GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
(RAILWAY BOARD)

INDIAN RAILWAY
STANDARD SPECIFICATION
FOR PRE-TENSIONED PRESTRESSED CONCRETE SLEEPERS
FOR
BROAD GAUGE AND METRE GAUGE

SERIAL NO. T-39-85
(FOURTH REVISION – May’ 2011)

RESEARCH DESIGNS AND STANDARDS ORGANISATION
LUCKNOW – 226011
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0. **FOREWORD**

0.1 This standard specification (First revision) was adopted by the Indian Railways in May 1985 after the draft was finalized by the Sub-committee of Track Standards Committee.

0.2 The last revision (Third Revision) was adopted by the Indian Railways in May 1996.

0.3 The present revision (Fourth Revision) has been taken up with a view to incorporate modifications found necessary as a result of use of the specification both by the manufacturer and user.

0.4 The significant modifications incorporated in this revision are as follows:

0.4.1 The specification has been revised to permit use of both M55 & M60 grade of concrete and relevant values for M60 grade concrete have been incorporated.

0.4.2 Additional relevant tests on aggregates have been added.

0.4.3 All Correction slips (upto Correction slip no. 4) issued till date have been incorporated.

0.4.4 Clauses regarding concrete and method of casting and testing of cubes for mix design are revised.

0.4.5 Guarantee Clause has been revised.

0.4.6 Clause on ‘Re-test’ has been modified.

0.4.7 Flow chart of Static Bending Test procedure has been revised and is attached as Annexure-IV.

0.4.8 List of specifications needed for daily use and referred to in this specification has been updated in Annexure-VI.
1. **SCOPE**

1.0 This specification covers the manufacture and supply of pretensioned pre-stressed concrete sleepers for broad gauge and meter gauge.

2. **GENERAL**

2.1 The manufacture of sleepers shall be to the Purchaser’s drawing or to drawings approved by the Purchaser and the production shall commence with the prior approval of the Inspecting Officer. Any subsequent change in material or production technique shall require prior approval of Inspecting Officer.

2.2 The reference to IRS specifications and drawings in this specification relates to the latest version of these standards as amended from time to time. The provisions of this specification shall override the corresponding provisions of IS: Specifications. Any special requirements given in the drawings of the sleepers will override the relevant provisions of the specification. Annexure-I shows the list of specifications required for manufacturing of sleepers.

3. **MATERIALS**

3.1 **High Tensile Steel**

3.1.1 High tensile steel in the form of plain wire or strand shall conform to IS: 1785 Part-I and IS: 6006 respectively. It shall be procured only from BIS approved manufacturers who shall furnish the proof of approval by BIS with the first consignment during the currency of approval and for each fresh approval. Each consignment of high tensile steel must be accompanied by a test certificate showing the serial no. of coils. Each coil shall carry a tag in accordance with the IS specifications mentioned above. In addition to the normal tests stipulated in the IS specifications for every consignment, results of “relaxation test” shall also be furnished once in six months. In case of change of source the first test certificate shall include “relaxation test” results also.

The steel shall be used for production only after ascertaining that it meets the provisions of relevant specifications.

3.1.2 Whenever directed by the Inspecting Officer, the manufacturer shall get the steel in stock tested at his own cost.
3.2 **Cement**

3.2.1 Cement shall conform to Indian Railway Specification No. T-40.

3.2.2 Each consignment of cement shall be covered by a test certificate. Each consignment shall be stocked separately, tested in the laboratory of the plant immediately for all relevant properties and shall be clearly identified. Cement more than 3 months old, if free from lumps, shall be tested for physical properties by an independent government approved laboratory or as directed by the Inspecting Officer and may be used after his approval.

3.2.2.1 The Inspecting Officer has the right to have the cement in stock tested at any time at the cost of manufacturer.

3.2.2.2 In case the source of supply of cement is changed, the mix design shall be reviewed and modified, if necessary.

3.2.3 The cement content of the mix shall not be less than 350 kg/cu.m. and not more than 480 kg/cu.m. for M55 & 500 kg/cu.m. for M60.

3.2.4 Super Plasticizer conforming to IS: 9103 may be used with the prior approval of RDSO. At this stage the revised concrete mix design shall also be submitted to RDSO for approval. However, following shall be observed:

3.2.4.1 Use of any admixture containing chloride in any form is prohibited.
3.2.4.2 Generally one admixture at a time should be used.
3.2.4.3 Shelf life should be monitored continuously.
3.2.4.4 All containers should be correctly leveled. Reliable liquid dispenser for liquid admixtures should be used and calibrated.

3.3 **Aggregates**

3.3.1 The aggregates shall conform to IS: 383 and shall, before use, be got tested through an approved testing institute, and results submitted in accordance with Appendix ‘A’ of IS: 383 to the Inspecting Officer for approval. These tests shall be got done at the manufacturer’s cost once in a year or at the time of approval/review of mix design or as desired by inspecting official. The aggregates shall have 30% abrasion and 30% impact value suitable for wearing surfaces when tested in accordance with IS:2386 (Part-IV). The flakiness index and elongation index shall not exceed 30% when tested in accordance with IS: 2386 (Part-I).
3.3.2 Coarse and fine aggregates shall pass sodium or magnesium sulphate accelerated soundness test specified in IS: 2386 (part V)-1963.

