सत्यमेव जयते

GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

TECHNICAL SPECIFICATION FOR ELASTIC RING USED ON THREE PHASE ELECTRIC LOCOMOTIVES (WAP-5, WAP-7 & WAG-9)

Specification No. RDSO/2007/EL/SPEC/0053 (Rev. '2')

June' 2021

Approved by	Signature
PEDSE	29/6/21

ELECTRICAL DIRECTORATE
RESEARCH DESIGNS AND STANDARDS ORGANISATION
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Prepared by	Checked by	Issued by
SSE/Mech.	SSE/Mech.	DSE/Mech.

Status of Revision

S.N.	Date of Revision	Page No.	Revision	Reasons for Revision
1.	June'2007	All	0	First Issue
2.	January'2019	All	1	1. The spec was not as per latest ISO format. 2. Vide letter no. EL/3.1.35/12 dated 30.7.2010 the Amendment no. 1 to the specification was issued in separate sheet. The parameters in amendment no. 1 needed to be incorporated in main spec itself. 3. Change in deflection limit in Load deflection test. 4. Some of the firms mentioned in clause no. 4.2 of Section-B schedule of technical requirement do not exist or do not deal with polyurethane material at present. Spec need to be revised to delete the names of those firms and further for more option to vendors more reputed firms as per list of TOP-10 polyurethane manufacturers also added. 5. Removal of commercial clauses pertaining to tendering process. 6. Removal of criteria of field trial as it is separately mentioned in the existing ISO guidelines
3.	June 2021			1. 'Schedule of Technical requirements' has been removed from this specification

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Technical Specification for Elastic Ring used in Three Phase Electric Locomotives

1.0 GENERAL:

This specification outlines the requirement of elastic ring used in the traction link of WAP5/WAP7/WAG9 types of three phase electric locomotives. The traction link of the locomotives is providing a permanent connection between the bogie and the locomotive body. The link rod is situated between two pivot points, one on the locomotive under frame, the other on the end transom of the bogie, permitting lateral movement but restraining longitudinal movement. A pivot head, situated at each end of the link rod, has an elastic ring of pliable material between the pivot post and head. The elastic rings are secured to the pivot head by an outer retaining ring and a retaining plate bolted to the post. All tractive and braking forces between locomotive body and its bogies are transferred through the traction rod. The force path is mainly in the radial direction of the ring fitted at both the ends of the traction rod. It should be noted that the actual force applied on the ring is not strictly radial, but also torsional component because of its movement from bogie to body by several degrees.

The test arrangement depicted on the RDSO drawing no. SKEL-4717 (latest version) denotes the force acting in one direction only. However, when installed, the ring is subjected to an alternating force of the same magnitude applied in the opposite direction.

In case of heavy shunting collision, the forces acting through the ring could be several times higher than the maximum force indicated in the compression diagram. In such case, the total compression is limited to the maximum travel of 21 mm.

2.0 SCOPE OF SUPPLY:

Quantity required per loco is 04 nos.

3.0 CLIMATIC, ENVIRONMENTAL AND WORKING CONDITIONS:

The aforesaid elastic ring is likely to come in contact of very dusty/humid conditions the ambient temperature ranging from 0°C to 50°C.

i) Maximum Atmospheric Temperature: Under Sun : 70°C
In Shade : 50°C

ii) Humidity : 100% saturation during rainy season

iii) Reference site conditions:

a) Ambient temperature - maximum 47°C, minimum 0°C

b) The supplier will indicate expected temperature rise in the machine room under reference site conditions.

c) Humidity: 60%

d) Altitude: 160 m above mean sea level.

iv) Rain Fall: Very heavy in certain areas. The locomotive will be designed to permit its running at 10 km/h in flood water level of 102 mm above rail level.

v) Atmosphere during hot Weather: Extremely dusty and desert terrain in certain areas.

vi) Coastal area: Equipment will be designed to work in coastal areas in humid and salt laden atmosphere.

vii) Vibration: The equipment, sub-system and their mounting arrangement will be designed to withstand vibrations and shocks encountered in service as specified in corresponding publications i.e. IEC-61373 unless otherwise prescribed.

4.0 MATERIAL:

The material shall be cast polyurethane elastomer. The supplier shall select the exact material based on the requirements of this specification and their experience with similar applications / products. The chosen material should preferably have been used in a similar rolling stock application. Supplier should demonstrate the same. Use of regenerated/re-constituted material is not permitted.

The material shall be resistant to water, organic fecals, waste products, oils, acids and ageing.

4.1 Properties of material used for manufacturing the elastic ring are given below:

Properties of Material before ageing:

SN	Properties	Permissible Value
1	Hardness	90±3 Shore A
2	Tensile strength	> 35 MPa
3	Stress at 100% elongation	> 6.0 MPa
4	Stress at 300% elongation	> 14 MPa
5	Stretch (elongation) at break	(600±50)%
6	Compression set (residual compressive deformation after 24 hours at 70±1 °C)	<30%
7	Rebound Resilience	>40%
8	Tear propagation Resistance	> 40 KN/m
9	Density	1.20±0.1 g/cm^3
10	Resistance to ageing	7 days at 70±1 °C

Variation in Physical Properties after ageing at 70±1 °C for 7 days in air oven.

