



**GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS**

(For official use only)

MAINTENANCE HANDBOOK

CARRIAGE FANS

(110 V DC)

CAMTECH/2000/E/CF/1.0

**Xentre
for
Advanced
Maintenance
TEXHnology**



Excellence in Maintenance

Maharajpur, GWALIOR - 474 020

FOREWORD

Railway is a service oriented organisation and for better service to the customers, the passenger amenity items should be kept in good working condition. Carriage fan is an important items and specially in summer season its failure create much inconvenience to the pasengers, hence our aim should be for zero line failures of carriage fans.

This maintenance handbook describes all the maintenance features in detail. Maintenance schedules, do's and don'ts , trouble shooting etc. have been explained in easy and simple language. I hope, with all these useful features, the book will certainly prove to be very useful in the hands of railway maintenance personnel and will be helpful in increasing the reliability of carriage fans.

Gwalior
24th July, 2000

M. L. Gupta
Director

PREFACE

The proper upkeep and maintenance of Carriage Fans is necessary to ensure good reliability and availability of Carriage Fans for passengers comfort. This handbook on maintenance of Carriage Fans has been prepared by CAMTECH with the objective of making our maintenance personnel aware of maintenance practices of Carriage Fans to be adopted in field.

It is clarified that this handbook does not supersede any provision laid down by RDSO or Railway Board.

I am sincerely thankful to officers and staff of Electric Power Supply Directorate of RDSO/LKO and IRIEEN/NKRD for their valuable help. I am also thankful to all field personnel who helped us in preparing this handbook.

Technological up-gradation & learning is a continuous process. Hence feel free to write to us for any addition/modification in this handbook or if you have any new ideas. We shall be extremely thankful for your kind contribution in this direction.

CAMTECH, Gwalior
Date : 19/06/2000

Khushi Ram
Jt. Director(Elect.)

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The correction slips to be issued in future for this handbook will be numbered as follows:

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Where “XX” is the serial number of the concerned correction slip (starting from 01 onwards).

CORRECTION SLIPS ISSUED

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CHAPTER 1

GENERAL

Carriage fan is a passenger amenity item. We have to keep it in good and reliable working condition to ensure maximum passenger satisfaction. On Indian Railways 225, 300mm and 400mm sweep carriage fans are used in SG, MOG and EOG coaches where the system voltage could be 110V DC or 110V AC. In suburban EMU services 140 V AC system is used for carriage fans.

Railway carriage fans are either of the fixed or swivelling types and conforms to specification IS : 6680-92 deviation with Annex. H (latest). Performance requirements of DC fans are as follows:

Requirement	D.C. fan size		
	400mm	300mm	225mm
Minimum air in m ³ /min.	50	37	20
Maximum Electrical Power input in Watts	38	32	20
Maximum weight in kg.	15	14.5	13

Performance requirements of AC fans are as follows:

Requirement	A.C. fan size		
	400mm	300mm	225mm
Minimum air in $m^3/min.$	65	30	14
Maximum Electrical Power input in Watts	60	40	28
Maximum weight in kg.	15	14.5	13

Such design performance of the carriage fan can be maintained in service only by efficient maintenance of its vital accessories such as carbon brushes, brush holders, spring, commutator, bearings, regulator and its resistance etc. Parts when replaced should be of correct specifications to ensure efficient performance of fans.

1.1 ACCESSORIES

1.1.1 Regulator: This shall conform to IS: 6680-92 deviation with Annex. H (latest). The regulator with a separate resistance

unit enclosed in cast iron housing is provided for regulating fan speed in upper class coaches.

1.1.2 Fuse Protection: Tinned copper fuse of 35 SWG is provided as protection for each fan circuit . This safeguards the fan from surges & short circuit and isolates the circuit in case of faults in the sub-circuit.

1.1.3 Gimbal ring : This shall conform to IS: 6680-92 deviation with Annex. H (latest). This is provided in upper class coaches in swivelling type fans, so that the passenger can keep the fan angle to any position desired by him for comfort. It must be ensured that the screw holding the ring are properly screwed.

1.2 SAFETY ASPECTS

- The fan shall be provided with a closed mesh guard for protection of user against injuries. It should be ensured that the close mesh guard is properly fitted and the clips are tightened properly.
- The fan base is fixed to the coach body by using hexagonal head screws and flat washers. This shall receive special attention since there have been cases of fans dropping in service and causing injury to occupants.