3.3.3 Aggregates shall not contain any harmful material such as pyrites, coal, lignite, mica shale or similar laminated material clay, alkali soft fragments, sea shells and organic impurities in such quality as to affect the strength for reinforced concrete shall not contain any material liable to attack steel reinforcement. Maximum limit of deleterious material in aggregates should conform IS: 383 when tested in accordance with IS: 2386-1963.

3.3.4 Aggregates which are reactive with alkalies of cement are harmful as cracking of concrete may take place. Potential reactivity of aggregates shall be tested as per IS:2386 (part VII)-1963.

3.3.5 Coarse aggregates shall be crushed stone, angular in shape and gravel shall not be used.

3.3.6 Different sizes of aggregates shall be stacked in different storage bins or stock piles on proper hard floor surface. The bins near batching plant must be located under a covered shed to avoid any chance of raw material getting wet due to rains.

3.4 Water

3.4.1 Water to be used in making and for curing of concrete shall conform to IS: 456. However use of sea water is prohibited.

3.4.2 If water needs any treatment before use, adequate storage of treated water for daily requirement shall be made. Facilities for testing treated water shall be provided in the plant. Treated water shall be tested daily or as directed by the Inspecting Officer.

3.4.3 The total water content per batch shall be regulated with conform with the ratio by weight of free water to cement required for the particular design mix as established by preliminary tests. The total water content of a batch includes:

(a) Absorbed water in the aggregates;
(b) Free water in the aggregates; and
(c) Free water added to the mix.

3.4.3.1 The water to be mixed at the mixer shall be free water content required per batch less the amount of free water in the aggregates, if wet, or plus the amount of water the aggregates will absorb, if dry. Free moisture content shall be determined at least once a day.
3.5 **Concrete**

3.5.1 The concrete shall be of controlled quality with the nominal maximum size of aggregates limited to 20mm. Where wire spacing permits, aggregates upto 25mm may be used. The manufacturer shall get the concrete mix design along with the upper and lower limits of granulometric curves approved by the Inspecting Officer.

3.5.1.1 The granulometric curves shall be plotted on semilog graph once in a week and shall be between the approved limits.

3.5.1.2 Coarse and fine aggregates shall be batched separately.

3.5.2 The concrete shall satisfy the following design parameters:

i) Minimum release strength after steam curing
   - 40 N/sq.mm (For Mix M-55)
   - 40N/sq.mm (For Mix M-60)

ii) 15 days characteristic strength after water curing
   - 55 N/sq.mm (For Mix M-55)
   - 60 N/sq.mm (For Mix M-60)

iii) Percentage of cubes with strength less than the characteristic strength
    - Not more than 2.5%

iv) Co-efficient of variation
    - Less than 7%

3.5.3 At the time of approval/review of mix design, 80 cubes shall be cast, using materials proposed for regular manufacture, in 10 batches of 8 cubes each, 4 for steam curing and 4 for water curing.

3.5.3.1 All the 40 cubes cured according to the proposed steam curing cycle shall attain the specified minimum release strength.

3.5.3.2 The statistical analysis of the compressive strength values of the 40 water cured cubes shall satisfy the design parameters of clause 3.5.2 (ii), (iii) & (iv).

3.6 **SGCI Inserts**

3.6.1 SGCI inserts shall conform to IRS Specification No.T-46-1996 as amended up-to-date and will be procured only from RDSO approved manufacturers. Each consignment of SGCI inserts shall be accompanied by a test certificate from inspecting agency for inspection conducted prior to dispatch of consignment from supplier’s premises.
3.6.2 Whenever directed by the inspecting official, the sleeper manufacturer shall get the SGCI inserts in stock tested at his own cost”.

4. **MANUFACTURE**

4.1 **Moulds**

4.1.1 Moulds shall be of steel with minimum plate thickness of 10 mm in Rail seat area as well as for end plates. For other locations minimum plate thickness is to be 6 to 8 mm. Moulds shall be of rigid construction so as to prevent any in-service distortions. Moulds shall not allow any appreciable leakage of cement mortar in casting. The holes in the end plates shall be accurately drilled for correct placement of prestressing wires.

4.2 **Stretching of wires**

4.2.1 The prestressing wire shall be stretched either individually or collectively by an approved method. The tensioning force shall be as shown on the sleeper drawing. The final force to be adopted, duly considering the losses while stretching shall be approved by the Inspecting Officer. However, the stretching force shall in no case exceed 75% of the minimum specified UTS of the wire. The pre-tensioning force in the wire shall be applied by a tensioning device equipped with automatic load cut off unit along with measuring gauge. The final force shall also be verified by measuring the extension of the wire.

4.3 **Mixing and consolidation of concrete**

4.3.1 Manufacture of sleepers shall be done under a shed.

4.3.2 Batching of different ingredients shall be done by weight only. A modern, mechanized, or automatic weigh batcher shall be used for weighing aggregates and cement. The weigh batcher shall have an accuracy of +/- 3%.

4.3.3 Modern high speed mixer, pan, turbine or any other suitable type, approved by the Inspecting Officer shall be used for mixing concrete. Concreting shall commence within 2 hours of stressing of wires, failing which the HTS wires shall be checked and re-tensioned, if necessary.

