

**GOVERNMENT OF INDIA  
MINISTRY OF RAILWAYS  
(RAILWAY BOARD)**

**INDIAN RAILWAY  
STANDARD SPECIFICATION  
FOR  
ELASTIC RAIL CLIPS**

**S.No.T-31-~~2021~~ 2025  
(~~Fifth-Sixth~~ Revision)**

**RESEARCH DESIGNS AND STANDARDS ORGANISATION  
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**INDIAN RAILWAY STANDARDS SPECIFICATION  
FOR ELASTIC RAIL CLIPS  
S.No.T-31- ~~2024~~ 2025  
(~~Fifth~~ Sixth Revision)**

**0. FOREWORD:**

- 0.1 This specification was first adopted in 1976 and was revised in 1984, when new clause for the 'toe load' test was included. Subsequently the specification was amended in 1987 when the range of toe-load value of Elastic Rail Clip was changed from 645-775kg to 645-800kg. Subsequently in April 1988, the scope of specification was extended to flat toe Elastic Rail Clips. In 1989 the specification was further revised to enhance its scope to cover all types of Elastic Rail Clips such as ERC MK-II, ERC MK-III and amendment no.1 of September 1990 for ERC MK-IV.
- 0.2 To improve the quality and serviceability of clips, the specification was revised as third revision and issued in 1992 with a view to cover the specification and sources for raw material for use by the manufacturer of Elastic Rail Clips and to exercise checks on inclusion rating, grain size and heterogeneity of steel. Further, in this revision the sampling plan was also revised for tests under clause No.7.2, 7.6, 7.7 and 7.8 for which reference was drawn from IS:2500 (Part I)-1973.
- 0.3 Subsequently, Corrigendum no. 1 to the specification was issued in 1998 for amendment in clause 7.4.3. Later on, Corrigendum no. 2 to the specification was issued in 1999 in which drawing number, type of clip, diameter, approximate weight of clip, toe deflection, toe-load range and other relevant parameters for ERC Mk-V was added in **Annexure-V**. Clauses 3, 4.8.2, 4.9, 5.1, 5.2, 6.1 were also revised. In addition to above, **Annexure-I** was deleted and **Annexure-IV** was re-worded. Subsequently, Corrigendum no. 3 to the specification was issued in January' 2016 to reword the clause 7.4.3 for bringing clarity.
- 0.4 This specification was revised and Fourth revision was issued in 2018 to cover the entire corrigendum issued to this specification till date and to enhance the scope for manufacturing process of raw material, inclusion rating values, freedom for surface defects, inspection of raw material, magnetic particle flaw detection of bars, fatigue test, alternative packing of clips in polythene bags, and renaming of Annexure. ERC Mk-IV was removed from the scope of specification. In the reference documents, the IS codes were updated. The sampling plan was also incorporated as per the latest IS: 2500 (Part-1):2000 and reproduced in **Annexure-III**.

- 0.5 This specification has been issued in 2021 under Fifth Revision with certain modifications in clause 1.1, 4.10, 6.2, 7.4.1, 7.6.2, 7.7, 7.8, 8 & Annexure-V in the present form. A new clause 7.10 (Stress test) and Annexure-XIV (Test scheme for the Stress test) has also been incorporated to have more clarity of this test.

The specification of ERC-J (Provisional) Rev.-1994 along with latest corrigendum 2 of October 2016 has now been merged with this specification.

## 1 SCOPE:

- 1.1 This standard covers the specification and the approved sources for the raw material for the production of Elastic Rail Clips for the guidance of clip manufacturers. This standard also covers the technical requirement, inspection and testing procedure of the different designs of Elastic Rail Clips viz. ERC round, ERC flat, ERC MK-II, ERC MK-III, ERC Mk-V and ERC-J, hereinafter referred as 'clips' which call for stricter control in the quality of raw material, testing standards for implementation of quality assurance programme by the manufacturer. Contract awarding party has been referred as 'purchaser' and its nominated inspection agency/representative as 'inspection agency/officer'. The firm entrusted with manufacture and supply of clips, is referred to as 'manufacturer'.
- 1.2 All the provisions contained in RDSO's ISO procedures laid down in **Document No. QO-D-8.1-11 ver. 3.3 dated 02.01.2025** (titled "vendor-changes in approved status") and subsequent versions/ amendments thereof, shall be binding and applicable on the successful vendor/vendors in the contracts floated by Railways to maintain quality of products supplied to Railways.

## 2 REFERENCE DOCUMENTS

- 2.1 This standard refers to the following Indian Standards of the BIS. These should be available at the manufactures' works for reference:

S.No.	IS Code No.	TITLE
1.	IS:77-1976 (Re-affirmed 2019)	Specification for Linseed oil, boiled, for paints. (Second Revision)
2.	IS:1500-2005 (Re-affirmed 2010)	Method for Brinell Hardness test for metallic materials. (Third Revision)
3.	IS:1501:2002 (Re-affirmed 2007)	Method for Vickers Hardness Test for Metallic Materials. (Third Revision)
4.	IS:1586 (Part-2):2012 2018 (Fifth Revision)	Metallic Materials - Rockwell Hardness Test, Part 2 verification and calibration of testing machines and indenters (Fifth Revision)
5.	IS:2500(Part 1)-2000	Sampling procedure for Inspection by

	(Re-affirmed 2016)	Attributes, Part 1 sampling scheme indexed by acceptance quality limit (AQL) for lot by lot inspection. (Third Revision)
6.	IS:4748-2009 (Re-affirmed 2017)	Steels-Micrographic determination of the apparent grain size.(Second Revision)
7.	IS:3195-1992 (Re-affirmed 2017)	Steel for the manufacture of volute and helical springs (For Railway Rolling stock)-specification. (Third Revision)
8.	IS:4163-2004 (Re-affirmed 2017)	Steels-determination of content of nonmetallic inclusionsmicrographic method using standard diagrams. (Third Revision)
9.	IS:6396-2000 (Re-affirmed 2018)	Method of measuring decarburized depth of steel. (Second Revision)
10.	IS:7739 Part 5-1976 (Re-affirmed 2018)	Code of practice for preparation of metallographic specimen, Part 5 iron and steel and their examination.
11.	IS: 3703:2004 (Re-affirmed 2020)	Recommended practice for magnetic particle flaw detection. (Second Revision)

Verification of the chemical analysis of raw as well as finished product can be done through wet analysis for the laid down elements as per relevant methods of IS codes (IS:228 Part-1,2,3,8,9) from outside Government laboratory or from lab accredited by Accreditation agency as per extant guideline issued by RDSO or National Test House or Regional Test Centre (RTC), if required at any stage. The latest version of IS: 228 Part-1,2,3,8,9 should therefore be available with the firm.

- 2.2 A reference to the specifications quoted herein shall be taken as reference from the latest edition of the specification concerned.
- 2.3 The specific provision in this specification will over ride those in the above specifications, where these are not in conformity with one another. Any special requirements given in the drawing of the clips will over ride the relevant provisions of this specification.
- 2.4 RDSO drawings relevant to the clip under production should be available for reference at the manufacturer's works.

