Specn .No.SPEC/E-7/06 (Rev.2)

GOVERNMENT OF INDIA

MINISTRY OF RAILWAYS

SPECIFICATION OF LEATHER BELLOWS

FOR

TRACTION MOTOR OF ELECTRIC LOCOMOTIVES

RDSO SPECIFICATION No. SPEC/E-7/06 (Rev.2)

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ISSUED BY

ELECTRICAL DIRECTORATE

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1.0 **SCOPE:**

This specification covers the quality and performance requirements of leather bellows for use on electric locomotives of different classes. **(This specification supersedes earlier RDSO's Specification No. SPEC/E-7/06 (REV. 1 issued under Modification Sheet No. ELRS/MS/0305-2001 (Rev. 0) EL/3.2.85 dated 29.5.01).**

1.1 In preparing this specification, reference has been made to the following publications :

a. ***IS:578 – 1985, 3rd revision, Amendment 1, November, 1992*** – Indian Standard Specification for full chrome upper leather.
b. ***IS – 4054 – 1966, Amendment 1, Reaffirmed 1992*** – Indian Standard Specification for Neatsfoot oil.
c. ***IS : 582 – 1970, 1st revision, Amendment 1, Re-affirmed 1990*** – Indian Standard Specification method of chemical testing of leather.

1.2 While the above specification will apply in general, provisions in this specification will prevail in case of any deviation. Any deviations from this specification designed to improve the performance, utility, quality and efficiency of the equipment, proposed by the manufacturer will however be considered provided full particulars of the deviation with justifications thereof are furnished along with detailed drawings and calculations.

2.0 Conditions in which the Bellows are to work:

The Bellows are used to convey air from traction motor blowers of locomotive to the commutator chamber of the traction motors. They are required to take up the relative motion between the locomotive body and the bogies. They are required to convey maximum $90M^3$ /min of air at about 47 º C without leakage and with the minimum pressure drop across the Bellows. The pressure difference between the air inside the Bellows and the ambient pressure outside will be about 250 mm WG.

2.1 The Bellows shall be suitable for service in ambient temperature of up to 55 ºC with maximum relative humidity of 100% at altitudes of up to 1000 meters above MSL, under dusty atmospheric conditions.

2.2 The outside of the Bellows are likely to be exposed to different types of lubricating oils, apart from the metallic brake block dust and sparks from brake blocks. Further, oil fumes & exhaust fumes from the compressor and exhauster will also be found in the vicinity.

2.3 During operation, the Bellows will be subjected to deflection and twisting.

2.4 The Bellows are fitted between the air inlet of traction motor and air outlet duct of electric locomotive.

3.0 **Manufacturing requirements of the traction motor Bellows:**

The bellows shall be manufactured in accordance with the Drawing No. SKEL-4583 Alt 1.

3.1 The material of the Bellow shall be free from pin holes, cuts and any open surface blemishes likely to cause leakage of air.

3.2 The Bellow material shall be oil and water resistant , spark proof and shall remain flexible for long periods.

3.3 The Bellows shall be embossed with the name of the manufacturer, month and year of manufacture and the letter 'IR' in the location shown in the drawing which should be clearly legible with naked eyes.

3.4 All the stitches shall be made by machine. At least two stitches per cm shall be provided throughout. Further, there should be two parallel lines of stitching at each joint, the distance between the lines being not less than 5 mm.

3.5 Nylon threads of good quality with minimum of 10 kg ultimate breaking strength should be used for stitching.

3.6 There should not be more than two joints in the leather throughout length. The joint may be suitably skewed to prevent tearing.

3.7 8 SWG Galvanised Iron Wire stiffeners should be provided all around the leather bellow encasing each 'G.I.' wire periphery as shown in the RDSO Drg. No.SKEL-4583 Alt.-1.

4. Properties of Leather for Bellows

1.1 The leather for traction motor bellows shall be fully chrome tanned buffalo hide leather of thickness 2 ± 0.3 mm conforming to IS : 578 – 1985, 3rd revision, Amendment 1, November 1992, in regard to following properties.

4.2 **Physical requirement for Upper Leather :**

Sl.No.	Characteristics	IS 578 – 1985
i).	Crackiness of the grain	shall not crack on single folding
ii)	Tensile strength –Kg/cm^2 (Min)	210
iii)	Tensile elongation at 1kg/mm^2 force after 15 minutes -%	25-30
iv)	Tearing strength, kg/cm of thickness – Min.	45

4.3 Chemical requirement of Upper Leather :

i)	Solvent extractable substances percent by mass.	3.0 to 7.0
ii)	Chromium content percent by mass-Min.	3.5
iii)	pH of water solubles.	Not below 3.5

4.4 The buffalo hide leather used for manufacturing of bellow should be properly chrome tanned and splitting of leather will not be used to manufacture leather bellow.

