



M AINTENANCE I NSTRUCTION

AC COOLING FAN MOTORS 36" AND 48" MODELS

DESCRIPTION

Many locomotives are equipped with an alternator for supplying power to such important auxiliaries as the AC motor driven cooling fans. Two or more fans are used depending on the locomotive model, engine size and cooling requirements. The fans are either of the 36" type shown in Fig. 1 or the 48" size shown in Fig. 2.

Inverted squirrel cage type induction motors are an integral part of the cooling fan assembly. These motors differ in construction from conventional squirrel cage motors by having the rotor "inverted" or located outside of the stator. Careful balancing and the use of double shielded sealed grease ball bearings insure smooth, efficient operation.

Motor and fan speed is directly proportional to the AC frequency which in turn depends on the engine (and alternator) speed. At idle speed of 275 RPM, the cooling fans would run approximately 540 RPM. At full engine speed of 800 RPM, fan speed is 1550 RPM. Fan speed is 1600 RPM on units that have engines operating at a top speed of 835 RPM. Rotation is clockwise when looking down at the fan.

The fans are generally mounted in a hatch located in the roof of the locomotive above the engine cooling system radiators. When operating, the fans draw air through the radiator assemblies removing heat from the circulating water. The heated air is discharged through the roof of the locomotive. Fan operation is

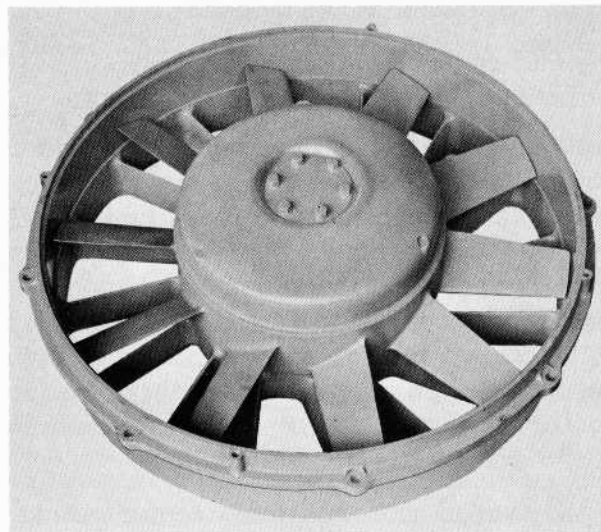


Fig. 1 - 36" Cooling Fan Assembly

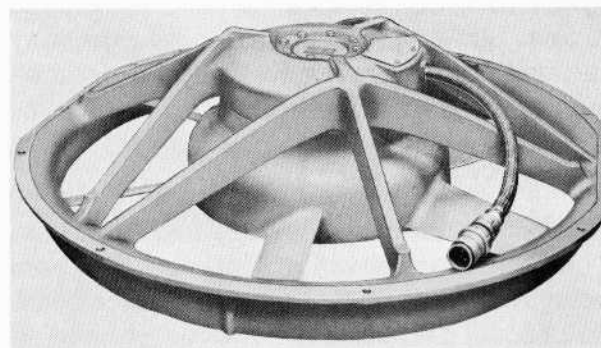


Fig. 2 - 48" Cooling Fan Assembly

controlled automatically by a thermostat switch and contactors which in turn function with changes in cooling system temperature. Through operation of the fans and associated equipment, engine cooling system temperature is maintained within desirable limits.

Further information on cooling system operation may be found by referring

* THIS BULLETIN IS COMPLETELY REVISED AND SUPERSEDES M.I. 910.

to the specific locomotive operating manual concerned. Maintenance of system components is covered in individual Maintenance Instruction bulletins.

MODEL DIFFERENCES AND INTERCHANGEABILITY

The 36" type cooling fans have been of the following model designations: I-666, I-666R, I-1236, I-1777, I-1787 and I-4499.

