Government of India
Ministry of Railways
Research, Designs & Standards Organisation
Manak Nagar, Lucknow - 226 011

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MODIFICATION SHEET NO. RDSO/WAG 5/15 (New No. MS 228)

IMPROVEMENT MEASURES FOR SMOOTHING REACTORS TYPE: SL - 42 AND SL - 30

1. OBJECT

1.1 Failure on smoothing reactors reported by Rlys are normally of the following two types which account for more than 80% of the total incidences on SL.

(a) Short between the core and the inner coil, usually at the corners and

(b) Short between the support channels and the inner or outer coils by tracking across the end pressure blocks.

1.2 Failures on account of the following are also reported but they are not in appreciable number.

(i) Over heating/flashing at terminal clamps:

(ii) Short between connecting cables and terminals:

(iii) Inter turn short between turns of either inner or outer coils.

(iv) Short between bus bar terminals and cleat fixing bolts and:

(v) Busbar breakage.

1.3 The reasons for these failures have been analysed and certain improvement measures idetified which needs to be implemented at the manufacturing stage to over come the above problems on future build smoothing reactors. These improvement measures along with the procedure for their implementation are enclosed as Annexure 1.

1.4 In order to ensure improved reliability of the in service smoothing reactors, following course of action is needed.

(i) Change the ground insulation at the ends of the coils on the existing SL-42 as per details enclosed as Annexure II.

(ii) Check the gap between the inner coil and core as per maintenance instruction enclosed as Annexure III.

2. **WORK TO BE CARRIED OUT**

As per details given in Annexure I.II & III.

3. **APPLICATION TO CLASS OF LOCOMOTIVES**

All 25 KV a. c. electric locomotives provided with either SL-42 or SL-30

4. **MATERIAL REQUIRED**

As per details given in Annexure I,II and III.

5. **MATERIAL RENDERED SURPLUS**

As per details given in Annexure I,II and III

6. **AGENCIES OF IMPLEMENTATION**

(i) Improvement measures as per Annexure I to be implemented by CLW and rewinding shops.

(ii) Changing of ground insulation and checking and measuring gap between core and coil as per Annexure II and III are to be carried out by POH/rewinding shops.

7. **DISTRIBUTION**

All CEEs and CLW.

Encl: Two Drgs.SKETCH No.1 & SKETCH No.2.
Total pages 8

(R. N. LAL)
for Director General/Elect.

ANNEXURE 1

IMPROVEMENT MEASURES FOR SMOOTHING REACTORS

1. Ensure proper control on dimensions and tooling to achieve specified air gap at corners between inner coil and core, failing which increase in the inner coil dimensions.

1.1 WORK TO BE CARRIED OUT:

(i) Examine and if necessary, rectify all the coil forming and pressing tools;

(ii) Inspection all formed coils, fully insulated and pressed coils and insulated cores to ensure that their dimensions are within stipulated limits.

(iii) Check and ensure that cores are easily inserted on to the inner coils leaving a clear gap of at least 2 mm at the corners. In case the above gap at the corners can not be achieved, the dimensions of the inner coil should be increased as under:

	Existing dimensions (mm)	Proposed dimensions (mm)
Inner dimension of inner coil	267 $\pm$0/1	277$\pm$0/1
Gap between insulated core & inner coil	Max.4 Min 2.5	Max.9 Min7.5
Gap between inner coil & outer coil	Max.23 Min.21	Max.18 Min. 16

2. Use glass epoxy material conforming to IS:10192 Gr. EPL for insulating boards, support blocks and sleeves for bots fixing cleats in place of the laminated boards conforming to IS:2038 grade `F`

2.1 <u>WORK TO BE CARRIED OUT:</u>

Use the insulating boards support blocks and sleeves of the material conforming to IS:10192 Gr. EPL after drying it out in an oven at 110 deg.C for a period of 24 hours and then giving a coat of anti tracking varnish.

3. APPLICATIOON OF ANTITRACKING VARNISH ON THE COILS:

3.1 WORK TO BE CARRIED OUT:

Give two coats of antitracking varnish on the coils.

4. PROVISION OF CLEATS ON THE CABLES TO PREVENT THEIR RUBBING:

There exists a difference in levels of the twoterminals on each side and the cables connected to the terminals at the lower levels passes close to the terminals on the higher level. due to vibration in service, these cables may rub with the terminals of the higher levels and cause failure.

In order to eliminate the possibility of such failure, a cleat made of synthetic resin bonded glss fibre conforming to IS: 10192 Gr. EPL should be provided as per details in sketch No.1

4.2 WORK TO BE CARRIED OUT

(i) Cut two cleats to size as per details in sketch No.1

(ii) The cut pieces maybe dried in oven at 110 deg. C for a period of 24 hours and then coated with anti tracking varnish.

(iii) Fix these cleats on the smoothing reactor frame.

5. RADIUS OF INNER FACES OF BUS BAR BENDS TO BE MAINTAINED AT LEAST THREE TIMES OF TEEIR THICKNESS:

Breakage of bus bars and also coil ends where they are bent at right angles for connection to the terminals are usually due to the cracks developed in service. These cracks normally start at the bends if the inner radius of the bend is less then three times the radius of the bus-bar.

5.1 WORK TO BE CARRIED OUT:

Check and ensure that this inner radius of bend is not less than three times the thickness of the busbar.