### **3 RAW MATERIAL PROCUREMENT:**

Spring Steel Rounds of grade 55 Si7 conforming to IS: 3195, for manufacture of Elastic Rail Clips (ERCs), shall be procured from RDSO approved / developmental vendors only. Vendors list can be accessed through website [www.rdsso.indianrailways.gov.in](http://www.rdsso.indianrailways.gov.in) or [www.ireps.gov.in](http://www.ireps.gov.in)

#### 4. TECHNICAL SPECIFICATION OF THE RAW MATERIAL:

4.1 Silico Manganese spring steel as rolled bars to Grade 55 Si7 of IS: 3195-1992 shall be used in the manufacture of clips. The technical specification of as rolled steel bars relate to supply condition of the bars in the as rolled and straightened condition for hot forming.

#### 4.2 Manufacturing process for steel

4.2.1 Steel making through basic oxygen, electric arc process shall be employed and steel made through open hearth route shall not be used. The steel shall be refined in the ladle furnace and vacuum degassed before using continuous process. The continuous casting machine should have the facility of electromagnetic stirring.

4.2.2 The size of ingots, billets or continuous cast billets for any given size of finished steel product shall be such that a minimum reduction ratio of 16:1 from the minimum crosssectional area of the ingot billet or continuous cast billets to the maximum crosssectional area of the product is ensured.

#### 4.3 Chemical Composition:

The ladle analysis of the steel for the as rolled bars shall conform to following chemical composition as given in IS: 3195-1992 for grade 55 Si7 when tested spectrographically.

##### 4.3.1 Ladle analysis

Carbon	0.50	-	0.60%
Manganese	0.80	-	1.00%
Silicon	1.50	-	2.00%
Sulphur	0.03(max.)		%
Phosphorus	0.03(max.)		%

##### 4.3.2 Product analysis:

The variation for the product analysis shall be within the following permissible range over ladle sample analysis and Permissible variations shall not be applicable both over and under the specified limits in several determinations in a heat:

Element	Permissible variation
Carbon	± 0.03%
Manganese	± 0.04%
Silicon	± 0.05%
Sulphur	+ 0.005%
Phosphorus	+ 0.005%

**4.4. Grain Size:**

The grain size of as rolled bars shall be 6 or finer as per IS: 4748-2009.

**4.5 Inclusion Rating:**

The inclusion rating when determined as per IS: 4163-2004 shall not be worse than 2.0 (thin) and 2.0 (thick) A, B, C, D as per IS: 4163-2004.

**4.6 Hardness:**

The hardness of as rolled bars when tested in accordance with IS: 1500-2005, the average of three readings shall be approximately 270 HBW or its equivalent in HRC or HV scales. This value is for general guidance only.

**4.7 Depth of decarburization:**

The average total depth of decarburization (partial+ complete) tested in accordance with IS: 6396-2000 with magnification of x100 of 5 deepest decarburized zones shall not be more than 0.15mm.

**4.8 Freedom from defects**

4.8.1 The surface of the as rolled bars shall be reasonably smooth and free from distortion, twist and kinks, and shall be substantially straight.

4.8.2 The as rolled bars shall be free from harmful defects namely folds, laps, cracks, deep pits, grooves, excessive scaling which may lead to cracking during hardening or impair the serviceability. Permissible depth of seam and lap in the rolled bar shall be  $d/100$  or 0.25 mm whichever is less (d is bar diameter). It shall, however, be ensured that during the inspection of the raw material, a strict vigil is maintained and the raw material is purchased by the manufacturers as stated in clause 3 only. The material shall be free from harmful internal defects, such as piping and segregation which may impair serviceability.

**4.9 Section:**

Section of as rolled bars shall be as per order. The tolerance on the diameter of as rolled bars for 20.64mm & 23mm is as under:

For dia. 20.64 mm: -0.17 mm, +0.20 mm

For dia. 23 mm: -0.19 mm, +0.23 mm

The measurement of diameter shall be carried out with the help of Vernier callipers with digital display.

#### 4.10 Marking:

4.10.1 The bars supplied shall be distinctly marked with paint or sticker at the extreme ends with different colours to be related with the heat number of material by which steel may be traced to the cast from which it has been made. The bars of different heats shall not be mixed up and shall be stored in stacks heat wise.

4.10.2 The bars should be supplied in bundles tied with binding wires and also with packing strips (18-33mm width) at minimum three locations having manufacturer's seal/name/logo/code. In addition, a metal tag shall also be provided with each bundle bearing the details of firm (code, name etc), PO No., Heat No., date, grade, size and length.

#### 4.11 Test certificate and raw material checking:

4.11.1 The test certificate from the producer of steel bars showing the following should be available with the manufacturer.

- (i) Heat number & Grade
- (ii) Colour code
- (iii) Chemical analysis
- (iv) Inclusion rating
- (v) Grain size
- (vi) Depth of decarburization (C, P&T)
- (vii) Freedom from harmful defects
- (viii) Section
- (ix) Hardness
- (x) Weight of consignment.
- (xi) Process route
- (xii) MPI Test
- (xiii) Austenite Quenched Hardness
- (xiv) Reduction Ratio
- (xv) Gas Content (O<sub>2</sub> & H<sub>2</sub> in ppm)

The above particulars shall be furnished by the manufacturer for each heat of the raw material whenever requested by the inspecting agency.

4.11.2 The bars shall be checked by the ERC manufacturer for the properties (iii) to (ix) of para 4.11.1 above at the rate of two sample bars per heat, (except for the diameter of the bar) and 20 sample bars per heat for the diameter. The observations shall be recorded in the proforma given in **Annexure-I&Annexure-II** respectively and shall be compared with the test certificate and shall be



examined for acceptability with respect to specification for raw material before its use in the manufacture of clips. The chemical analysis (% value) of elements of raw material is mentioned in the Test Certificate of raw material supplier. When this chemical analysis (% value) of elements of raw material / finished product is verified / checked by the inspecting agency / firm, then the observed values shall not vary from the supplier's test certificate (ladle analysis) value beyond the permissible limits given in clause 4.3.2 for acceptance of that heat.

4.11.3 Inspection of raw material is mandatory for inspecting officials. The manufacturing of product shall be allowed only after inspection of raw material by inspecting authority. It shall be the responsibility of the firm to get the raw material inspected before its use for production of clips.

