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No. EL/3.2.176/2 **Date:** 15.03.2018

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- East Coast Railway, Chandrashekharpur, Bhubaneshwar-751 016.
- Eastern Railway, Fairlie Place, Kolkata- 700 001.
- North Central Railway, Subedarganj, Allahabad-211 033.
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- South East Centre Railway, Bilaspur-495 004.
- South Eastern Railway, Garden Reach, Kolkata- 700 043.
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SPECIAL MAINTENANCE INSTRUCTION NO. RDSO/2018/EL/SMI/0319 (REV.'0'), Dated 15.03.2018

1. Title:

Special Maintenance Instruction for maintenance of Oil Cooling Unit (OCU) for 3- phase Electric Locomotives.

2. Brief History:

In absence of any guidelines for maintenance of OCB, Zonal Railways are following different practices for its maintenance which creates problems for reliability. Railways have requested RDSO to issue guidelines for maintenance of OCB so that proper & uniform maintenance practices can be implemented. Therefore, detailed procedures for maintenance of OCB are chalked out & issued in this Special Maintenance Instruction(SMI).

3. Object:

To provide Maintenance Instruction for Oil Cooling Unit (OCU) for 3- phase Electric Locomotives.

4. Activities to be undertaken on Oil Cooling Unit (OCU) during different schedules

4.1 IA & IB Schedule

a) Check for abnormal noise, vibration level of OCU casing , burning smell.
b) Check for looseness and crack of motor mounting .
c) Check and tighten the foundation bolts of OCU .
d) Check and tighten the terminal connections.
e) Check the condition of terminal lugs.
f) Check the impeller blades, casing etc. for cracks, looseness etc.
g) Check the earthing connections of the motor body.
h) Check OCB casing fixing bolts with radiator.

4.2 IC Schedule

In addition to the works in IA /IB schedule, following additional works to be carried out during IC schedule.

a) Dust accumulated inside walls of OCB casing/motor/Impeller should be cleaned with brush keeping a protective cover on radiator. Then after , blow dust with compressed air.
b) Ensure intactness of duct jointing felt, tightness of foundation bolts.
c) Check the bearing condition using Shock Pulse Meter (SPM).Where bearings are found to be giving abnormal vibrations and noise by SPM, the clearance of the bearings to be measured and balancing of impellers to be checked/done as per need.
d) Lubricate motor bearing by approved grease.
e) Check OCU round gasket/casing inspection cover gasket for air leakage and if any leakage found , RTV should be applied to arrest the air leakage.

4.3 Term Over haul (TOH) Schedule

All the works mentioned under IA, IB or IC to be done in TOH also. In addition to this, following activities are to be carried out in TOH.

4.3.1 Pre -Testing

a) Check the insulation resistance of motor winding with the help of megger.
b) Give three-phase supply and start motor to check starting and running current.
c) Check and note down the defects and abnormality if any.
d) Check the impeller with Red Dye Penetrate Test (RDPT) or Magnaflux test for detecting any crack/discontinuity in the surface or welded portion.

4.3.2 Dismantling

a) Remove the impeller with the help of puller.
b) Unscrew the bearing cover bolts on both sides.

c) Unscrew the end shield bolts and remove end shield , check the condition of end shield, grease cups, .
d) Take out the rotor from stator carefully cover overhang portion with nomex paper, take out rotor cautiously without damaging the winding.

4.3.3 Cleaning

a) Clean duct, impeller and cover.
b) Clean the motor parts i.e. stator, rotor, bearing, grease cup (both outside and inside), end cover, protection by kerosene oil.
c) Dust accumulated inside walls of OCB casing/motor/Impeller should be cleaned with brush keeping a protective cover on radiator. Blow dust with compressed air.

4.3.4 Overhauling of stator

a) Dry stator by keeping in the oven.
b) Check the condition of terminal box/lugs and replace if required.
c) Surge test is done as per SMI/149.

4.3.5 Overhauling of Rotor.

a) Remove the bearing with bearing puller.
b) Check the rotor bars crack by growler test.
c) Check the bearing seat area of the rotor shaft.
d) Check the key slot on shaft and condition of the impeller key.

4.3.6 Impeller

By DPT Check for any cracks on Impeller, if found any defect replace impeller.