Beginning with fan Model I-666, various design changes have occurred in such areas as the bearings, wire size, connections and many others. The latest Model I-4499 incorporates all of these changes and in addition, is designed to supply a greater amount of air than previous fans operating at the same speed. This change in fan design required an increase in motor rating to 12 HP in comparison to the 9 HP of previous models.

Due to this increased motor rating, the Model I-4499 cooling fan should be used as a replacement for other models only after considering the suitability of power cabling to handle the increased rating. Information concerning this may be found by referring to Master Replacement Parts Catalog 90.

Fan Model I-1236 featured milled frame sides to permit fans to be mounted closer together on certain applications. This therefore prohibits other fans from being readily installed in such applications. Fan Model I-1236 may however be used as a replacement for other models.

Except for the limitations outlined above, all Models of the 36" cooling fan assembly are interchangeable.

Other than for its increased 48" size and rating of 25 HP, the Model I-4700 A2 cooling fan assembly is quite similar to the 36" models previously described. This increased size and power rating does of course prohibit the interchangeability of this model and the smaller 36" types.

The 48" fan has approximately twice the cooling capacity of the 36" fan. This

permits the use of two 48" fans in place of four of the 36" size on certain locomotive models. The maximum fan operating speed of 1600 RPM remains the same with the engine operating at 835 RPM.

MAINTENANCE

AC cooling fans have been carefully designed and manufactured for efficient performance and long, trouble free life. The only care or attention required is occasional inspections at intervals outlined in the Scheduled Maintenance Program, Maintenance Instruction 1704, and overhaul after an extended service life.

Unless otherwise specified, the following information shall apply to all models of both the 36" and 48" cooling fans.

OPERATING INSPECTION

Periodic inspection of the cooling fan should be made with attention given to the following points:

1. Inspect to see that fan is securely fastened to the locomotive hatch, and that the guard is in place and undamaged.
2. Observe that there are no restrictions to fan rotation or air flow.
3. With engine running, complete circuit through thermostat switch to cause fan to operate under power. While in operation, listen for unusual noises that could indicate possible internal or external trouble. Observe for vibration or other signs of unbalance.

CAUTION: Before doing any work on the fan make sure it is electrically disconnected from the source of power or that the engine is shut down. This will prevent fan from being inadvertently started.

COOLING FAN RECONDITIONING

In instances where the cooling fan assembly is removed from the locomotive for reconditioning, it is recommended that the following preliminary inspection be made before disassembly.

A. Preliminary Inspection

1. Place fan and motor assembly on a suitable stand with fan end up. Be careful not to damage flexible conduit or connection plug during handling.
2. Slowly rotate fan by hand to check for freedom of rotation.
3. Check stator winding insulation resistance with a megohmmeter. This value should not be less than one megohm. If less, it is suggested that the stator be dried by placing in a convection type oven set for 120° C. for a period of 4 to 6 hours. This should eliminate the possibility of moisture causing the low reading.

After drying, if the reading is still low, further inspection should be made after disassembly.

4. Connect motor leads to a 3 phase, 60 cycle AC power source of 85 volts

or to the locomotive alternator providing 149 volts at 106-2/3 cycles. Motor should be mounted in a suitable fixture that is designed to prevent air flow through the fan during the running test.

With the motor running, check the current flow in each line with an ammeter. These currents should balance within 10 per cent. If a greater than 10% difference exists, it may be assumed that the stator coils have turn-to-turn short circuits.