**~~4.11A INSPECTION OF RAW MATERIAL (i.e. SPRING STEEL ROUNDS) AT THE PREMISES OF PRODUCER OF SPRING STEEL ROUNDS:~~**

~~The producer/manufacture of spring steel rounds shall carry out the following tests and submit the necessary test certificates/reports. Further, documents pertaining to the steel manufacture, refining details, ingot shape and size of the rolled product, cropping yield etc. shall also be submitted.~~

- ~~i) Heat number & Grade~~
- ~~ii) Colour code~~
- ~~iii) Chemical analysis~~
- ~~iv) Inclusion rating~~
- ~~v) Grain size~~
- ~~vi) Depth of decarburization (C, P&T)~~
- ~~vii) Freedom from harmful defects~~
- ~~viii) Section/Dimension~~
- ~~ix) Hardness~~
- ~~x) Weight of consignment.~~
- ~~xi) Reduction ratio~~

~~4.11A.1 While carrying out inspection of rolled bars the inspecting official would pay special attention to following:~~

- ~~a) Size of ingots/billets used as verified from the records of the steel manufacturer.~~
- ~~b) Dressing of complete billet by general surface grinding and freedom from surface defects.~~
- ~~c) Discarding of end portions at both ends of each billet and freedom from piping.~~

- d) ~~The size of ingot used shall be checked, recorded and verified that minimum reduction ratio 16:1 is ensured for the rolled bars offered for inspection.~~

~~4.11A.2 The inspecting official shall carry out the tests of properties mentioned in Para 4.11A (iii) to (ix), as per sampling plan given in Para 4.11A.5 of this document and maintain records. He may draw any additional number of samples and carry-out tests at his discretion. He shall also have the right to cross check any of the above parameters by actual tests at his discretion and at the cost of the spring steel manufacturer.~~

~~4.11A.3 The inspecting official shall examine various registers and records maintained by the spring steel manufacturer to verify heat wise checks carried out on various parameters and manufacturing practices like production of ingots with wide end up and hot top cropping of each ingot/primary rolled billet etc.~~

~~4.11A.4 Records for all the above tests shall be made available for scrutiny of inspecting official. Samples of the above test shall be preserved for atleast 3 months for counter check by inspecting official.~~

~~4.11A.5 Sampling (Random) of Spring Steel Rounds shall be as follows:~~

S N	Items	Relevant Specificatio n	Sampling
1.—	Chemical Analysis	IS:228	2 bars per heat
2.—	Hardness	IS:1500	10 bars per heat.
3.—	Macro Examination	IS:7739	0.5% subject to minimum of 5 bars per heat.
4.—	Depth of Decarburisation	IS:6396	3 bars per heat
5.—	Inclusion Content.	IS:4163	3 bars per heat
6.—	Grain size.	ASTM-E112	3 bars per heat
7.—	Visual checks for defects.	IS:3195	2% of black bars per heat.
8.—	Verification of dimensional tolerance	IS:3195	5 bars per heat

~~4.11A.6 Inspecting official may pick up two samples per 250 tonnes of material offered or part thereof and send the same to NABL accredited labs for confirmatory test for chemical and metallurgical properties at Spring Steel Manufacturer's expense.~~

~~This test should not form part of purchase acceptance test but will only serve as a counter check on Spring Steel Manufacturer's quality control practice.~~

~~4.11A.7 Rejection: In case the material offered for inspection fails to meet any of the requirements laid down in specification, twice the size of the original sample shall be drawn and tested for the parameters in which the original sample had failed. If one or both the retest samples fail, the complete heat shall be treated as failed. The manufacturer shall then undertake to render the heat unserviceable for Railways' use.~~

~~4.11A.8 Procedure of Inspection of Raw material i.e. spring steel rounds of dia 20.64mm/23mm of grade 55Si7 conforming to IS: 3195~~

- ~~a) The inspection shall be carried out by the RDSO.~~
- ~~b) Raw material manufacturer has to submit an advance intimation in writing, at least 15 days prior to their rolling schedule to RDSO, so that the inspecting officials can be nominated by RDSO accordingly.~~
- ~~c) The Raw material manufacturer can offer the entire/partial quantity rolled or planned to roll for inspection.~~
- ~~d) The raw material manufacturer shall offer the spring steel round bars, size wise and heat wise for inspection.~~
- ~~e) The inspecting official will check all the parameters as per Para 4.11A.5 above and certify the manufacturer's test certificates (MTC) heatwise.~~
- ~~f) Inspecting official shall issue Inspection Certificates (ICs) for the offered round bars, heatwise and shall paste a hologram on each bar.~~
- ~~g) The raw material manufacturer will then supply the certified material to ERC manufacturers against their PO along with the certified true copy of manufacturer's test certificates (MTC) and certified true copy of IC.~~

## **5. MANUFACTURE OF CLIPS:**

- 5.1 The clips, except for ERC Mk-V shall be manufactured from as rolled silico-manganese spring steel rounds as per technical specification (reference Para 4) by hot forming and shall be subsequently oil hardened and tempered to give uniform hardness across the section. The clips shall conform to the requirements of the relevant drawing and tests stipulated hereinafter. For ERC Mk-V, inter alia, the clips shall be manufactured by using 23mm dia. rod of material specified in clause 4.1 to keep the central leg portion fit to be used with existing design of sleeper, diameter in the central leg portion shall be reduced to 20.64mm. This shall be achieved by precise profiling using machines like Hydro copying turning machine to avoid sharp edges/curves.

## 5.2 Heat Treatment

The forging of the clip shall be carried out when the temperature of the cut bar is more than 900°C. The forging time of the clip after coming out from induction furnace and till immersion in the quenching tank shall not be more than 20 second. The temperature of quenching oil shall be maintained less than 70°C. The quenching tank shall be adequately dimensioned with capacity to hold more than 20,000 liters of quenching oil and should be checked regularly for water and dirt content and condition of the filter. Furnace used for tempering shall be electric continuous type equipped with independent thermocouple for each zone to control temperature within  $\pm 5^{\circ}\text{C}$ . The tempering should be done at the temperature range of 400°C – 505°C.

- 5.3 Minimum 03 bars per hour shall ~~also~~ be subjected to ~~100%~~ crack detection by Magnetic Particle Crack Detector Machine as per IS 3703: 2004 ~~before using them into~~ during production to ensure that the cut bars are free from harmful seams and other defects. Removal of surface seams by grinding shall be done provided the cut bar meets the specified limits of dimensional tolerances. The observations shall be recorded in the proforma given in **Annexure-II A**.

## 5.4 Marking:

All the firms have been given code for inscription of stamps. All clips shall bear clear inscription of stamp at the heel of the clip to indicate manufacturers initial, the last one digit of the year of manufacture and the lot number of the year.

Example: AE9

1

AE	Firms initial
9	last digit of year of manufacture
1	Lot No.

## 6. LOT AND SAMPLE SIZE FOR TESTING

- 6.1 For the purpose of testing the number of clips manufactured from the same heat and heat treated in similar manner will form one lot. The clips inspected by RDSO should be distinctly identifiable in the field. For ERC Mk-III & ERC Mk-V, a mark is to be made at the end face of straight leg with yellow paint and green paint respectively of approved quality, before giving one coat of boiled linseed oil as per clause 9 of specification.
- 6.2 For Hardness test, dimensional check toe load tests and weight test, the sample size and the acceptance and rejection numbers for Inspection Level IV and AQL of ~~4.5~~ 2.5% shall be as per **IS:2500 (Part I)-2000** and reproduced in **Annexure-III** of this standard.