4.3.7 Assembly

a) As per SMI/79 before providing new bearing to be checked and tested for any abnormality.
b) Ensure fits and limits on bearing as per SMI/16.
c) Measure bearing clearance of free bearing as per SMI/23.
d) Provide the new bearing on rotor shaft, after heating it upto 70-80°C with induction heater and lock the bearing with circlips. Bearing to be filled with servogem-3 or its Equivalent grease.
e) Replace the bearing every overhauling i.e 18 months for WAP7 and 24 months for WAG9 .
f) Insert the rotor carefully in stator covering winding overhang portion with nomex paper.
g) Bearing retainer ANR 124 should be applied slightly before fixing end shield on bearings.
h) Mount the end shields and tightent the end shield and grease cup bolts. Replace and shields if found slack on stator.

i) Ensure the free rotation of rotor.
j) Fit the impeller on the shaft and lock with locking plate as per the procedure mentioned in 4.6.
k) Check the stator resistance, IR values .
l) Check the fitting of nuts and bolt screws.
m) Check the vibration level on OCU casing .
n) Check for moister contents/water ingress in terminal box and at cable casing. If any symptoms of moister contents/water ingress are observed, then apply RTV on terminal box cover and casing cable termination to avoid same.
o) Check OCB round gasket/casing inspection cover gasket for air leakage and if any leakage found , RTV should be applied to arrest the same.
p) Replacement of 10 sq mm cable type 4GKW-AX of cooling unit by 16sq mm (from motor terminals to duct junction box) as per RDSO MS no: 395.
q) Check the condition of knurling washers/gasket between OCB casing& radiator .If required replace it.
r) Ensure provision of Epoxy molded terminal box cover as per RDSO MS no: 290 Rev'1'.

4.3.8 Testing

a) Carry no load test on motor to measure no load current and decibel of bearing.
b) Carry load test with impeller fitted on motor shaft, the motor should not exceed rated current of motor.
c) Check OCB round gasket and change if required.
d) Measurements to be recorded during OCB (Overhauling(Enclosed as annexure)

4.4 IOH & POH Schedule

4.4.1 All the works mentioned in TOH schedule shall be carried out in IOH also. Addition are as under:

a) Bearing replacement of motor.
b) Check the rotor bar crack with growler test.
c) Impregnation of stator as per SMI no: 86.

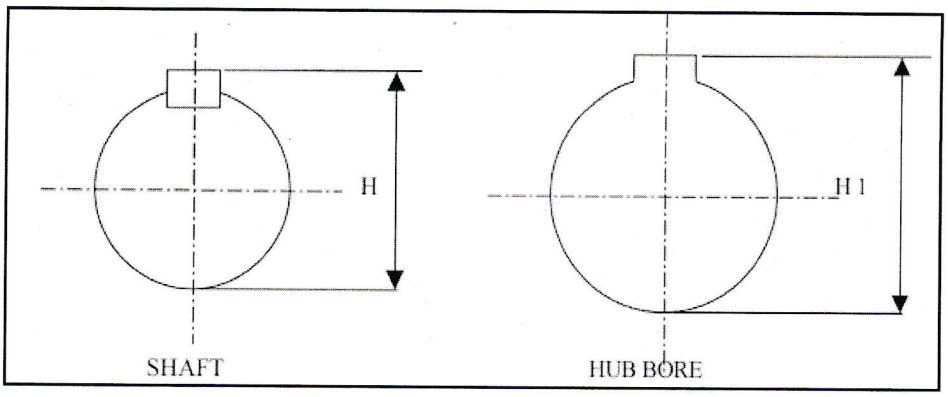
5. Assembly procedure of impeller on motor shaft

5.1 Before fitting of impeller on the motor shaft following checks must be done.

1. Bore of Hub with a "Go or no-go gauge" must be checked.
2. Keyway width should be checked as follows:

a) Take out key of motor and push into keyway of hub and ensure that it goes freely.
b) File keyway of hub if it does not move.

c) Key should not loose in the keyway.
d) If key is loose, another new key to be used.
e) Check keyway depth with the help of Vernier Caliper.
f) Place the key properly in keyway of motor.
g) Check H and H1 dimensions.
h) Maintain H1 - H = 0.05 to 0.1 mm. as shown below



After carrying out above checks, the impeller should be press on the motor shaft with proper press equipment. Special equipment jack/ pusher or puller should be used to push in and pull out the impeller.

5.2 Following important precautions should be taken while assembling the impeller on motor shaft.

a) Never exert force on any other part of the impeller except hub/ boss for pulling out or pushing in the impeller.
b) Do not use hammer for pushing in the impeller.
c) Never try to pull out impeller by holding shroud with a puller. This can damage the impeller to unrepairable extent. Shroud may deform or a prestress will be developed which can cause failure in service.
d) Sometimes motor footings are broken or outlet flange damaged due to mis-handling. Plane difference of motor and outlet flange causes assembled unit to rest on edge of outlet flange of casing and rear part of the motor foot which sometime results in "Broken motor foot" or outlet flanged twisted/ damaged/ welding crack. To avoid this, blower motor assembly may be fitted on a dummy wooden stool, which shall be removed only at the time of fitment in the loco. Assembled unit should not be kept on floor without stool.