4.3.4 Concrete shall be thoroughly mixed and consolidated by means of vibrators of at least 9000 revolutions/minute. The vibrator should normally be fixed at the bottom of the mould, at least at two
different locations for a sleeper. Any other vibration system should have prior approval of RDSO.

4.3.5 Freshly cast sleepers shall be protected during the first stage of hardening from adverse weather conditions.

4.4 **De-tensioning of wires**

4.4.1 Anchoring system shall provide a device for gradual de-tensioning of the wires. Back pulling of wires for releasing any wedge shall be strictly prohibited. De-tensioning of wires shall be undertaken only after the concrete has attained a compressive strength of 40 N/sq.mm.

4.5 **Curing**

4.5.1 Initial curing of concrete sleeper shall be done by steam at atmospheric pressure till the concrete attains a compressive strength of 40 N/sq.mm. Pre-steaming period shall not be less than the initial setting time of cement. Steam curing cycle shall have the prior approval of the Inspecting Officer.

4.5.2 After de-tensioning, the sleepers shall be cured for a further period of not less than 14 days (as per mix design) by submerging in water. Water used for steam curing should conform to the quality prescribed for water to be used for concrete mix.

4.5.3 Each steam chamber in stress bench method or production line in long line method shall be attached with a separate digital thermal sensor, temperature shall be recorded continuously and record shall be maintained.

4.6 **Supervision**

4.6.1 Suitably qualified persons as per Schedule of Technical Requirement shall be engaged by the manufacturer for supervising the following items at the works:

i) Placing and stressing of prestressing wire;

ii) Batching, mixing, placement and compaction of concrete. Checking of the steam curing arrangement for its adequacy.

iii) De-moulding of sleepers, water curing, stacking/ loading etc.

iv) Inserts shall be checked by suitable jigs before use by the manufacturer.
v) Testing of cement, cement mortar cubes, concrete cubes, concrete beams;

vi) Calibration of testing and measuring equipment and different gauges;

vii) Checking electrical resistance of sleepers.

4.6.2 Supervisor so engaged shall maintain records as directed by the Inspecting Officer and shall present them for scrutiny when demanded.

i) A site register shall be maintained in which inspecting officer shall record observations against which compliance will be recorded by the supervisor.

ii) Suitable records as per Schedule of Technical Requirement shall be maintained in such a manner that it can be correlated at a later date to the sleeper laid in field.

4.7 Finish

4.7.1 All sleepers shall be free from surface defects such as water retaining pockets, air holes or honey combed formations. The underside of the sleeper coming in contact with ballast shall be left rough but the unevenness shall not exceed 5mm. The ends of the prestressing wires shall be cut close to the surface of the sleeper in such a way that there is minimum damage to end plate and the wire in no case shall project more than 3 mm from the concrete surface. Two coats of suitable ISI mark anti corrosive paint, approved by Inspecting Officer, shall be applied at the ends of the sleepers in the following manner:

i) First coat of paint, sufficient thick to form impervious film of paint covering full surface of either ends of a sleeper shall be applied just after de-moulding from sleepers mould, and

ii) Second coat after taking out the sleepers from submerged water curing tank in the above manner, ensuring that surface to be painted is completely dry and clean of dirt etc.

4.7.2 No touching up or finishing by cement mortar etc. shall be permitted on concrete sleeper, after it is de-moulded, except as provided in clause 4.7.3.
4.7.3 Such sleepers which are not found acceptable due to surface defects, shall be accepted up to a ceiling of 1% of the supplies made any time during the currency of the contract provided such sleepers are adequately treated with epoxy compounds to the satisfaction of the Inspecting Officer. These sleepers shall be marked as shown in Drawing No.RDSO/T-2466 before dispatch. The rectified sleepers shall be paid for at the rates fixed by the Purchaser.

4.8 **Stacking**

4.8.1 After the sleepers have been cured in terms of clause 4.5.2 and checked both dimensionally and visually they shall be stacked at convenient place in lots. The stacking of sleepers shall be done on leveled and consolidated ground, one over another up to 25 layers. Each layer shall be separated by wooden/concrete battens of 50mm x 50mm size of suitable lengths to avoid any damage.

4.9 **Lots**

4.9.1 All sleepers cast in one shift shall form one lot.

5. **INSPECTION AND TESTING**

5.1 The manufacturer shall supply at his expense, all the sleepers required for tests and retests, samples of materials, labour, machine, tools, gauges, apparatus, forms of test reports etc. and any other item which may be necessary or required by the Inspecting Officer for carrying out any or all of the checks and tests mentioned in these specifications and shall render all reasonable assistance in conducting such checks and tests. All measuring and testing appliances shall be got checked and calibrated according to the schedule given in Annexure-I, through government approved agency or as directed by the Inspecting Officer. The calibration certificate shall be furnished to the Inspecting Officer. The cost of all such checks and calibrations shall be borne by the manufacturer.

5.2 Inspecting Officer and the Purchaser shall have free access at all reasonable times to the works in which the sleepers are manufactured. They shall be at liberty to inspect the manufacture of sleepers at any stage and to reject any material supplies not conforming to the terms of the specifications and to reject sleepers not manufactured according to approved manufacturing process. They shall be provided with necessary assistance for inspection by the manufacturer.
5.3 **Checks and tests**

5.3.1 In addition to the control checks exercised on the materials and manufacturing process specified above, the concrete and the finished sleepers shall be subjected to regular checks and tests, after 14 days submerged water curing, as detailed in clause 5.3.1.1.