For “Application & Deflection” test, all clips shall be driven at least one time into the application deflection block (RT-3745 Alt.1/RT-4710) and results shall be recorded in **Annexure-X** of this standard.

6.3 For chemical analysis, depth of decarburization, freedom from defect, examination of microstructure and inclusion rating, the sample size shall be as given under relevant clause.

6.4 The test samples for different tests shall be drawn at random from each lot.

6.5 The clips shall be offered for inspection as per letter given in **Annexure-IV**.

## 7. TESTS:

### 7.1 Chemical analysis:

One sample clip drawn from the production of each lot shall be tested for chemical analysis spectrographically for determination of Carbon, Silicon, Manganese, Sulphur and Phosphorus. The sample shall conform to the requirement of chemical composition stipulated in Para 4.11.2. If the chemical composition does not conform to the specified chemical composition, the lot shall be rejected.

### 7.2 Hardness test:

The sample clips shall be tested for Hardness in accordance with IS: 1586 (Part 2)- 2018 “Rockwell Hardness Test (B&C Scales) for steels’ ~~or IS: 1501 (Part I) – 2020 (Fifth Revision) “Vickers Hardness Test for Steel” or IS: 1500-2005 “Brinell Hardness Test for Steel”~~ and shall conform to the following requirements as the case may be:

Hardness	Hardness Number
HRC	42 ± 2
<del>HV</del>	<del>380-435</del>
<del>HBW</del>	<del>375-415</del>

### 7.3 Decarburisation Test

7.3.1 For decarburization test, the sample clips shall be microscopically examined at magnification x100 for decarburization as per IS: 6396-2000. The average total depth of decarburization (partial + complete) of five deepest decarburized zones of each sample clip shall not be more than d/100 or 0.25mm whichever is less for acceptance of material where ‘d’ is bar dia.

7.3.2 Sample size will be 5% of that for Hardness Test, and the sample clips drawn accordingly will constitute the first sample.

7.3.3 All the sample clips tested in the first sample must pass the test for acceptance of the lot. In case, more than one clip fails, the lot will be rejected. If only one clip fails in the first sample, a second sample of clips will be drawn such that the sample size is twice the sample size of the first sample. All the clips in the second sample of clips should be tested and each clip should pass the test for acceptance of the lot, i.e. in case one clip fails the lot will be rejected.

#### 7.4 **Freedom from Defects**

7.4.1 Sample clips will be checked for freedom from defects and should be free from harmful surface defects such as seams, laps, rough or jagged and imperfect edges. The sample clips shall also be examined for the heterogeneity of steel and freedom from internal defects by the micro-etching process as per IS: 7739 (Part 5) 1976.

7.4.2 Sampling of clips and acceptance/rejection of the lot for freedom from defects will be as per 7.3.2 and 7.3.3 above.

##### 7.4.3 **Examination of Micro Structure:**

7.4.3.1 Sample clips shall be microscopically examined for microstructure. Sample prepared for micro examination shall be etched with 2% nital. Microstructure of the clip should reveal tempered martensite structure **not less than 98%** across the section excluding the decarburized layer at 500X /1000X magnification.

7.4.3.2 Sample size will be 5% of that for hardness test and the sample clips drawn accordingly will constitute the first sample. Samples thus drawn for microstructure examination will be the same as selected for decarburization test and decarburization test samples shall also be examined for microstructure.

7.4.3.3 All the sample clips tested in the first sample must pass the test for acceptance of the lot. In case, more than one clip fails, the lot will be rejected. If only one clip fails in the first sample, a second sample of clips will be drawn such that the sample size is twice the sample size of the first sample. All the clips in the second sample of clips should be tested and each clip should pass the test for acceptance of the lot i.e. in case one clip fails the lot will be rejected. Test result of samples of ERCs taken for microstructure examination shall be recorded in **Annexure-VII**.

#### 7.5 **Inclusion Rating:**

7.5.1 Minimum sample size required for the test shall be six. The sample clips of the decarburization test and additional samples required to make up the number to

six, depending upon the lot size, shall be taken up for testing for inclusion rating. The inclusion rating in the material of clips when determined as per IS: 4163-2004 shall not be worse than 2.0 (thin) and 2.0 (thick) A, B, C, D as per IS: 4163-2004.

## 7.6 Dimensions:

7.6.1 The sample clips shall be checked for the dimensions by means of inspection gauges as per RDSO drawings, and shall **meet the requirement** of dimensions and tolerances as provided in the drawings of Inspection gauges. The **diameter of front** arch position of ERC shall be checked by **Vernier calipers** having digital display, in two perpendicular directions of the ERC at front arch and average value shall not be less than 20.47mm for ERC Mk-III & ERC-J and 22.81 for ERC Mk-V

7.6.2 The sample clips shall also be examined for the flat bearing lengths of the major & minor axis of toe of the clip with the rail flange in the rail seat assembly or in fixture, which deflects the clip to the same extent as in the rail fastening assembly. For this purpose, the major and minor axis of the elliptical contact surface shall be measured to meet the requirements given in **Annexure-V**. For ensuring that the flat toe bearing area of the toe of the clip with rail flange slope surface at the major and minor axis, a filer 0.05mm thick shall not pass under the toe of clip along the major and minor axis of the clip. In case of ERC-J, the clips shall be examined in a similar way as indicated above, but for the bearing length of the toe on rail seat which shall be between 15-20mm.

## 7.7 Application and Deflection Test:

The sample clips shall be tested by driving into a fixture i.e. (Application Deflection Block as per relevant clip RDSO drg.) through horizontal pushing by Hydraulic Jack or Power Press or using any suitable arrangement, which deflects the clip to the same extent as in the rail fastening assembly. The clips shall then be removed from the fixture and this process is to be repeated successively thrice. On 3rd drive clips to be checked for flat bearing length as per clause 7.6.2 and for Toe Load as per clause 7.8.

## 7.8 Toe load test:

The sample clips shall be tested for toe load, with the help of ~~toe load testing arrangement approved by purchaser / inspecting agency~~ application deflection block of approved drawing using UTM of sufficient capacity. The toe load values of the different clips shall comply with the requirements shown in **Annexure-V**. The clips shall then be checked for compliance with the dimensions and tolerances as per clause 7.6.1



### 7.9 **Fatigue Test:**

Four sample clips shall be tested for fatigue test, as per test scheme enclosed as **Annexure XII**.

This test shall be carried out in case of complaint/ reference from the user or any similar potent reason (on need basis only) as decided by RDSO at the cost of firm. Fatigue testing shall be done in RDSO or Government laboratory or from lab accredited by Accreditation agency as per extant guideline issued by RDSO or National Test House or Regional Test Center (RTC), as per fatigue scheme enclosed as Annexure XII.

### 7.10 **Stress Test:**

This test shall be carried out at RDSO, only at the time of initial approval of firm in the category of Developmental Vendors. Out of eight samples, four sample clips having higher toe load shall be tested for stress test as per test scheme enclosed as Annexure - XIV. The value of the stress in the clip shall not be more than 148 Kg/mm<sup>2</sup>.