B. Disassembly

With the cooling fan placed on a stand in its normal position, it may be disassembled by referring to Figs. 3, 4 or 5 and following the procedure outlined below:

1. Remove the six cap screws from the fan hub and remove the cover plate.
2. Remove fan and rotor assembly from shaft hub. It may be necessary to lightly tap center of shaft hub to loosen fan pilot from shaft hub.
3. Separate sections of 3 pole male plug to expose solder connections of cables to plug terminals. Unsolder terminals from cables and remove plug, flexible

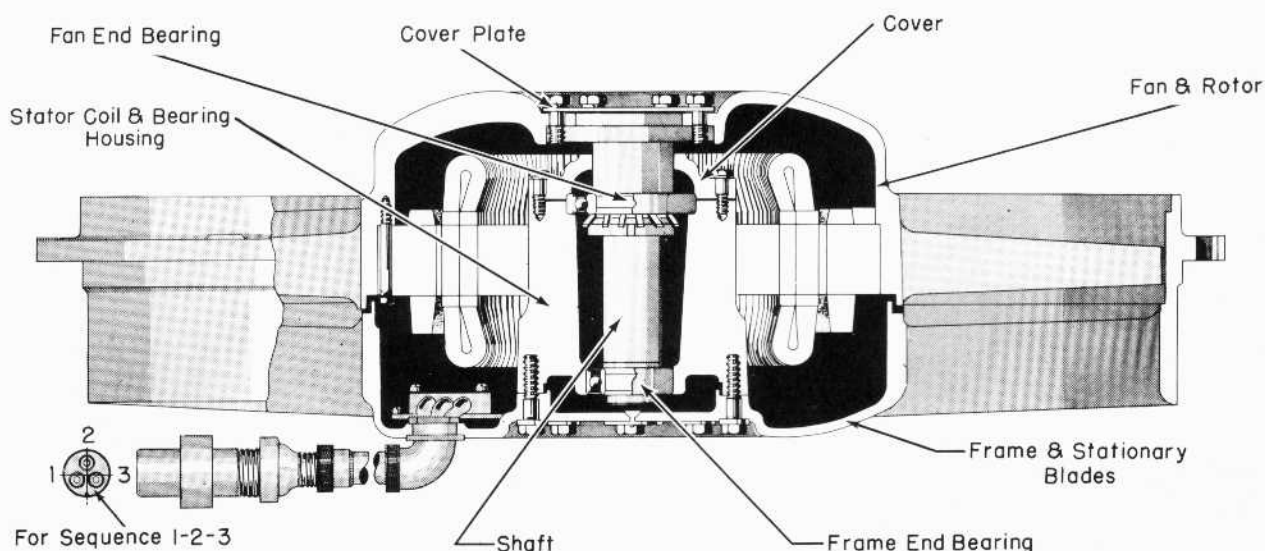


Fig. 3 - Cross-Section Of Fan Model I-666

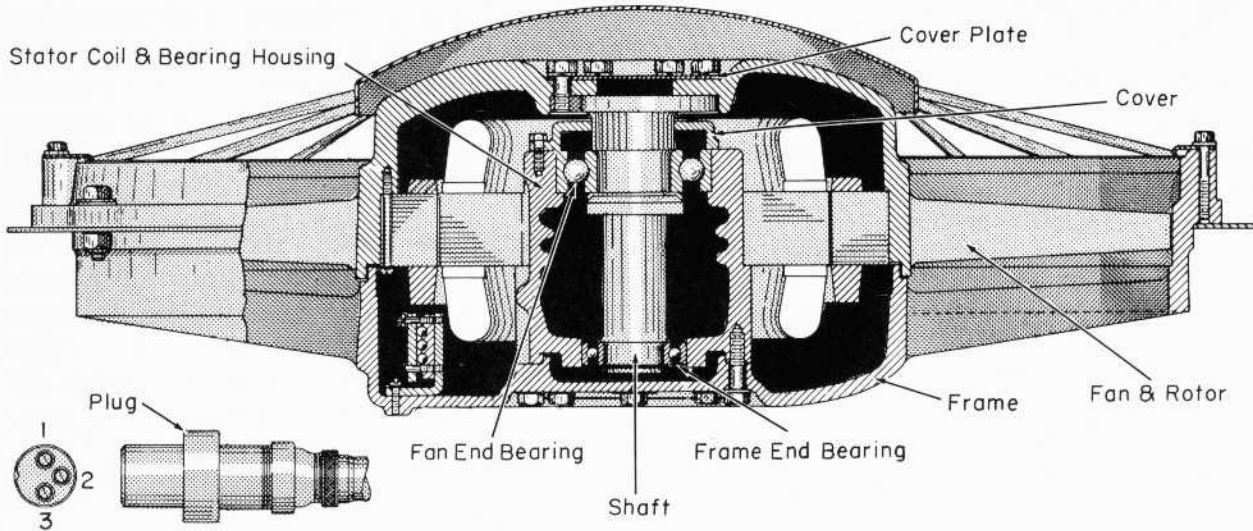


Fig. 4 - Cross-Section Of Fan Model I-4499

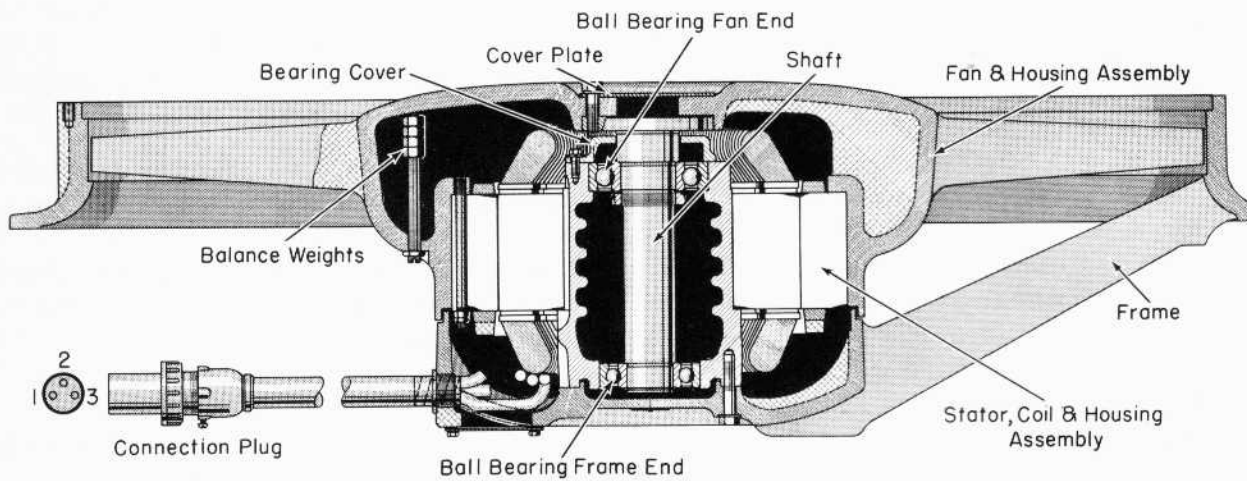


Fig. 5 - Cross-Section Of Fan Model I-4700 A2

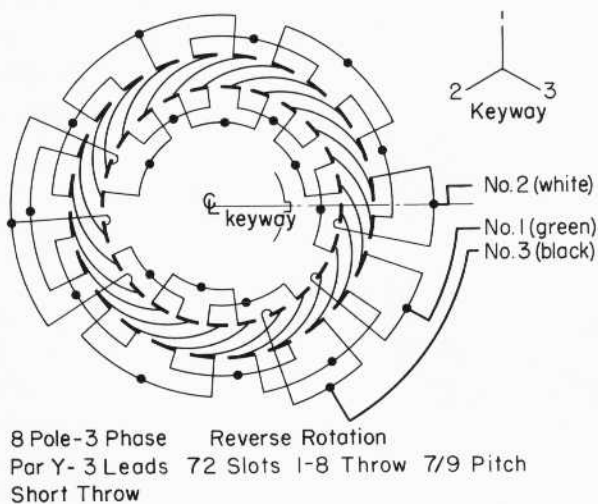


Fig. 6 - 36" Fan Motor
Connection Diagram

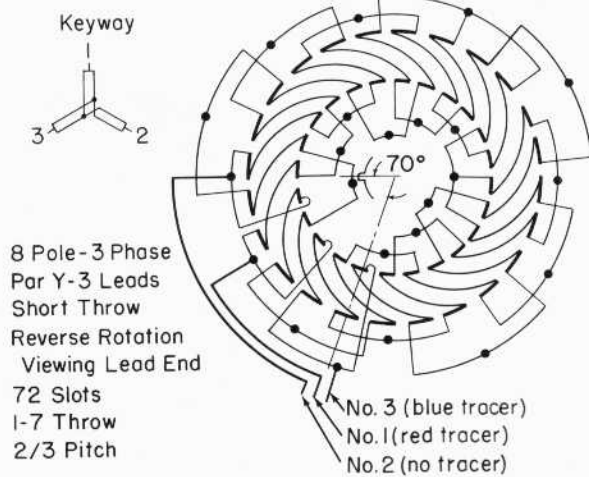


Fig. 7 - 48" Fan Motor
Connection Diagram

conduit and elbow. If leads are not colored, tag each lead for identification, see Figs. 6 and 7.

4. Loosen lead clamp in base of the aluminum frame and remove clamp from mounting plate. Pull leads through opening in aluminum frame.
5. Turn stator and frame assembly upside down, blocking under shaft to support stator winding assembly.