This will also be verified during the tests at outside laboratories.

2. Test required on the finished leather bellow :

2.1 TYPE TEST

2.1.1 **Appearance & Dimensional Check :**

The appearance of the bellows shall be checked and no abnormality shall be permitted in respect of rubbing impairment on the leather surface, pin holes, stripping off of the sewn or adhered parts and exposed wire. Bellows shall be dimensionally verified for all the dimensions as per Drawing No SKEL– 4583 Alt 1 for traction motor Type TAO-659/HS 1050 Er/HS-15250A application.

2.1.2 Maximum Stretch test :

a) The bellow will be stretched using 200 kg weight on the bottom periphery. In the stretched condition, angular twist of 5º shall be given, while keeping an offset of 250 mm between top and bottom opening. There shall be no failure, breaking of stitches, crack etc. The test shall be repeated three times.

b) When the bellow is transformed as shown in the figure given below, the amount of transverse movement shall not be less than 75 mm.

5.1.3 **Leak & balloon test :**

A suitable test rig will be provided by the manufacturer to build up air pressure inside the bellow. The bellow will neither allow any appreciable air leak nor balloon up when air under pressure of 0.5 psi (350 mmWG) is maintained inside.

5.1.4 **Leather quality:**

The quality of the leather of buffalo hide will conform to IS : 578 – 1985, 3rd revision, Amendment 1, November 1992, as detailed in the above specification Para 4.2,4.3 and 4.4. The test of leather can be conducted at :

a) Central Leather Research Institute, Chennai or its branches.
b) F.D.D.I, Noida.
c) HBTI, Kanpur.

For such test on leather quality, one sample from a lot of 100 or more will be taken at random.

The testing charges will be borne by the supplier. One number extra leather bellow will be manufactured by the supplier for cutting the sample for necessary testing.

However, the test on leather quality may not be insisted if the order quantity is less than 100. But, Consignee Railway unit is at liberty to test the leather quality at Railway's cost for these supplies in lots smaller than 100.

The leather test labs must also confirm that there is no splitting of leather being used to manufacture leather bellow.

5.1.5 Endurance Test :

The finished bellow will be subjected to 1,00,000 bellowing operations stretching the bellow from 200 mm to 360 mm. The number of cycles per minute shall be 45 $\pm$ 5 for the first 50,000 operations and 100 $\pm$ 6 cycles per minute for rest of the operations. After the trials, the bellow will be inspected for any cracks/collapse of the bellows, opening of stitches in leather bellows and any other visible physical deterioration.

Routine Tests :

The tests as detailed above vide **para 5.1.1 to 5.1.4** shall be carried out as Routine Tests on all lots of supplies.

Special Test :

7.1. **Test for fitment at site for development only :**

The bellows will be visually inspected for any physical damages or deterioration before fitment. Correct fitment of bellow and tightness of bolts/nuts shall be verified after fitment on the locomotive, ensuring that there is no mechanical damage during fitment. A test for air leakage shall be carried out and there will be no leakage of air from the bellows/joints with the traction motor blowers of electric locomotive running on full speed.

8. Inspection:

8.1 Prototypes for development:

Prototype samples will be inspected by representative of RDSO/Railways. Inspection shall include visual inspection on the general finish of the product such as quality of finishing, gluing, stitching and marking dimensional accuracy. Type tests including routine tests, as specified in this specification, as well as special tests to be stipulated by RDSO/Railways for ascertaining the suitability of the prototype, will also be conducted, either at the premises of the manufacturer or in a RDSO approved test laboratory at the cost of manufacturer. However, these type tests will be conducted by RDSO/Railways only at a interval of 2 years or earlier. In addition, RDSO/Railways authorities inspecting the prototype may, at his discretion, call for such special tests as are not specified in this specification, as he may consider necessary for determining the quality of the material and workmanship. Railways/manufacturing units will not carry out type tests & will carry out only routine tests while inspecting the materials.

8.2 Routine Tests by Railways only :

Routine tests as detailed above vide para 5.1.1 to 5.1.4 are to be carried out. The inspection will be done as per IS 2500 (Part-I)-1992 titled 'Sampling Inspection Procedures : indexed by acceptable quality level (AQL) for lot-by-lot inspection second (revision)' at AQL of 1 per cent and third level inspection as per table 1 with single sampling plans.