### 7.11 **Weight Test:**

The sample clips shall be checked for the weight by means of digital weighing machine and shall meet with requirement of weight as given in Annexure-V.

If, a lot fails in weight test, the manufacturer may re-offer the Elastic Rail Clip lot wise, once more, after sorting out the defectives, with written permission of the inspecting authority. If, the offered lot fails again in the weight test, it will be rejected.

## 8 **In-process Inspection:**

The in-process inspection during manufacturing of clips shall be carried out by nominated inspection agency. The minimum quantity of 35000 nos. of ERCs shall be offered for in-process inspection. For offering in-process inspection of lesser than 35000 ERCs, the manufacturer shall obtain written permission of PCE specifying the reasons for the same.

Following minimum tests shall be carried out during the in-process inspection:

SN	Item	Sampling Procedure	Frequency of Inspection
1.	Checking of length of Cut bars	Random	03 bars per hour
2.	Turning length	Random	03 bars per hour
3.	MPI test	Random	03 bars per hour



4.	Forging Temperature	Random	Once every Hour
5.	Checking of dies	100%	at the start of the shift. If production per shift is more than 4000 ERCs, additional check in the middle of the shift.
6.	Quenching temperature and duration	Random	Once every hour
7.	Quenching Hardness	Random	02 ERCs per hour
8.	Tempering temperature and duration	Random	Once every hour
9.	Dimension check	Random	02 ERCs per hour
10.	Hardness of finished ERC	Random	02 ERCs per hour
11.	Documentation	100%	Documentation should be done along with the aforementioned inspections.

## 8.9 FINAL INSPECTION/TESTING & DOCUMENTATION:

The manufacturer shall carry out the final inspection and testing internally in accordance with the plan of testing given under 'Tests' clause 7 above except clause 7.9 Fatigue Test & 7.10 Stress test, and shall maintain the records as per **Annexure-VI to XI** to ensure that the clips have passed inspection criteria.

## 910. PROTECTION:

After inspection and approval, the clips shall be cleaned off all rust and protected with one coat of boiled Linseed oil as per IS: 77-1976 or any other rust preventing compound approved by the purchaser.

## 1011. PACKING:

**1011.1** The clips shall be packed in double gunny bags / polythene bags, each bag containing 50 clips. In the consignment to be sent by the manufacturer, not more than one gunny bag / polythene bags shall be filled with less than 50 clips which should be clearly mentioned by the manufacturer in the dispatch particulars giving the bag numbers (as painted thereon) and number of clips. The packing shall be sound to ensure that there is no loss or damage to the clips during transit.

**1011.2** The gunny bags / polythene bags should not have any exterior stitching whatsoever, except for the edge to be sealed. The hesian thread used for

stitching the gunny bag / polythene bag edge should be free from any knots except at the sealing point.

#### **4412. TEST FACILITIES:**

The manufacturer shall be required to install all the necessary test facilities for inspection of clips in separate well lit, clean and properly ventilated laboratory room provided with easily maintainable floor and platform.

#### **4. 13 INSPECTION GAUGES:**

The inspection gauges for dimensional check should conform to RDSO drawings. The manufacturer shall submit two sets of inspection gauges for the approval of Inspecting officer. Out of these, one set of inspection gauges shall be used as master gauge and shall be preserved safely by the clip manufacturer. The second set shall be used by the Inspecting Officer. For internal quality checks, the firm should use an additional set of gauges as per RDSO's gauge drawing.

#### **13 14. DISPOSAL OF REJECTED CLIPS:**

The rejected clips shall be cut in two pieces by the manufacturer using oxy-acetylene flame and shall then be disposed of as scrap.

#### **14 15. GENERAL**

44.1 15.1 The manufacturer shall furnish, at his cost, the clips required for all tests and shall also provide necessary man-power and facilities for carrying out tests at his works.

44.2 15.2 Purchaser/Inspecting officer shall have free access to the works of manufacturer at all reasonable times and shall be at liberty to inspect the manufacture at any stage and to call for any records, pertaining to manufacture, which shall be made available to him within reasonable time.

#### **45. 16. Consignee End Inspection of ERCs**

45.1 16.1 The Purchaser/Consignee or its nominated representative shall pick up and seal 02 sample sets per lot in the presence of firm's representative within 01 month after receipt the material (ERC) at the consignee depot which shall be preserved in the consignee depot or nominated location for a period of one year from the date of receipt of material. One sample set shall comprise of 30 nos. ERCs picked randomly.

15.2 **16.2** If the firm's representative does not turn up within one month after receipt of material (ERC) at the consignee end for joint sampling by Purchaser/Consignee, the sampling shall be done by Purchaser/Consignee solely.

15.3 **16.3** The sealed sample set can be got tested by the Purchaser/Consignee, from RDSO or NABL accredited labs within 12 months from the date of receipt of material with the approval of an officer not below the level of JAG of the concerned Zonal Railway or equivalent as per the observation during field inspections / specific nature of complaint regarding performance of ERC. 14 nos. ERCs from the first sample set shall be tested for conformity as per following scheme:

No. of ERCs	Test to be conducted for conformity
14	Dimension
06	Hardness, depth of decarburization and freedom from surface defects
08	Toe-load, flat bearing area, application & deflection test

15.4 **16.4** After decision for testing of samples, the supplier shall be informed to witness the test of first sample set. Second sample shall be kept as standby as per the provisions of ISO Apex documents.

15.5 **16.5** If the first sample set passes the tests, no further action will be needed. In case the first sample set fails as per acceptance / rejection criteria, the corresponding lot shall be rejected. The supplier/firm shall remove the rejected lot from the consignee depot at their own cost, but only after the supplier/firm has reimbursed payments already made if any by Purchaser/Consignee or an equivalent amount has been recovered for this purpose. However, the Purchaser/Consignee shall not be liable to return the material that is already put into track and the supplier/firm shall have no claim for compensation.

15.6 **16.6** The rejected lot shall be removed by the supplier/firm within 03 months of date of rejection advice, failing which the Purchaser/Consignee shall not be liable to return the rejected lot and the supplier/firm shall have no claim for compensation for such material. The rejected clips shall be cut into two pieces by the supplier/firm using oxy-acetylene flame at their own cost before removing the rejected clips from purchaser/consignee depot.

15.7 **16.7** Financial recovery and Penal action shall be taken as per the provisions of ISO Apex documents and Railway Board's extant policy.