- The fan body shall be mounted on the coach body directly and not electrically insulated in 110 V DC system.
- The fan shall be taken in such a way that the wires do not rub or get damaged by the swivelling motion of the fan body.

1.3 ANTI-THEFT MEASURES

- The inspection dome cover shall be provided with locking arrangements as per IS code 6680-92 deviation with Annex. H (latest).
- Fill the slot of screw heads by soldering (with solder wire and paste) to secure commutator end shield and bearing caps.
- Fix split pin, as per IS: 6680-92 deviation with Annex. H (latest), by passing through the hub of the blade and the armature shaft to prevent easy removal of armature.
- Secure screws (2 nos) holding the commutator end shield to the field magnets by sinking them further inside and plugging the screw head pockets with soldering as per IS: 6680-92 deviation with Annex. H (latest).

- Use aluminium/zinc alloy or cadmium plated/zinc passivated mild steel brush holder as per IS: 6680-92 deviation with Annex. H (latest).

CHAPTER 2

MAINTENANCE

The aim in maintenance is to reduce or compensate for the wear and tear in operation so that the carriage fans function well and give good services. Preventive maintenance covers the following four basic aspects:-

1. Systematic checking of the carriage fan while in service.
2. Localisation of defect, rectification and restoration of normalcy, if necessary, by replacement of the defective/worn-out parts.
3. Analysis of the basic cause of failure and taking remedial action to avoid recurrence.
4. One of the basic causes of passenger complaints is excessive noise of fans and steps should be taken to minimise the noise level.

2.1 TRIP ATTENTION

Following scheme is prescribed for all trains primarily or secondarily maintained at a depot.

2.1.1 Switch on each fan individually. Check starting of fan when switched on. In upper class coaches, check fan for starting in the lowest position of regulator and also for variation of speed in the 3 regulator positions. If the fan does not start, short the switch terminals with a small piece of wire temporarily. If the fan starts, this will indicate that the controlling tumbler switch/regulator is defective. Replace defective switch/regulator.

2.1.2 If the fan does not start when the tumbler switch terminals are shorted, proceed as follows.

- a. Test for supply at the 2-way connector near the fan with tumbler switch on, if there is no supply, the wiring is defective and has to be attended.
- b. Open dust cover in case of swivelling fans and remove fan body fixing screws in case of fixed fans. Remove carbon brushes. Check carbon for condemning size (condemning length is 10 mm), proper bedding correct spring tension and correct grade of brush (RDSO SKEL 3722). Check for free movement of brush holder (RDSO SKEL 2680). Replace defective brushes/springs. Ensure proper bedding.

- c. If the commutator is dirty, clean the surface with emery paper.
- d. If the commutator surface is grooved or the segments are found pitted in one or more locations, replace the fan by an overhauled fan. The defective fan can thereafter be rectified by replacement of the defective armature by a good one. If spare armature is not available send defective fan to shop for attention.
- e. If the fan is noisy, check for loose blades/fan guards and tighten, if the noise is due to bearing, replace the fan by a good one.

2.1.3 Check the individual fuse for fan circuits and ensure it is of correct size (35 SWG tinned copper)

2.1.4 Clean fan body and guard thoroughly.

2.1.5 In swivelling and bracket fans, free movement of fan for keeping at the desired angle as also the fan remaining at this angle should be ensured.

2.1.6 In swivelling and bracket fans, ensure that the fan dust cover is promptly replaced after attention.

- 2.1.7** Note down the total number of fans in each coach and the number of fans found defective on arrival. Defective fans shall include fans which require push start. Note down the total number of fans in the entire rake and the number of fans found defective. Such records may be maintained for each train, rake-wise. The aim is to achieve cent percent working of fans.
- 2.1.8** All fans as per scale laid down for the various types of coaches shall be available in the coach. In case it is necessary to remove any fan for attending to major defects and no spare fan is available, a deficiency label shall be affixed near the fan point. In case no deficiency label is available, theft memo shall be issued to the security branch.
- 2.1.9** Deficiency of fans shall be promptly made good when noted by any depot irrespective of whether the train is primarily maintained or not except in case of recurrent large scale deficiencies of foreign Railway's coaches. The depot/Rly entrusted with primary maintenance shall be advised by message whenever the deficiency is made good or when large scale deficiencies are noted on arrival.