6. Cut lockwires and remove eight cap screws from frame to bearing housing. Remove frame from bearing housing and stator assembly.
7. Remove stator assembly and mount on a clean work bench in preparation for removal of bearing assembly.

C. Removal Of Bearing Assembly From Shaft

1. Remove the four cap screws holding bearing cover to housing. Removal of bearing assembly is to be made from hub end of shaft.
2. Remove bearing assembly and shaft from housing by tapping with a soft mallet on the small end of the shaft.
3. After removal of bearing assembly and shaft from housing in stator assembly, remove snarling from small bearing end of shaft and remove bearing by applying pressure to the inner race.
4. Remove bearing lock washer and nut from shaft and remove bearing cover and large bearing simultaneously from shaft. Discard (scrap) bearings removed.

D. Cleaning Of Stator Assembly

The stator assembly should be thoroughly cleaned of all dirt and grease using equipment and methods suitable for such purposes. Successful varnish treatment which follows depends on cleanliness to a great extent, thus this work should be done carefully.

E. Varnish Treatment Of Stator Assembly

After the stator windings have been cleaned, dried and found to be suitable for reuse, they should be given a varnish treatment as outlined in the procedure that follows.

Prior to varnish treatment, mask off the machined surface on bearing housing; also, apply protective covering to the main leads to prevent varnish from getting on leads during varnish treatment.

1. Preheat stator 2 hours at 155°-160° C. in convection type oven.
2. Dip stator subassembly while hot in clear baking varnish type R-851-F (8160879 for 55 gals.) for 3 minutes. Varnish should have a viscosity of 40-55 seconds at 21.1° C. as measured with a Ford cup #4 orifice. Varnish temperature should be maintained between 20° C. and 50° C. The thinner used is Xylol 8122139 (5 gals.).
3. Bake stator assembly for 5 hours in oven set at 155°-160° C.

NOTE: If an additional dip and bake varnish treatment is needed, the first baking time can be reduced to 1 hour and the stator dipped while hot a second time; however, the last baking time should be 5 hours.

F. Cleaning And Painting Of Stator Assembly

1. Remove protective material from main leads and machined surface of bearing housing. Clean varnish, if necessary, from machined surface of bearing housing.
2. Clean off excessive varnish from outside of laminations. This cleaning can be accomplished with a power driven wire brush being careful not to damage the winding.

3. Tap out threaded holes.
4. Paint bearing housing with red air drying enamel 8084875 (1 gal.).
5. Paint outside of laminations with black air drying varnish 8122347 (1 gal.).
6. Allow painted areas to dry thoroughly.