SN	Properties	Permissible Variation
1	Hardness	± 5%
2	Tensile strength	± 20%
3	Stretch (elongation) at break	± 20%
4	Modulus at 100% elongation	-------

Resistance to Hydrolysis:

On boiling in distilled water at atmospheric pressure for 72 +0/-2 hours, the hardness, tensile strength and elongation at break shall not vary from the values before boiling by more than the following:

SN	Properties	Permissible Variation
1	Hardness (Shore 'A')	± 5%
2	Tensile strength	± 20%
3	Elongation at break (%)	± 20%

5.0 DESIGN LOADS:

The design loads indicated on the drawing shall be considered as the minimum requirement of the component. When in the installed position, the ring must be capable of transferring the dynamic load applied between the locomotive body and bogie, including the max. sustained tractive force of 27 t / bogie. The ring must be capable to withstand the maximum deflection of 21mm without damage or permanent deformation.

6.0 DESIGN LIFE:

The minimum design life of the ring shall be five (5) years. The load spectrum shall consist of sustained traction and braking forces with occasional shock loads.

7.0 CONSTRUCTION AND FINISH:

The elastic ring shall be manufactured in accordance with RDSO's drawing No. SKEL - 4717 (Latest version). The elastic ring shall fully comply with the dimensions and tolerances on the relevant drawing. The material shall be smooth and free from air bubbles & pinholes, surface streaks, splash marks, voids, crazing, blisters and other visual flaws. All the edges shall be neatly finished and free from flash. The manufacturer shall prepare a "Standard surface pad" and have it approved by RDSO/Lucknow. This surface pad shall be used as a comparator for surface defects. Machining on the elastic ring, if required after moulding, is permitted. However, the finished dimensions must conform to relevant drawing.

8.0 INSPECTION, TESTS AND ACCEPTANCE:

8.1 Type Tests:

The type tests will consist of the. Dimension check, load deflection Characteristics tests, Tests for material properties and the field trials. At the time of offering material for prototype test, the firm shall submit the internal test certificates.

8.1.1 Dimension Check:

Dimensions of the prototype elastic ring shall be checked as per above relevant drawing.

8.1.2 Load Deflection Test and Characteristics:

The load deflection characteristics of prototype sample shall be checked as given in RDSO's drawing no. SKEL-4717 (Latest version). The load deflection shall be done as given below:-

Load Deflection Test:

The test method: the test shall be carried out at 27±2 ^{0}C and at a machine speed of 10±5 mm/min. the ring shall be mounted in a suitable fixture and load shall be applied to the assembly placed between two compression platens. The ring shall be subjected to three successive loading of 90 kN in the radial direction. At the beginning of the fourth cycle, the ring shall be compressed in the radial direction with a load of 0.5 kN and the deflection taken as 'ZERO' at this point. During the fourth cycle, deflection at a load of 90 kN shall be within the range 5.7±1.3 mm. the condition of elastic ring should be checked periodically for various defects like cracks, debonding, crushing, crumbling etc.

8.1.3 Tests for material's properties:

The tests shall be carried out to verify that the material used on prototype elastic rings meets the properties declared by the firm and approved by RDSO as per IS 3400 (refer to clause 4.1). For this purpose the supplier shall prepare two samples of size 2 mm x 250 mm x 250 mm of the material compound prepared for batch production. Test specimens for compression set, rebound resilience and tear propagation resistance test shall also be prepared as per IS 3400 part-10, part-11 & part-12 respectively by using same compound as that of finished product with same degree of vulcanization. To assess the tear propagation resistance test method as given in IS 3400 part-12 shall be followed. All the precaution taken for material preparation and casting for preparing test piece shall also be followed for batch production. The material disc for preparing the test piece shall be taken from the material compound prepared for batch production (sample shall be selected at random from the lot). However, purchaser reserves the right to cut any finished elastic ring, if needed.

For the purpose of conforming / co-relating the composition of the test specimens with that of the finished product, the specific gravity shall be measured both on test slab /specimen and the finished product and the results shall be within ± 0.02.

8.2 Routine Tests:

8.2.1 Visual inspection shall be done on 100 % basis.

8.2.2 Dimensions shall be checked as per RDSO's above relevant drawing, one from each lot on two elastic rings or 10 % quantity, which over is more.

8.2.3 The tests of the deflection characteristics over the entire force range up to the maximum force (according to para 8.1.2) shall be conducted on at least two parts from each batch of the elastic ring.

8.2.4 The material's properties shall be verified on one sample from each batch of the material compound as per clause 8.1.3.

8.2.5 In the event of the rejection of the lot, the lot shall be made unusable in the presence of inspection authority.

8.3 Inspection Plan:

The inspection plan for type test and routine test shall be got approved by RDSO / Lucknow before offering for inspection. The supplier shall supply, free of charge, the material required for testing and shall, at his own cost, furnish and prepare the necessary test pieces and supply labour and appliances for such testing as may be carried out at his premises.

9. MARKING:

Each elastic ring shall bear the following clear readable marking at appropriate location:-

a) Supplier's Name and Trade Mark
b) Specification No.
c) Serial No. / Batch No.
d) Year and Month of manufacture.

10. GUARANTEE/DEFECT LIABILITY:

The elastic rings shall be guaranteed by the supplier for the period of 24 months from the commissioning or 36 months from the date of supply, whichever is earlier. All aspects of the design, workmanship and material will be covered by this guarantee. The elastic ring which fails during guarantee period must be replaced by the Supplier free of cost.

11. PACKAGING, STORAGE AND DELIVERY:

The elastic rings shall be prepared and packed in such a manner as will properly protect them from damage or deterioration during transit and storage prior to installation. The elastic rings shall be securely packed in bags strong enough to resist damage in transit/storage. The packed material should be stored in a cool dry place free from constraints in the original packing, free from exposure to bright light and particularly sunlight. The packed material shall be stocked and arranged in such order as to ensure use of old stock first. The storage period of at least 24 months shall be considered.

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