6. PROPER FIXING OF CABLE LEADS ON THE CLAMPS:

6.1 WORK TO BE CARRIED OUT:

Check and ensure that a clear gap is available between the faces of parallel clamps after fixing and tighteing of the cable leads. If there is contact at any point, replace or machine the clamp to proper size.

7. PROCEDURE FOR ASSEMBLY OF INNER COIL ON THE CORE:

7.1 WORK TO BE CARRIED OUT:

As per details given in Annexure-III.

ANNEXURE II

MODIFICATION SHEET

IMPROVED INSULATING MATERIALS FOR SMOOTHINGREACTORS TYPE SL 42

1. INTRODUCTION

1.1 The ground insulation at the ends of the core of smoothing reactor type SL 42 is in the form of specially shaped boards and blocks machined out of laminated boards conforming to IS: 2038 grade 'F' Sleeves provided on the bolts through bus bar clamps are also of the same material. This material is hygroscopic in nature and failures due to tracking have been observed.

1.2 In order to over come-failures due to tracking, insulating laminates of highertracking ressitance, lower water absorption and higher dielectric strength as per IS:10192 Gr. EPL (already by CLW on smoothing reactors SL30 being maufactured) is proposed for use on the in service smoothing reactors.

2. WORK TO BE DONE

2.1 Dismantle the smoothing reactor and remove dust from the core, coils and clamping fixtures by blowing compressed air.

2.2 Scrap all the insulating boards and blocks (at the end of the coils and also the sleeves on the bolts through busbar cleats) of material spec IS:2038 Gr.I.

2.3 The corresponding new components conforming to material specification IS:10192 Gr. EPL (component drgs.to be obtained from CLW) to be dried outin an oven at 110 deg. C for a period of 24 hours and then coated with anti tracking varnish.

2.4 Reassemble the core/coils using the new components, check & maintain the gap between the core and the inner coil as per Annexure III.

3. MATERIAL REQUIRED

Insulating boards, blocks and sleeves to IS:10192 Gr. EPL

4. MATERIAL RENDERED SURPLUS

Insulating boards, blocks and sleeves to IS:2038 Gr. 'F'

ANNEXURE-III

SPECIAL MAINTENANCE INSTRUCTIONS
CHECKING AND MAINTENANCE OF GAP BETWEEN CORES AND INNER COILS OF SMOOTHING REACTORS TYPE SL-42/30

1. INTRODUCTION

SL-42 and SL-30 if manufactured and assembled correctly will have a gap of 2.5 mm at the corners and 1 mm at the centres of flat portions of the core between the cores and the inner coils. some cases have been reported where ther was physical contach between the cores and the inner coils mostly at the corners. Due to expansion/contraction of the coil and also due to vibration the core coil insulation gets damaged and eventually there is an earth fault.

2. INSTRUCTIONS

2.1 Check the presence of a gap at each corner of the core after blowing with compressed air.

2.2 In case of absence of the air gap, dismantle the smoothing reactor and check whether the dimensions of the core and inner coilare within specified limits. In case they are not within specified limits, they are to be rejected.

2.3 In case they are within limits, place the coil on a suitable mandrel and check for any axial twist in the coil. if axial twist is noticed, remove the coil from the mandrel and insert new inter-turn insulation. Press the coil in the fixture to ensure squareness and freedom from axial twist. (The fixture drgs. to be obtained from CLW).

2.4 Re-insulate the core.

2.5 Correctly centre the coil on the core using curved steel wedges as shown in sketch No.2 at the corners. Remove these steel wedges after inserting flat insulating wedges in the flat portion of the core.

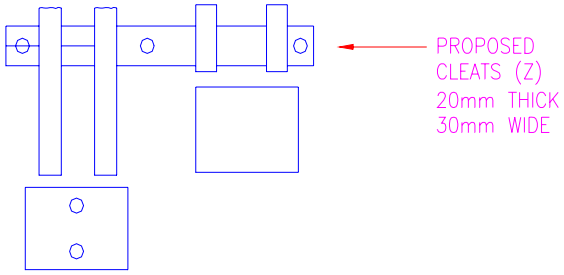
2.6 Measure and increase the gap.

Note: The steel wedges can be manufactured by machining a hollow cylinder with tapered outer face and cutting it into 4 parts. All sharp edges and corners should be grounded off and surfaces polished to facilitate insertion and with drawl.

3. Periodicity of check:

During POH of the locomotive.

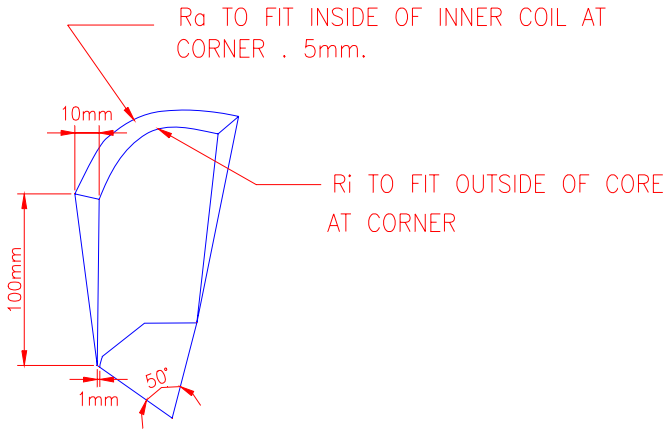
THREE BOLTS (15mm DIA & 80 LONG)
WITH NUTS. SPRINGWASHERS



CLEATS FOR CABLE SUPPORT

SKETCH No.1

WAG5/15



CURVED STEEL WEDGES

SKETCH NO. 2