5.3.1.1 **Visual and Dimensional Check**

Every sleeper shall be visually inspected for surface finish. No sleeper shall have surface defects except as provided in para 4.7.3.

Sleeper dimensions to be checked are listed below:

(i) Critical dimensions are toe gap, location of inserts, distance between inserts at rail seat, distance between outer most inserts and slope at rail seat.

(ii) General dimensions are depth of sleeper at centre, rail seat and end of sleeper; width of sleeper at top and bottom; length of sleeper, camber and wind at rail seat and position of high tensile steel wires at ends.

The sketch at Annexure-II shows the dimension checking arrangement. The dimensions shown on the sleeper drawing, shall be checked by means of approved gauges, procured by the manufacturer. (Annexure II/A shows the gauge for measuring toe gap of rail seat).

(iii) Scale of check

   a) Prior to stabilization of production technique* :- Scale of check per lot for critical dimension is 100% (hundred percent) and for general dimensions 10% (ten percent) of sleepers produced.

   b) After stabilization of production technique* :- Scale of check per lot for critical dimensions is 10% (ten percent) and for general dimension 1% (one percent), but the dimensions between outer inserts shall be checked 100%.

   c) Notwithstanding the provisions in (a) & (b) above the Inspecting Officer may decide to check the dimensions at scale higher than mentioned in para (a) & (b) above.
Acceptance of minimum 10000 sleepers and achieving rejection rate less than 2% consistently, whichever is later, shall be one of the major criteria for deciding the stabilization of the manufacturing technique.

5.3.2 **Casting of cubes**

5.3.2.1 15 cm size cubes shall be cast on a vibrating table conforming to IS:2514 (1963) from random samples spread over the entire lot, out of concrete used for casting sleepers for testing prior to transfer of prestress and 15 days.

5.3.3 **Method of testing**

5.3.3.1 The cubes shall be surface dry at the time of testing. The rate of loading shall be about 400 KN/minute.

5.3.4 **Compressive strength of concrete at transfer (release) of prestress**

5.3.4.1 These cubes shall be steam cured along with sleepers in the same manner and tested for transfer of prestress to concrete (at least one cube for every steam chamber/3 for each long line but not less than a total of 3 in any case).

5.3.5 **Test for 15 day compressive strength of concrete**

5.3.5.1 These cubes shall not be steamed but shall be water cured for 14 days after de-moulding. Three cubes per lot shall be tested for 15 days compressive strength of concrete. The minimum strength will represent the strength of concrete for that lot. In case strength of concrete is less than 48 N/mm$^2$ for M55 Grade of concrete and 55/mm$^2$ N for M60 Grade of concrete, the lot shall be rejected and the mix design shall be reviewed.

5.3.6 **Test for 15 day modulus of rupture of concrete**

5.3.6.1 The test for 15 day modulus of rupture of concrete shall be carried out on concrete beams of 10 x 10 x 50 cm size as specified in IS:516. One specimen shall be tested daily prior to the stabilization of production technique, once a week thereafter. If any value falls below 5 N/sq.mm for M55 and 6 N/sq.mm for M60, the mix design shall be reviewed.
5.3.7 **Tests for static bending strength of sleepers**

5.3.7.1 **Method of testing**

5.3.7.1.1 The tests shall be conducted in accordance with the arrangement shown in Annexure-III.

5.3.7.1.2 The sleepers shall be loaded gradually (30-40 KN/min) up to the specified load, which will be retained at this level for one minute for observing cracks, if any. For the purpose, a crack is defined as one which is barely visible to the naked eye and is at least 15mm long from the tension edge of the sleeper. However, if crack appears at a load smaller than the specified load, that value shall be recorded.

5.3.7.1.3 In case of ‘Moment of Resistance’ (MR) test, the sleeper shall be deemed to have passed the test if it sustains the loads specified in Annexure-III without cracking. Sleepers shall be subjected to loading till the appearance of first cracks.

5.3.7.1.4 In case of ‘Moment of failure’ (MF) test, the sleeper shall be deemed to have passed the test if it is able to take load beyond the specified test load.

5.3.7.2 **Acceptance tests**

5.3.7.2.1 **Moment of failure (MF) test (for rail seat bottom)**

Prior to stabilization of production technique, one sleeper for every 250 sleepers manufactured shall be tested. After the production technique gets stabilized the testing scale shall be reduced to one sleeper for every 2500 sleepers produced.

5.3.7.2.2 **Moment of resistance (MR) test (Rail seat bottom, centre top, centre bottom)**

Depending on 15 day cube strength of the lot as mentioned in para 5.3.5. The scale of testing for the lot shall be as follows:

i) 55 N/sq.mm and above for M55 & 60 N/sq.mm and above for M60 – one sleeper per lot

ii) For Mix M-55:- less than 55 N/sq.mm but up to 48 N/sq. mm – two sleepers per lot.