2.2 FORTNIGHTLY EXAMINATION (FNE)

In addition to the items listed under “Trip Attention” the following works shall be carried out.

- The fan body, guards and blades shall be thoroughly cleaned with cloth.
- All fans shall be opened and condition of commutator, brushes and brush gear shall be thoroughly checked and action taken where necessary as given under “Trip Attention”.
- Fan fixing studs to carriage body shall be checked and tightened, wherever necessary. Availability of all the three fixing studs shall be ensured.
- Voltage shall be checked at the following location with coach load. “ON” and recorded
 - a. at the battery terminals,
 - b. at the junction box, and
 - c. at three fan points at random.

It shall be ensured that local voltage drop between the battery and any of the farthest fan point shall not exceed 3 Volts at battery voltage of 108 (+0 –2) Volts.

- All the switches controlling the fans shall be checked thoroughly and replaced, where necessary.

- Fan regulators in Upper class coaches shall be checked for smooth operation from one position to the other. In case the regulators are not regulating the fan speed, the resistance box shall be checked and replaced, where necessary.
- Fan blades shall be replaced, if found bent, or if there is no proper air delivery on examination.

2.3 POH SCHEDULE

In workshops the POH of carriage fan is done once in 13 months.

First the carriage fan is to be removed from coaches and brought to the fan repair/POH section. In the fan repair/POH section following repair/tests are to be done.

- Visually inspect the fan for damage and broken condition. If found segregate all defects and process accordingly.
- After visual inspection the guard blades of the fan is to be removed from the fan body.
- Conduct running test to check for bearing noise etc. by giving 110 V ac or dc supply (as case may be). If the bearing found noisy, change it with a new one. Bearing should be removed by hand puller.

- Ball bearing should be used after cleaning, checking and greasing (in case of open bearing).
- After satisfactory run test, dismantle inner accessories accordingly.
- After dismantling the fan, the armature is to be send to armature winding section for skimming, polishing and milli volt drop test and IR test.
- Check continuity of field coils by giving 110 V supply. If found O.K., provide class-155 varnish on the coil. The Varnish should be of good ISI quality.
- Check commutator end shield, If found damage it should be replaced by new one.
- Check carbon brush and brush-holder condition. If found damage it should be replaced by new one.
- All the accessories of the fan are again re-assembled accordingly and new carbon brushes with springs are provided.

- **Testing**

After assembly of the fan, it is again checked for the following test.

- a. Run test (by giving 110 V d.c. supply.)
 - b. Bearing noise (by audible means)
 - c. Megger test (by 500V, megger)(should not be less than twenty Mega ohm)
 - d. Checking for correct fitment (whether end shield of the bearing cap, are properly fitted). All screws are properly tightened. Armature are free moving in the armature cage etc.
- After these test paint the fans in smoke grey colour.
 - Fit the guard blades on the fan. Check the air delivery and fitment of the guard blade by giving supply to fan.
 - Label the fan as “OK”.

2.4 DO'S & DON'TS

2.4.1 DO'S

- Understand the problem while carrying out the repairs
- Keep all the tools, gauges and instrumentation in working condition
- Approved grade of carbon brushes to be used.
- Work with full confidence.
- Put fan in store away from dirt and moisture.
- Ensure supply is available.
- Blow the dust from carbon brush before putting in the holder.
- Put proper clipping at terminal.
- Check proper tension on spring.
- Remove bearing by hand puller only.

2.4.2 DON'T S

- Don't leave any loose connection.
- Don't use screw in between fan guard.
- Don't put any weight on fan body.
- Don't use fan body as stool.
- Don'ts wear loose clothes and chappals.

CHAPTER 3

TROUBLE SHOOTING

Fans failure mainly come under the following categories.

- Excessive noise and vibrations.
- Excessive sparking/blackening of commutator and excessive wear of carbon brushes.
- Inadequate air delivery.
- Poor insulation.

Remedial action to be taken in respect of the defects mentioned above is explained in the following sections.

3.1 EXCESSIVE NOISE AND VIBRATIONS

Excessive noise and vibration may be due to defective bearing, loose cage guards loose fan blade rivets, incorrect blade angle and profile and wrong balancing of blades.

- Bearing should be of standard quality.
- Mishandling of the fans during storage, maintenance or due to vibrations in service will cause the cage

wires coming out of its fixations. This will create abnormal noise with vibration and consequent passenger complaint.