15.8 **16.8** Acceptance / Rejection of the sample: The sample set will be subjected to the tests as per Acceptance / Rejection criteria

15.8.1 **16.8.1** Dimension checking of ERC: (Defect and Non-conformity criteria)

Parameters	Main gauge	Dia .	Major axis	Minor Axis	Slip gauge 'L'	Slip gauge 'M'	Slip gauge 'N'	Slip gauge 'R'	Details at F	Application Block
Defect/Non conformity	D	D	NC	NC	NC	NC	NC	NC	NC	NC
ERC no. 01										
upto ERC no. 14										

- **D**: Defect, **NC**: Non-conformity
- All the 14 ERCs shall be checked for dimension.
- More than three NC in a piece will constitute a defect.
- More than 16 NC in the set will render the whole set defective
- Defect in more than one ERC in the whole set of 14 pieces will render the whole set as failed and lot shall be rejected.
- After successful dimension test as per para 15.8.1, sample no. 1 to 8 will be tested for Toe load, Application & Deflection and Flat bearing area

15.8.2 **16.8.2** Toe load, Application & Deflection and Flat bearing area checking of ERC:08 nos. ERCs shall be checked for Toe load, Application & Deflection& Flat bearing area test

Parameters	Toe load	Application & Deflection test	Flat bearing area
Whether Defect or NC	Defect, if the value is beyond the specified limit as per Annexure-V of IRS/T-31 in more than one clip	Application test shall be done on each piece as per Para 7.7 of IRS/ T-31. Non-conformity during application test shall be considered as a defect in any of the following conditions: - a) When any piece breaks during insertion or extraction in application block. b) When any piece cannot be driven into the application block. c) When any piece bounces back while driving into application block.	Defect, if value is beyond specified value in Annexure-V of IRS/T-31 in more than three clips
ERC no. 01			
upto ERC no. 08			

- After successful Toe load, Application & Deflection and Flat bearing area test as per para 15.8.2, ERC no. 01 to 06 will be tested for Metallurgical and chemical (M&C) tests.

~~15.8.3~~ **16.8.3** Metallurgical and chemical (M&C) tests on ERC:6 nos. ERCs shall be checked for Hardness (HRC), depth of decarburization & surface condition

Parameters	Hardness (HRC)	Depth of decarburization	Surface condition
Whether Defect or NC	Defect, if deviation are beyond 2 on either side in more than one clip	Defect, if any piece having value beyond $d/100$ or 0.25mm.	Defect, if non conformity with para 7.4 of IRS T-31 in more than one clip
ERC no. 01			
upto ERC no. 06			

#### **16. 17. Warranty for Elastic Rail Clips**

The warranty period of the supplied ERCs shall be 48 months from the date of issue of Inspection Certificate or 36 months from the date of actual fitment in the track, whichever is earlier.

### CHECKING OF RAW MATERIAL

Name of the firm: M/s

S. No	Date	Source of raw material Name & Trade mark	Certificate No.	Cast/Heat No.	Colour code (heat wise)	Quantity	Sample No	CHEMICAL ANALYSIS (%)					GRAIN SIZE	INCLUSION RATING	HARDNESS	DEPTH OF DE-CARB.	FREEDOM FROM DEFECTS	ACCEPTED <b>OR</b> NOT ACCEPTED	SIGNATURE OF LAB SUPERVISOR WITH DATE
								C	Si	Mn	S	P							

1		A (e.g)	Yellow (or any Other	1															
	Colour)	Remarks		2															
				S															
2			Red	1															
				2															
				Remarks															
				S															
3			Green	1															
				2															
				Remarks															

**CHECKING OF RAW MATERIAL**  
**(Dimensions)**

**Name of the firm: M/s**

S.No	Date	Source of raw material Name & Trade mark	Certificate No.	Cast/Heat No.	Colour code	Quantity	Sample No	Dia (mm)	Sample No	Dia (mm)	Sample No.	Dia(mm)	Sample No	Dia(mm)	Accepted or not accepted	Signature of Supervisor
1.		A	Yellow			1		6		11		16				
						2		7		12		17				
						3		8		13		18				
						4		9		14		19				
						5		10		15		20				
						Remarks										
2.			Red			1		6		11		16				
						2		7		12		17				
						3		8		13		18				
						4		9		14		19				
						5		10		15		20				
						Remarks										

**FINAL INSPECTION REPORT  
(MAGNETIC PARTICLE TEST)**

**NAME OF THE FIRM M/s**

S. No	Date of checking	of Cast Heat No.	of Colour code	Lot No	Quantity of cut bars (Nos)	No of Samples checked (100%).	Remarks	Accepted or not accepted	Signature of supervisor
		A	Yellow	P					



**DOUBLE SAMPLING AQL PLANS FOR NORMAL INSPECTION**  
**GENERAL INSPECTION LEVEL-II**  
(ref: Table 1 of IS:2500 Part 1-2000)

Lot size	Sample size code letter	Sample	Sample size	Cumulative sample size	Accepted quality level percent, defectives – <del>1.5</del> <b>2.5</b>	
					Acceptance number (a)	Rejection number ®
151-280	G	First	20	20	0	<del>23</del>
		Second	20	40	<del>13</del>	<del>2 4</del>
281-500	H	First	32	32	<del>9 1</del>	3
		Second	32	64	<del>34</del>	<del>45</del>
501-1200	J	First	50	50	<del>42</del>	<del>35</del>
		Second	50	100	<del>46</del>	<del>5 7</del>
1201-3200	K	First	80	80	<del>23</del>	<del>56</del>
		Second	80	160	<del>6 9</del>	<del>710</del>
3201-10000	L	First	125	125	<del>35</del>	<del>69</del>
		Second	125	250	<del>9 12</del>	<del>1013</del>
10001-35000	M	First	200	200	<del>57</del>	<del>911</del>
		Second	200	400	<del>1218</del>	<del>1319</del>
35001-150000	N	First	315	315	<del>7 11</del>	<del>14 16</del>
		Second	315	630	<del>1826</del>	<del>1927</del>

Notes:

- In the first sample if the numbers of failed pieces are equal to the acceptance number (a), the lot shall be accepted.
- If the failed pieces exceeds the acceptance number (a) but is less than the number given under column ®, the second sample should be considered.
- If the cumulative failed pieces equal or exceed the rejection number ®, the lot shall be rejected. The cumulative failed pieces are the total number of failed pieces in the first and second samples.

No.  
(Address of Inspection Agency)

Date

Dear Sirs,

Sub: ..... Railway Purchase Order No.....dt.....  
For manufacture and supply of.....clips to  
Drg.no.RDSO/T.....Alt.

Clips as per the following details are offered for inspection. The clips have been internally checked as per drg.no.....& IRT-31-2021 and found satisfactory.

The test results have been mentioned in the proforma prescribed in the RDSO Specification No.IRT-31-2021.