5.3 **Dynamic balancing of impeller with motor during replacement of impeller**

As per TC No. RDSO/2013/EL/TC/0123, Rev '0', the impeller should be replaced in every POH. During schedule maintenance of Impeller, if crack is observed on Impeller, it should be replaced by new one with matching pair of

cone (matching pair means the impeller & cone should be of same make) and local welding of impeller should not be done . Further, every impeller shall be dynamic balanced to G2.5 grade as per ISO - 1940 .

5.4 Special Precautions to be observed during maintenance of OCB & its motor

a) Do replace bearings of OCB in TOH.
b) Do balancing of impeller during POH as well as after repairs.
c) Do ensure 100 % replacement of bearings during IOH/POH.
d) Do ensure availability of special tools in section required for repairing/ overhauling.
e) Do use puller and pusher for removing and fitment of impeller.
f) Do ensure winding diagram and winding procedure for rewinding work being done through trades.
g) Do change the impeller if it is unbalanced due to vibration etc.
h) Do ensure use of approved winding wire and procurement from approved sources only as per rewinding specifications.
i) Do use approved make of varnishes, leads and sleeves.
j) Do pretest the locomotive before taking into schedule.
k) Do change the cracked motor end shield.
l) Do depute two persons for removing and assembling of OCB rotor to avoid damages at overhang portion due to falling by weight.
m) Do ensure proper identification mark on the rotors fitted with bearing numbers 6312 to avoid interchanging during assembling.
n) Do vacuum pressure impregnation of stators.
o) Do surge test on stator after every overhaul.
p) Do dye penetrate test/ magna flux test for crack detection.
q) Do measure shaft dimensions at bearing seating as per norms.
r) Do prevent stretching of supply leads.

6.0 LIST OF SMI/LETTER / SPECIFICATION FOR IMPROVING RELIABILITY OF OCB UNIT.

SN	TITLE	SMI/Letter no: reference
1	Rewinding materials for Auxiliary motors and Arno Converters.	RDSO/ELRS/SMI/185-2000 Rev.1
2	Use of corona resistant wire for manufacturer and rewinding of auxiliary motor of three phase Locos	RDSO letter no: EL/2.2.8/17 dated 14/08/2008 & amendment no; to RDSO specification no: E 10-3-09 (motor)

7.0 TEST FACILITIES

The following minimum essential testing facilities are required for blowers:

a) Manometers
b) Control panel comprising wattmeter, ammeters, voltmeters, frequency meter etc.
c) Multimeter

d) Tongue Tester
e) Tachometer
f) Vibration meter
g) Shock pulse meter
h) Stop watch
i) Thermometers
j) Air velocity meter
k) Vernier calipers, screw gauge, scale, etc.
l) Megger.
m) Magna flux meter.
n) Surge tester.
o) Induction heater for heating bearing.
p) Grease gun.
q) Puller of various types for removal of bearing and impeller

8.0 Application to the Class of Locomotives:

Oil Cooling Blower (OCB fitted in 3-phase locomotives viz. WAP5, WAP7 and WAG9/WAG9H.

9.0 Agency of Implementation:

All Electric Loco Sheds holding 3-phase Electric Locomotives and POH shops carrying out POH of 3-phase Electric Locomotives.

10.0 Periodicity of Implementation:

Minor schedule inspection (IA/IB/IC), TOH/MOH, IOH and POH schedules and any other unscheduled maintenance as per need.

(A.K.Shukla)
for Director General Std./Elect.

Encl: Nil

Copy to: As per standard Mailing List No.EL-M-4.2.3-19(latest revision)

15/03/18
(A.K.Shukla)
for Director General Std./Elect.

Encl: Nil

ANNEXURE

PARAMETERS TO BE RECORDED DURING OCB OVERHAULING

SL NO.	PARAMETER	RECOMMENDED VALUE	OBSERVATION
1)	Stator IR value	Above 5 mega Ohm	
2)	Surge test on 5kV	Good Wave form	
3)	Condition of lugs & terminal block	Visual Examination	
4)	Condition of end shields & grease cups	Visual Examination	
5)	No load voltages & current (with out impeller)	Record the current	
6)	Voltages & current (with impeller)	Current drawn should not exceed rated current	
7)	Starting time to achieve full speed with impeller	Not more than 6 sec	
8)	SPM reading	GREEN ZONE	
9)	Impeller sl no & make & record	Record	
10)	DPT test on impeller		