For Mix M-60:- less than 60 N/sq.mm but up to 55 N/sq. mm – two sleepers per lot.
a) Prior to stabilization of production technique: Sleeper to be tested shall be subjected to rail seat bottom, centre top and centre bottom tests.

b) After stabilization of production technique: Sleeper to be tested shall be subjected to rail seat bottom and centre top tests only.

iii) In case, 15 days cube strength of the lot is less than 48 N/sqmm for M55 Grade and 55 N/sqmm for M60 Grade, the lot shall be rejected and no testing for moment of resistance or moment of failure will be conducted.

**NOTE:**

(i) Test procedure has also been shown as a flow chart in Annexure IV.

(ii) Wherever MF test is to be conducted, it shall be performed on the first sleeper selected for testing under clause 5.3.7.2.2.

**5.3.7.3 Acceptance of ‘lots’**

5.3.7.3.1 All sleepers tested in accordance with clause 5.3.7.1 should pass all the acceptance tests provided in clause 5.3.7.2 for the lot to be accepted. The specified values of Load for Centre Top, Centre bottom, Rails Seat cracking and MF test are as under:-

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<th>SLEEPER</th>
<th>CENTER TOP(KN)</th>
<th>CENTER BOTTOM(KN)</th>
<th>RAIL SEAT BOTTOM (KN)</th>
<th>CRACKING</th>
<th>FAILURE</th>
</tr>
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<tr>
<td>BG</td>
<td>60</td>
<td>52.5</td>
<td>230</td>
<td>150</td>
<td>370</td>
</tr>
<tr>
<td>MG</td>
<td>25</td>
<td>40</td>
<td></td>
<td>250</td>
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5.3.7.3.2 If the sleeper fail in any of the tests conducted as per clause 5.3.7.2.2 (i), the lot shall be subjected to ‘retest’ as per clause 5.3.7.4.
5.3.7.4 **RETEST**

5.3.7.4.1 **MR**

For every sleeper failed in acceptance tests as per clause 5.3.7.2.2 (i), two more sleepers from the same lot shall be retested as per clause 5.3.7.2.2.

However, in case of testing of two sleepers as per clause 5.3.7.2.2(ii), if any of the sleepers fail, the lot shall be rejected.

5.3.7.4.2 **MF**

In case of failure of the sleeper in MF test as per clause 5.3.7.2.1, 2 more sleepers from the same lot shall be selected for testing in MF as per clause 5.3.7.2.1 and 5.3.7.2.2 and subjected to all relevant tests. However, if the sleeper has passed MF test and failed in some other test MF test need not be repeated on subsequent sleepers subjected to testing.

5.3.7.4.3 For acceptance of the lot, all the sleepers tested in ‘retest’ must pass all the tests conducted. However, sleepers failing in any static bending tests shall not be paid for.

Also final passing of the lot is a prerequisite condition for payment for any sleeper having passed all the relevant tests conducted on that sleepers.

Sleeper/sleepers tested for rail seat bottom failure test and passes the test, shall be paid by the purchaser, if that particular lot passes all the relevant retests.

**NOTE:**

In case where more than one test value is obtained in retests. The lowest value obtained will be taken as strength of the lot for deciding the result of the lot.

5.3.8 **Measurement of electrical resistance**

5.3.8.1 All sleepers shall be tested as per Annexure-V for electrical resistance for their fitness for use in track circuited area.

5.4 For inspection of concrete sleepers, officials having competency certificate issued after due test by RDSO/Chief Track Engineer only shall be posted.
6. **STAMPING AND MARKING**

6.1 All the sleepers shall have legible permanently inscribed and painted markings on the top as per drawing No.RDSO/T-2466.

6.2 The accepted sleepers shall bear the passing marks of the Inspecting Officer in indelible paints. Sleepers which have been subjected to static bending strength test up to cracking and accepted, shall in addition be marked on the top in indelible paint with the letter ‘T’. MF tested and accepted sleepers shall bear the marking ‘MF’ in paint with yellow bands at ends.

6.3 All sleepers fit for use in track circuited area shall bear the mark ‘FTC’ at the center of the sleeper.

6.4 Rejected sleepers shall be stacked separately by the manufacturer so as to avoid their mixing with the accepted sleepers. Such rejected sleepers shall be marked in the way specified in drawing No.RDSO/T-2466.

6.5 All markings mentioned in para 6.1 to 6.3 shall be done with enamel paint of ISI mark and shall be such as to last for at least 3 years under normal weather conditions. Colour and quality of the paint used shall be got approved by the Inspecting Officer. All such markings shall be done by the manufacturer at his cost.

7. **LOADING AND DESPATCH**

7.1 Only those sleepers which have been passed, properly marked and accepted by the Inspecting Officer shall be loaded for despatch.

7.2 The loading of the passed sleepers in wagon shall be done by the manufacturer at his cost as per the loading arrangement approved by the purchaser. The sleepers shall be properly secured to avoid movement and displacement during transit. The manufacturer shall be responsible to replace, free of cost, all the sleepers which are found damaged in transit on account of defective loading.