- Proper care should be taken in handling the fans and in case any wire of the cage guard is found loose out of its fixation, it should be repaired or the cage guard be replaced.
- Fans blades should be checked for loosening of rivets and for any distortion in profile, correct blade angle and balancing to minimise excessive vibrations and noise of the fans. The blade angle to be corrected with the help of fixture.
- Fans should also be checked for wrong balancing. The static balancing could be observed/checked by revolving the blade at slow speed and checking position of stops of blade. Prior to the above checking, the fan blade should be checked for any distortion in profile of blade angle. An unbalanced fan blade should be rejected and replaced with good one. Fixtures shall be provided to check the blade angle.

3.2 EXCESSIVE SPARKING/BLACKENING OF THE COMMUTATOR

Excessive sparking at the commutator may result because of

- Improper spring pressure, carbon brushes grade and carbon brush bedding on commutator.
- Improper commutator surface condition.
- Defective winding and commutator connection.

The following are the approved grades of carbon brushes used on Railway carriage fans.

- EG 3 of Assam Carbon
- L16 (I) of Electro Carbonium.
- E-55 (I) of Electro Carbonium.

The carbon brushes which reach the condemning limit mark (condemning length 10mm) should be replaced by a good one of the same grade. New brushes must be fully bedded to commutator over the whole area of contact.

Carbon brush springs should be checked for correct tension and should be replaced if found to have lost its tension or damaged during mishandling.

The commutator surface should be smooth and clean to avoid excessive wear and sparking at the commutator. Cut during commutator turning should be restricted to minimum so as to obtain maximum life.

3.3 INADEQUATE AIR DELIVERY

Inadequate air delivery can be because of low speed or incorrect profile or blade angle.

- For low speed, check for any mechanical jamming of fan or excessive blackening of commutator.
- Fan blades are likely to get distorted losing their profile and blade angle if handled or stored roughly without care or tampered during service. The corrugated depression has been introduced on fan blades to stiffen the blade to certain extent. This prevents its distortion in service but it is necessary that fans and blades are handled with care during transportation. Fans should be stored properly to avoid their deformation/damage due to excessive loads in storage.
- The blade angle should be checked with the help of fixture or angle gauge and shall be 12 degrees.
- Blade angle can be checked and maintained within acceptable limits by keeping the total maximum blade

off-set at two extremes of blade width parallel to fan axis to 32mm. It can be checked and maintained easily using simple fixture and shall be done every time fan is taken for repairs in sick line or during POH in shops. All the four blades of fan shall be adjusted for blade angle to obtain optimum air delivery.

3.4 POOR INSULATION

Poor insulation of fans may result in local heating and damage to insulation. Fans should therefore, be meggered with 500 V megger and ensured that the fans are having the required insulation value. The insulation value of new fans should not be less than 20 M ohms. This insulation value of fans in service may deteriorate due to ingress of moisture, deposition of carbon dust and ageing of insulation etc.

The fan insulation value less than 20 M ohm is not permissible to be in service. These fans shall be dismantled, armature/field with poor insulation shall be taken out of motor and following operations be performed.

- Clean the armature/field coils with the help of a brush to remove all dust and carbon deposits accumulated on armature.
- Heat the armature in a heating chamber for two hours at 90 degree C.

- Dip the armature/field in the impregnating varnish suitable for class “E” thermal insulation.
- Cure the varnish by heating the armature in heat chamber according to curing schedule prescribed by the varnish manufacturer.
- Measure the insulation resistance by 500 V megger. If the resistance is less than 2 M ohms even now, discard the armature/field and use a new one. The defective armature/ field be rewound with proper winding wire.

If sufficient facilities are not available for heating and impregnation, send the defective fans for attention to shops.

REFERENCES

1. Indian Railways Maintenance Manual for BG Coaches, Published by Railway Board, in Dec.1995.
2. “Train Lighting” Publication of IRIEEN, Nasik Road.
3. Papers presented during the seminar on “Maintenance of Coaching Fans” organized by CAMTECH, at Zonal Training School, Udaipur on 18/02/2000.

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- 91. Principal ,
C.E.T.I. Central Railway, Thakurli
- 92. Documentation Centre/CAMTECH.
- 93. Library/CAMTECH.

Notes