It is requested to please undertake the Inspection

1. Instalment No.
2. Qty.on order
3. Qty. previously inspected & passed.
4. Qty.offered for inspection
5. Lot No./Batch Nos.
6. Corresponding Cast/Heat No. of raw material & its source of procurement.
7. Rate
8. Delivery period
9. Marking on clips
- 10.Packing
- 11.Consignee
- 12.Consignee authority letter reference(copy enclosed)
- 13.Test certificate No. of raw material

Thanking you,

Yours faithfully,

(Signature with date)  
Name:

**TOE-LOAD, TOE-DEFLECTION, WEIGHT & FLAT BEARING CONTACT LENGTH OF DIFFERENT ELASTIC RAIL CLIPS**

Drawing No.	Type of clip	Dia (mm) (tolerances as per clause 4.9)	<del>Minimum</del> <del>Nominal Weight</del> of clip (g)	Tolerance in weight (g)	Toe deflection (mm)	Toe load range (kg) Clause 7.8	Contact of surface for flat toe clips clause 7.6.2	
							Major axis (mm) minimum	Minor axis (mm) minimum
1	2	3	4		5	6	8	9
<del>RDSO/T-1892</del>	<del>ERC round toe</del>	<del>20.64</del>	<del>-</del>		<del>11.4</del>	<del>645-800</del>	<del>—</del>	<del>—</del>
<del>RDSO/T-3700</del>	<del>ERC flat toe</del>	<del>20.64</del>	<del>-</del>		<del>11.4</del>	<del>645-800</del>	<del>28</del>	<del>9.5</del>
RDSO/T-3701	ERC Mk-III flat toe	20.64	<del>904922</del>	<del>±20</del>	13.5	850-1100	28	9.5
RDSO/T-3722	ERC Mk-II Flat toe	18.0	<del>589 600</del>	<del>±15</del>	11.2	700-900	20	8
RDSO/T-5919	ERC Mk-V	23.00 and 20.64 for central leg portion	<del>10681089</del>	<del>±25</del>	13.5	1200-1500	28	9.5
RDSO/T-8258	ERC-J	20.64	<del>904922</del>	<del>±20</del>	8.5	650 (Min.)	Bearing length 15-20mm	
RDSO/T-6254	Anti-Theft ERC	20.64	<del>925927</del>	<del>±20</del>	13.5	850-1100	28	9.5
RDSO/T-6255	& Circlip	-	10	<del>±2</del>				

**FINAL INSPECTION REPORT  
(CHEMICAL ANALYSIS)**

**NAME OF THE FIRM M/s**

S. No	Of Cast Heat No.	Of Colour code	Lot No	Quantity (in nos.)	Sample No.	Chemical Analysis (%)					Remarks	Accepted or not accepted	Signature of supervisor
						C	Si	Mn	S	P			
	A	Yellow	P		1								
					2								

**FINAL INSPECTION REPORT**  
**(Inclusion rating, Depth of Decarb& Freedom from Defects)**

**NAME OF THE FIRM M/s**

S. No	Of Cast Heat No.	Of Colour code	Lot No	Quantity (in nos.)	Sample Size.	Sample No.	Depth of Decarb, not more than d/100 or max 0.25mm which ever less	Inclusion rating (not worse than 2 thin & 2.0 thick A,B,C,D)	Micro structure	Freedom from defects	Remarks of supervisor accepted or not accepted	Signature of supervisor
						1. 2. 3. 4. 5. 6.						

**FINAL INSPECTION REPORT  
(Hardness)**

**NAME OF THE FIRM M/s**

S. No	of Cast Heat No.	of Colour code	Lot No	Quantity (in nos.)	Sample Size.	Hardness values <del>42±2 HRC</del> <del>380-435 HV</del> <del>375-415 HBW</del>	No.of Defectives	Cumulative No.of Defectives	Remarks
	A (e.g.)	Yellow (e.g.)	P (e.g.)	2000	80	44,42,43,44,45,46 ---upto80 values	2		Accepted

**FINAL INSPECTION REPORT**  
**(Dimensions)**

**NAME OF THE FIRM M/s**

S. No	of Cast Heat No.	of Colour code	Lot No	Quantity (in nos.)	Sample Size.	Main gauge acceptance Yes/No	Falling in Gauges		Flat bearing length clause 7.6.2	No.of. Defectives	No. of cumulative defective	Remarks
							Go Dimension	No Go Dimension				
1	A	Yellow	P	2000	80	Yes				2		Accepted

**FINAL INSPECTION REPORT**  
**(Application & Deflection Test)**

**NAME OF THE FIRM M/s**

S. No	of Cast Heat No.	of Colour code	Lot No	Quantity (in nos.)	Sample Size.	No.of Defectives	Cumulative No.of Defectives	Remarks
1	A	Yellow	P	2000	80	3	-	Go for double sampling
					80	3	6	Accepted



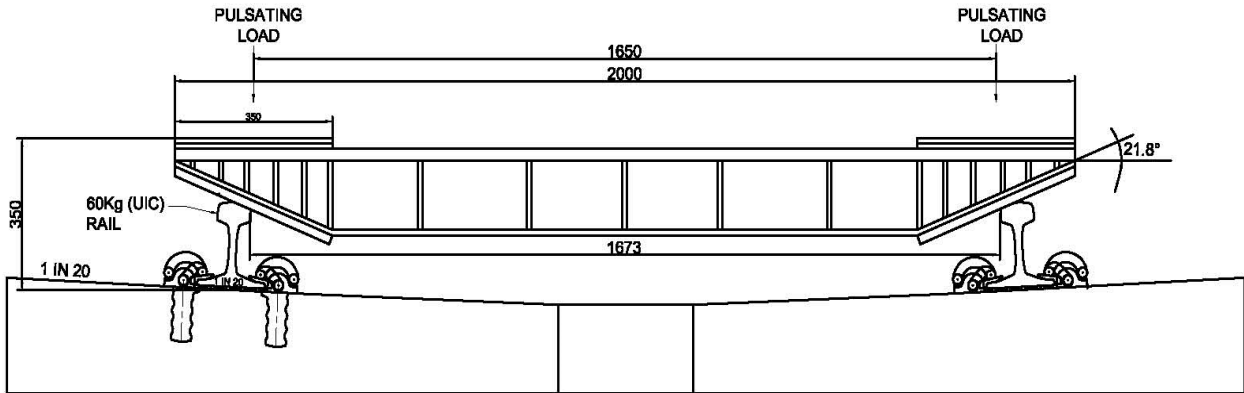
**FINAL INSPECTION REPORT  
(Toe load Test)**

**NAME OF THE FIRM M/s**

S. No	of Cast Heat No.	of Colour code	Lot No	Quantity (in nos.)	Sample Size.	Toe load values (Kg.)	No.of Defectives	Cumulative No.of Defectives	Remarks
1	A	Yellow	P	2000	80	Upto 80 values	5	-	Rejected

### **PROCEDURE FOR CONDUCTING FATIGUE TEST**

1. The fatigue test for ERC including all components of fastening system shall be carried out on complete PSC sleeper as per arrangement given below:-



#### **LOADING ARRANGEMENT FOR FATIGUE TESTING OF ERC** **WITH FULL CONCRETE SLEEPER**

(Rail head to be cut at angle to maintain the L/V ratio)

