. naptha.

MIDDLE TUBE ROW REPAIR

Use the following procedure to repair leaks in the middle tube rows:

1. Construct a clamping fixture using the dimensions given in Fig. 3.

NOTE: The clamping fixture will keep the headers square while the core is being repaired.

2. Bolt each half of the clamping fixture to the core header flanges.

3. With the core resting on both header flanges and the tubes in the horizontal position:

a. Melt out all solder from the tube-to-header bond. Melt solder by playing a 327° C (620° F) flame over the entire area of solder. The melted solder will run out of the dish over the header flange and out.

b. When all solder has been removed, clean all surfaces that are to be resoldered with zinc chloride flux. See Service Data. Use a syringe to ensure that all cracks, tubes, and header surfaces have been cleaned with flux.

NOTE: When applying flux, play a medium flame on the fluxed surfaces. The heating will boil the flux thus improving its cleaning ability. Use a soft wire brush to scrub and clean the area which are being prepared for resoldering.

c. Repeat Step b using clean flux. This will remove any remaining dirty flux.

4. Perform Steps 2-4 under Outer Tube Row Repair.

SERVICE DATA

SPECIFICATIONS

FIN-TO-TUBE BOND

Loose Fin-To-Tube Bond - Total Area Not To Exceed . . . . . 9678 mm^2 (15 sq. in.)

Loose Fin-To-Tube Bond - No Single Area To Exceed . . . . . 6452 mm^2 (10 sq. in.)

TUBE REPAIR

Maximum Number Of Adjacent Tubes Required 4

Maximum Percentage Of Total Number Of Tubes Repaired 2%

EQUIPMENT

	PART NO.
Solder, Soft - 50% Tin, 50% Lead, 0.68 kg (1.5 lb.) Bar	3225762
Paint, Black Radiator - Use One Part Paint With One Part U.P.M. Naptha, 3.78 litres (1 Gallon) Can	8204764
Solder, TRIBAR - 40% Tin, 60% Lead, 11.34 Kg (25 lb.) Bar	8478479
Solder, Silver Wire - 2.5% Tin, 97% Lead, .5% Silver, 3.2 mm 1/8") dia. No. 7, 11.34 kg (25 lb.) Spool	8478480
Solder, Puddle - 38% Tin, 62% Lead, 3.2 mm (1/8") dia. 11.34 kg (25 lb.) Spool	8486859
Flux, Zinc Chloride - 3.78 litres (1 Gallon) Can	500-FL-93

Cleaning Solutions - Quaker Solv Cleaner 76, Cecolene (trichlor Ethylene), Or Oakite No. 31

Soldering Tip, Stainless Steel Tube - Available From National Cylinder Gas and Blower Pipe Company, under PN 700-27-813N

Litho in U.S.A.