8. **GUARANTEE**

8.1 The sleepers shall be guaranteed by the manufacturer for sound manufacture for a period of ten years from the date of manufacturing. If during the guarantee period any sleepers are found to develop defects attributable to bad material, workmanship and/or dimensions requiring withdrawal from service, the cost of sleepers and their replacement shall be borne by the manufacturer. The defective sleepers withdrawn from service can be taken over at site by the manufacturer for their disposal. The manufacturer shall make good the cost due within 60 days of advice of defects. The decision of the purchaser shall be final and binding in this regard.
ANNEXURE-I

**SCHEDULE FOR CALIBRATION OF VARIOUS GAUGES AND TESTING EQUIPMENTS IN THE CONCRETE SLEEPER PLANT**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Equipment</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15 cm concrete cube testing machine (2000 KN capacity)</td>
<td>Once in 3 months</td>
</tr>
<tr>
<td>2</td>
<td>Cement mortar cube testing machine (500 KN capacity)</td>
<td>Once in 6 months</td>
</tr>
<tr>
<td>3</td>
<td>Sleeper Static Bend Test Machine (500 KN capacity)</td>
<td>Once in 3 months or after testing 250 sleepers, whichever is earlier.</td>
</tr>
<tr>
<td>4</td>
<td>Pre tensioning Jacks (500 KN capacity)</td>
<td>Once a month or after casting 5000 sleepers, whichever is earlier.</td>
</tr>
<tr>
<td>5</td>
<td>Pre-tensioning load cell</td>
<td>-do-</td>
</tr>
<tr>
<td>6</td>
<td>Concrete Beam Testing Machine (100 KN capacity)</td>
<td>Once in 6 months</td>
</tr>
<tr>
<td>7</td>
<td>Aggregate weight batcher</td>
<td>Once every week or after casting 2000 sleepers, whichever is earlier.</td>
</tr>
<tr>
<td>8</td>
<td>Cement weighing equipment</td>
<td>-do-</td>
</tr>
<tr>
<td>9</td>
<td>Water Meter</td>
<td>-do-</td>
</tr>
<tr>
<td>10</td>
<td>Master gauges for checking correctness of dimension measuring gauges</td>
<td>Once in 6 months</td>
</tr>
<tr>
<td>11</td>
<td>Dimension checking gauges</td>
<td>Once every 15 days or after inspecting 5000 sleepers, whichever is earlier.</td>
</tr>
<tr>
<td>12</td>
<td>Proving rings (2000 KN, 500 KN and 100 KN capacity)</td>
<td>Once in 18 months</td>
</tr>
<tr>
<td>13</td>
<td>Weights &amp; Measures</td>
<td>Once in two years by Weights &amp; Measures Department</td>
</tr>
<tr>
<td>14</td>
<td>Tachometer</td>
<td>Once a year</td>
</tr>
</tbody>
</table>
Note:

1. The items referred at S.No.1 to 6 above should be calibrated by proving rings in the sleeper plant itself.

2. The items referred at S.No.7 & 8 should be calibrated by dead weights and item at S.No.9 by measuring cans which should be available in the plant.

3. The proving rings should be got calibrated from a reputed organization like the IITs, NCCBM or NPL etc.

4. The record of calibration of all the above equipments should be maintained in a manner that previous records can be easily connected.

5. The calibration can be done more frequently at the discretion of the Inspecting Official.
DIMENSIONS CHECKING ON PSC SLEEPER

Convex or concave camber in any direction on rail seat shall not exceed 0.3mm.

Rail seat slope 1 in 20±0.25.

Length

Elevation

Distance between outer most inserts

Plan

Distance between inserts at rail seat.

Gauging points for measuring inclination and wind at rail seats. Wind shall not exceed 1.5mm on width of 120mm.

Position of H2S wires as per respective drawing.

At centre, rail seat and end of sleepers as per drawing.

Top width

Length

Bottom width

Heel

Toe gap to be measured with gauge to ISDG: No. RIS0/T-4154.

Not to Scale
**TABLE**

<table>
<thead>
<tr>
<th>Insert to Drg. No.</th>
<th>Dimensions mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>RDG017-181</td>
<td>7</td>
</tr>
<tr>
<td>RDG017-148</td>
<td>9.5</td>
</tr>
<tr>
<td>RDG017-247</td>
<td>17</td>
</tr>
<tr>
<td>RDG017-249</td>
<td>27.5</td>
</tr>
<tr>
<td>RDG017-297</td>
<td>5R</td>
</tr>
<tr>
<td>RDG017-309</td>
<td>130</td>
</tr>
</tbody>
</table>

1. **All dimensions are in millimetres.**
2. **Step gauge shall be used to measure toe gap of 8 ± 1 at rail seat.**
3. **Last alteration number shall be checked before placing orders.**

**NOTE**

- Dimensions: 50 x 35
- Elevation: 10 mm thick plate
- Weld of suitable size or screwed

---

**Description:**

- **SIDE ELEVATION:**
  - 8 mm M.S. rod
  - 20 mm dia. P.T.
  - 75 mm long handle

- **PLAN:**
  - Weld of suitable size and or screwed
  - 20 mm dia. P.T.
  - 10 mm thick plate

---

**Annexure – IIA (Contd.)**
ANNEXURE-III

TESTING ARRANGEMENT FOR STATIC BENDING STRENGTH TEST FOR PRESTRESSED MONOBLOCK CONCRETE SLEEPERS FOR B.G. & M.G.