2. The scheme of the loading and records of test will be as under:-

#### **(A) Scale of Loading:**

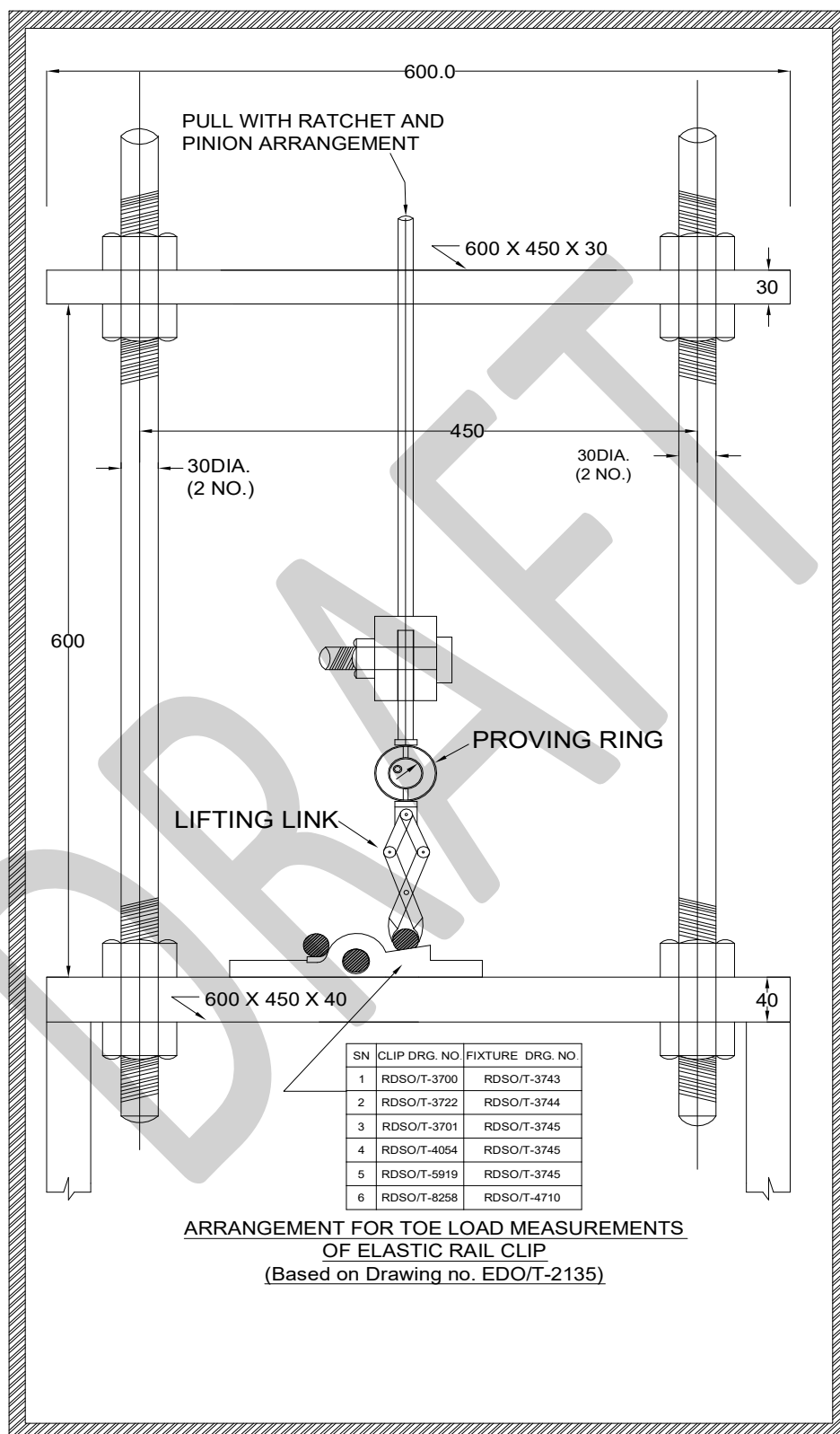
**Stage-I**      2 million cycles at frequency of 300/minute (L/V ratio = 0.4)  
Vertical load between (V) = 9.375t (max) - 0.5t (min)  
Lateral load between (L) = 3.75t (max) - 0.2t (min)

**Stage-II**      0.5 million cycles at frequency of 300/minute (L/V ratio = 0.62)  
Vertical load between (V) = 9.375t (max) - 0.5t (min)  
Lateral load between (L) = 5.81t (max) - 0.31t (min)

#### **(B) Records:**

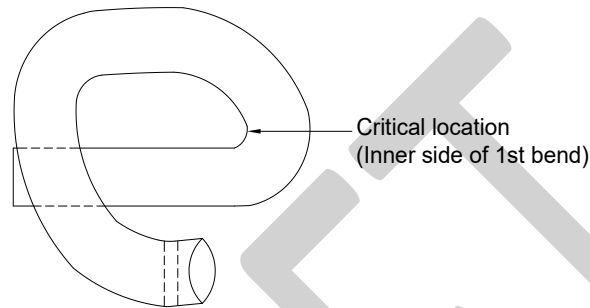
SN.	Before Fatigue Test			
	Clip No.	Initial toe load	Toe gap	Visual

SN.	After Fatigue Test			
	Clip No.	toe load	Toe gap	Visual



**Fig-1**

1. The stress test shall be conducted only if all the eight clips are conforming to clause 7.6.2, 7.7 & 7.8 during initial sample test for fresh vendor registration.
2. In the set of the eight ERCs, 50% of the clips (i.e. four clips) having higher toe load value will be selected for stress test.
3. Critical location where strain gauges are to be fixed as shown in figure, shall be cleaned for surface preparation.



4. Strain gauge has to be mounted at the critical location in the inner side at the 1<sup>st</sup> bend of ERC where the maximum bend is available.
5. Instrumentation work, proper curing, wiring and weather proofing of strain gauges will be done.
6. Lead wires of strain gauge, mounted on the clip shall be connected to strain recorder equipment and by making wheat-stone bridge assessment of the strain in the clip is done.
7. Engage the strain gauge mounted clip in the free movement fixture and house the assembly in the Universal Testing Machine frame.
8. Adjust zero on the universal testing machine
9. Calibration of channel of strain recorder to be done.
10. Clip will be lifted by applying the load through Universal Testing Machine up to known toe-load (the load of the same clip) and the corresponding reading of strain in graph will be recorded.
11. Load applied on the clip will be released.
12. Recording of strain shall be carried out three times by applying the known toe load of the clip.
13. Average of the three readings of strain will be calculated.
14. Stresses shall be calculated as per standard formula

Stress = Young's Modulus x Strain.

*The value of Young's Modulus is taken as  $2.11 \times 10^4 \text{ Kg/mm}^2$*

**FINAL INSPECTION REPORT**  
**(Weight Test)**

**NAME OF THE FIRM M/s**

S. No	of Cast Heat No.	of Colour code	Lot No	Quantity (in nos.)	Sample Size.	weight (Kg.)	No.of Defectives	Cumulative No.of Defectives	Remarks
1	A	Yellow	P	2000	80	Upto 80 values	5	-	Re-offered after shorting