G. Shaft And Bearing Assembly

1. Make sure that shaft and housing bore are clean and free of burrs.
2. Apply 3 ounces of the type grease contained in the new bearing to the cavity in the bearing cover and install cover on shaft, small end of cover toward shaft flange.

NOTE: When installing new factory lubricated bearings, it is necessary to use the same type of grease in the bearing cover cavities to prevent grease contamination and eventual bearing failure. Refer to Locomotive Parts Catalog for proper grease and bearings.

3. Press a new fan end factory lubricated and sealed bearing assembly on shaft. Apply pressure to inner race face and drive solidly up against shoulder of shaft. Apply lock plate and nut. Tighten nut and bend up lip of lock plate into nut slot to lock nut in place.
4. Install the small new factory lubricated and sealed bearing assembly on shaft. Apply pressure directly (straight and square) to inner race face and drive bearing solidly up against shoulder of shaft. Apply snapping in groove of shaft to hold bearing in place. Place 3 ounces of type grease contained in new bearing, on the side of bearing facing fan end bearing.

H. Final Assembly Of Motor

1. Slide elbow lock nut over main leads on 36" fan.

2. Install stator winding assembly in frame by first sliding main leads through lead outlet hole of frame. Apply a thin film of grease to the fits between frame and bearing housing.

NOTE: Assemble stator into frame in position to give ample external lead length.

3. Apply eight lock washers and cap screws to fasten the frame to stator winding assembly. Tighten bolts evenly. Wire cap screws together in direction to tighten screws. Use #21 steel wire.
4. Arrange stator leads and install lead clamp lock washers and screws.

NOTE: On the early Model I-666 motors that have an extra internal aluminum rib located between the cable cleat and where the leads emerge from the winding, it is advisable to place a rubber bushing 5308590 around the leads with the outside groove of the bushing placed over the extra internal rib; thus preventing chafing of the leads by the extra internal rib.

5. On 36" fans, slide conduit elbow over leads and into outlet hole. Fasten elbow with nut previously applied over cable. For position of conduit elbow see Fig. 3.
6. Slide flexible conduit over leads and lock in place.
7. Apply upper half of plug and slide half of plug over leads. Solder plug terminals to leads with 50-50 solder. Tin leads before applying solder to terminals. It is recommended that brass plug terminals (male contacts) be replaced with silver plated terminals 8195032; also, brass female contacts in the receptacle should be replaced at the same time with silver plated contacts 8195031.

NOTE: Leads should be arranged in the plug so that in looking at the plug from outer end with notch of plug at the bottom, the #1 lead should be at left of notch, the #2 at top or 180° from notch, and the #3 to the right of notch.

8. Finish assembly of plug and tighten up screw on plug thread.
9. Check tightness of balance weights on fan and rotor assembly.
10. The fan and the rotor assembly is furnished as a complete unit only and is dynamically balanced to within 5 inch-ounces at 750 RPM.
11. Mount fan and rotor assembly on shaft hub. Use two pilot bolts in hub holes as pilots for fan holes. Apply plate

over pilot bolts. Remove pilot bolts and apply cap screws and lock washers. Tighten cap screws to 70-75 ft-lbs. Paint plate end and cap screws with red air drying enamel to seal against moisture.

I. Final Inspection And Test

Give the complete motor assembly a high potential test at 1200 volts to ground for 10 seconds. Make a half hour running test using 60 cycle, 85 volts as outlined under "Preliminary Inspection," Item 4. While the motor is running, observe for vibrations. The fan should be running smoothly without noticeable vibration. If any vibration is noticed, the fan and rotor assembly should be removed and dynamically balanced to the figure shown in Item 10.

EQUIPMENT LIST

Grease - - - - -	Refer to Locomotive Parts Catalog
Clear baking varnish (R-851-F) - 55 gals. - - - - -	8160879
Xylol (thinner) - 5 gals. - - - - -	8122139
Red air drying enamel - 1 gal. - - - - -	8084875
Black air drying varnish - 1 gal. - - - - -	8122347