CENTER TOP

CENTER BOTTOM

RAIL SEAT BOTTOM

RUBBER PACKING OF SUITABLE SIZE

ROUND SUPPORTS OF 38 mm DI:

M.S. PLATE WITH SLOPE OVER 6.00 mm
THICK RUBBER SOLE PLATE

TABLE-1

<table>
<thead>
<tr>
<th>DIMENSION</th>
<th>52 Kg.(BG)</th>
<th>60 Kg.(BG)</th>
<th>90R(MG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1195</td>
<td>1201</td>
<td>520</td>
</tr>
<tr>
<td>B</td>
<td>1755</td>
<td>1761</td>
<td>1080</td>
</tr>
</tbody>
</table>

TEST LOAD FOR ACCEPTANCE (‘P’ IN MM)

TABLE-2

<table>
<thead>
<tr>
<th>CENTER TOP</th>
<th>CENTER BOTTOM</th>
<th>Rail Seat - Bottom</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cracking</td>
<td>Failure</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>BG</td>
<td>60.00</td>
<td>52.50</td>
</tr>
<tr>
<td>M.G.</td>
<td>25.00</td>
<td>40.00</td>
</tr>
</tbody>
</table>

NOTE: THE VALUES MENTIONED IN ABOVE TESTING ARRANGEMENT, TABLE-1 & TABLE-2 ARE FOR DRAWING NO. RDSO/T-2495 & 2496 ONLY FOR OTHER DROS, CORRESPONDING DRAWING SHALL BE REFERRED.
NOTE:

1. All dimensions are in millimeters.

2. The load ‘P’ will be applied at centre line of Rail Seat through pressure distributing M.S. Plate with 1 in 20 slope and size 130X25mm for 52kg rail and 145x25mm for 60kg rail, covering the full width of sleeper.

3. One rail seat bottom shall be tested at a time. It shall be ensured that the other end is not restrained in upward direction. The rate of loading is 30-40KN per minute.

4. Cracks shall not appear up to the load mentioned in column 2, 3 & 4 of table II when retained for one minute.

5. A coat of lime wash shall be applied on the sleeper surface before testing.
FLOW CHART FOR TESTING OF SLEEPER

A

STATIC BENDING TEST

B

MR

BEFORE STABILISATION
OF PRODUCTION

RAIL SEAT, CT, CB

ONE SHIFT
PRODUCTION

15 DAYS CONCRETE STRENGTH 'X'
N/mm²

X ≥ 55 (FOR M-55 GRADE)
X ≥ 60 (FOR M-60 GRADE)

FAILS

T-1

RT-2

ANY FAILS

BOTH PASS

ACCEPT LOT

REJECT LOT

MF

AFTER STABILISATION
OF PRODUCTION

RAIL SEAT, CT

T-1

PASSES

FAILS

T-2

BOTH PASS

ANY FAILS

BOTH PASS

ACCEPT LOT

REJECT LOT

BEFORE STABILISATION
OF PRODUCTION

EVERY 250 SLEEPERS

AFTER STABILISATION
OF PRODUCTION

EVERY 5000 SLEEPERS

T-1

PASSES

FAILS

RT-2

BOTH PASS

ANY FAILS

BOTH PASS

ACCEPT LOT

REJECT LOT
NOTATIONS & EXPLAINATORY NOTES:

MR: MOMENT OF RESISTANCE TEST:
- RAIL SEAT BOTTOM, CENTRE TOP & CENTRE BOTTOM (PRIOR TO STABILISATION)
- RAIL SEAT BOTTOM & CENTRE TOP (AFTER STABILIZATION)

MF: MOMENT OF FAILURE TEST FOR RAIL SEAT BOTTOM

TEST/RETEST SLEEPER FROM THE SAME LOT

NUMBER OF SLEEPERS TO BE TESTED

PASSES : SLEEPER PASSES RELEVANT TEST SUCCESSFULLY
FAILS  : SLEEPER FAILS IN ANY OF THE RELEVANT TEST

NOTE  : (1) WHEN DUE, MF TEST SHALL BE CONDUCTED ON THE FIRST SLEEPER SELECTED FOR TESTING UNDER MR

(2) WHENEVER MF IS DONE, PASSING THIS TEST IS A PREREQUISITE FOR ACCEPTANCE OF THAT LOT UNDER ‘A’ OF FLOW CHART.

(3) IF THE FIRST SLEEPER HAS PASSED MF TEST BUT FAILED IN ANY OTHER TEST, MF TEST NEED NOT BE REPEATED ON SUBSEQUENT SLEEPERS SUBJECTED TO RE-TESTING.
PROCEDURE FOR CHECKING FITNESS OF CONCRETE SLEEPERS ON TRACK CIRCUITED STRENGTH (AT THE TIME OF INSPECTION IN THE CONCRETE SLEEPER MANUFACTURER’S PREMISES)

1. All the sleepers shall be tested.

2. The sleeper shall be checked for electrical resistance at 230 volts AC supply. The circuitry to be followed will be shown in sketch at Annexure-V (Contd.).

3. The 230 volts AC supply will be passed through a not less than 300 W test lamp in series with the pairs of inserts being tested. For the sake of comparison, another comparator bulb of the same wattage directly connected to the 230 volts AC supply will be fitted along side.

4. Since the testing is being done at a higher voltage, removal of the rust layer by grinding shall not be necessary.

5. Resistance will be checked against 2 rail seats.

6. If the test lamp emits light dimmer than the comparator lamp in the sleeper, the sleeper shall be accepted and marked ‘FTC’ (Fit for Track circuit). If it emits light with the same brightness as the comparator lamp, the sleeper will be rejected and marked ‘NFTC’ (Not fit for track circuit). In case the test lamp does not emit light at all, it indicates that the circuitry is defective and should be rechecked.

7. In the event of doubts regarding comparison of brightness, such sleepers will not be marked. They will be retested with 1.5 V Avometer and marked for fitness, if found fit with 200 ohms resistance.

8. The ‘NFTC’ marked sleepers should be stacked separately. The FTC/NFTC marking shall be done on top of sleepers in middle portion, as shown on Drawing No.RDSO/T-2466.

9. As the testing is done at higher voltage, all precautions such as use of gloves in the hands, insulated boots and insulated chairs for operator and other necessary precautions shall be taken for the safety purpose.
ELECTRICAL CIRCUIT FOR TESTING CONCRETE SLEEPER IN PLANT

230V a - c SUPPLY

300W BULB "COMPARATOR"

300W BULB "TEST LAMP"

CONNECTORS WITH TWO PRONGS

CONNECTORS WITH TWO PRONGS

NOTE:

1. THE CONNECTORS SHALL HAVE TWO PRONGS EACH SO THAT BOTH INSERTS AT A RAILSEAT ARE TESTED AT A TIME.
2. NECESSARY PRECAUTIONS FOR WORKERS SAFETY SHALL BE TAKEN.
LIST OF IRS & BIS CODES REFERRED TO
(Up-to-date version of Codes/Specifications with latest
amendments/correction slips shall be followed)

<table>
<thead>
<tr>
<th>S.No.</th>
<th>IRS/BIS No. &amp; Year</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IRS/T-40 1985</td>
<td>Special grade cement for use in concrete sleepers</td>
</tr>
<tr>
<td>2</td>
<td>IS:383 1999</td>
<td>Specification for coarse and fine aggregates from natural sources for concrete (Second Revision)</td>
</tr>
<tr>
<td>3</td>
<td>IS:456 2000</td>
<td>Code of practice for plain and reinforced concrete (Fourth Revision)</td>
</tr>
<tr>
<td>4</td>
<td>IS:516 1959</td>
<td>Method of test for strength of concrete with amendment No.2</td>
</tr>
<tr>
<td>5</td>
<td>IS: 650 1991</td>
<td>Specification for standard sand for testing of cement (First Revision with amendment No.3)</td>
</tr>
<tr>
<td>6</td>
<td>IS:1785 1983 Pt.I</td>
<td>Specification for plain hard drawn steel wire for prestressed concrete Part.I Cold drawn stress relieved wire (Second Revision with amendment No.1)</td>
</tr>
<tr>
<td>7</td>
<td>IS: 2386 1963 Pt. I – VIII</td>
<td>Methods of tests for aggregate for concrete</td>
</tr>
<tr>
<td>8</td>
<td>IS: 2430 1996</td>
<td>Methods for sampling of aggregate for concrete</td>
</tr>
<tr>
<td>9</td>
<td>IS:2514 1963</td>
<td>Specification for concrete vibrating table</td>
</tr>
<tr>
<td>10</td>
<td>IS:3536 1999</td>
<td>Methods of sampling hydraulic cements (First Revision)</td>
</tr>
<tr>
<td>11</td>
<td>IS:4031 1999 Pt.I-XVI</td>
<td>Methods of physical tests for hydraulic cement</td>
</tr>
<tr>
<td>i)</td>
<td>Part II 1999</td>
<td>Determination of fineness by specific surface by blaine air permeability method (First Revision)</td>
</tr>
<tr>
<td>ii)</td>
<td>Part III 1988</td>
<td>Determination of soundness (First Revision)</td>
</tr>
<tr>
<td>iii)</td>
<td>Part IV 1988</td>
<td>Determination of consistency of standard cement paste (First Revision)</td>
</tr>
<tr>
<td>iv)</td>
<td>Part V 1988</td>
<td>Determination of initial and final setting times (First Revision)</td>
</tr>
<tr>
<td>v)</td>
<td>Part VI 1988</td>
<td>Determination of compressive strength of hydraulic cement (other than masonry cement) (First Revision)</td>
</tr>
<tr>
<td>vi)</td>
<td>Part XIV 1989</td>
<td>Determination of false set</td>
</tr>
<tr>
<td>12.</td>
<td>IS:4032 1985</td>
<td>Methods of chemical analysis of hydraulic cement (First Revision)</td>
</tr>
<tr>
<td>13.</td>
<td>IS:6006 1983</td>
<td>Specification for uncoated stress relieved strand for prestressed concrete (First Revision) with amendment No.2</td>
</tr>
<tr>
<td>16.</td>
<td>IRST-45-1996</td>
<td>Specification for Pretensioned Prestressed Concrete Sleepers for Turnouts of BG &amp; MG</td>
</tr>
<tr>
<td>17.</td>
<td>STR</td>
<td>Schedule of Technical Requirement as applicable from time to time.</td>
</tr>
</tbody>
</table>