



भारत सरकार

रेल मंत्रालय

**GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS**

इमडी डीजल विद्युत लोकोमोटिव
में प्रयोग होने वाले
कर्षण मोटर बैलोस (चमड़ा) का विशिष्ट

**SPECIFICATION FOR TRACTION MOTOR BELLOWS
(LEATHER)
FOR USE ON EMD DIESEL-ELECTRIC
LOCOMOTIVES**



विशिष्ट संख्या चा०श०. ०.२४००.५७

संशोधन. ०० फरवरी २००९

Specification no. MP-0.2400.57
(Revision-00 of February 2009)

अनुसंधान अभिकल्प एवं मानक संगठन

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MANAK NAGAR, LUCKNOW-226 011**

**SPECIFICATION FOR TRACTION MOTOR BELLOWS
(LEATHER)
FOR USE ON EMD DIESEL-ELECTRIC LOCOMOTIVES**

1.0 Scope

This specification covers the material requirements, method sampling and testing for traction motor leather bellows used on WDG4 & WDP4 class of diesel electric locomotives.

1.1 In preparing this specification, assistance has been taken from the following publications.

- a. IS: 578 – 1985, 3rd revision, Amendment I, November 1992 – Specification for full chrome upper leather;
- b. IS: 4054 – 1966, Amendment I, Reaffirmed 1992 – Specification for Neatsfoot oil;
- c. IS: 582 – 1970, 1st revision, Amendment I, Reaffirmed 1990 – Specification for method of chemical testing of leather;
- d. IS: 5914-1970 - Specification for method for Physical testing of leather.

1.2 Manufacturers should submit design/ drawing, manufacturing details and QAP to RDSO before taking up actual production.

1.3 Any deviation, proposed as an improvement over the existing specification, by a manufacturer may be considered by RDSO, provided that all technical details thereof are submitted with such a proposal.

1.4 The leather bellow shall generally confirm to SK.DP- No 3915 (TM Air duct boot ASM) (enclosed). Rest of the components as stated in said drawing should confirm to EMD part numbers and RDSO drawing no. SK. DP-3916 (enclosed) as per following list -

S. No	Description	EMD Part No./dwg no.
1	Plate ASM	40023926
1a	Plate	40024812
1b	Angle	9520068
2	Duct flexible Air (leather)	SK.DP- 3916
3	Plate spring bearing	40058538
4	Spring	40024793
5	Retainer Spring	40024794
6	Clamp ring-half	40024795
7	Clamp ring-half	40024796
8	Clamp ring-half	40024798
9	Bolt	179843
10	Screw	156567
11	Nut	9416513
12	Wear Plate	40058479
13	Shim for air duct ASM	DLW 17272336

1.5 Material specifications used to manufacture TM air duct boot assembly are indicated in relevant EMD part no./IR drawing as indicated above.

2.0 Conditions in which the bellows have to work

The bellows are used to convey air from blowers inside the locomotive body to the commutator chamber of the traction motors they are required to take up the relative motion between the locomotive body and the bogies. The bellows have to convey 2600 cfm air (max) at about 47°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 (max).

2.1 The bellows shall be suitable for service in ambient temperature of upto 55°C, with maximum relative humidity of 100% at altitude of upto 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 metallic dust and sparks from cast iron brake blocks. A certain amount of oil and exhaust fumes from the compressor/exhauster will be found in the vicinity.

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

2.4 The bellows are fitted to the openings of the traction motor at the under frame,

3.0 Material and constructional requirement

General :

The material of the bellow shall be free, on both sides, from pinholes, cuts, and any open surface blemishes likely to cause leakage of air. The Bellow material shall be oil resistant, spark-proof and remain flexible for long periods.

The leather for traction motor bellows shall be full grain chrome tanned leather of thickness $2.1\text{mm} \pm 5\%$, meeting the physical and chemical test requirements given at clause 4.1.1 to 4.1.4 for raw material and test requirements given at clause 4.2 for finished bellow. Grain leather used for these Bellows shall be tanned and treated with neatsfoot oil for balancing itself. The smooth surface of the leather shall be on the outer side when finished.

All the stitches shall be made uniformly using leather-stitching machines. Hand stitching is not permitted. The stitching standard is same for all the joints. The number of stitches per cm., worked out by counting the number of stitches over 5 cm stitched length, shall be 13 ± 2 . There shall be two parallel lines of stitching at each joint, the distance between the lines being $6 \pm 1\text{mm}$. Six-ply Nylon threads of Twist grade 'S' having minimum 6 Kg ultimate breaking strength and elongation of $16 \pm 5\%$ (of Modi, Vardhaman or a similar reputed make) shall be used for stitching. There shall not be more than two joints in the leather throughout the length and the joint shall be suitably skewed to prevent tearing. The leather bellow shall be free from any type of repair for cuts/defects. The needle used for the purpose of stitching shall be in accordance with the size of the thread and holes caused by the needle shall be filled by the thread during stitching. The leather used to form the two flanges shall be of good quality and of 2 mm thickness.

Suitable galvanized steel Wire of size 6 swg shall be used as stiffeners all around the leather bellow, encasing each pleat periphery as shown in the relevant drawing. The end of the wire shall be suitably welded at the joints and shall be free from any twist.

- **Construction Workmanship and finish:** Bellows shall be smooth, free from pinholes, pits etc., on both the sides and shall be moulded according to the shape and dimension as prescribed in the relevant drawing.

- **Dimensions and tolerances:** The dimensions and tolerance of the bellows shall conform to the relevant drawing.
- Firm shall submit test certificates of leather as well as material of other components used for manufacture of bellows indicated in relevant drawings.

4.0 TESTS:

The tests shall be carried out in two parts – first on samples of raw material and second on the finished bellows.

4.1 Tests for raw material (leather)

The quality of leather will confirm to IS :578-1985, 3rd revision, amendment-1, November 1992, as detailed in the specification in para no. 4.1.1 & 4.1.4. Tests for material shall be conducted on finished leather sample, extracted from the side to be used for manufacture of the bellows by Central Leather Institute, Chennai or its branch or Footwear Design and Development Institute, NOIDA, U.P., unless specified otherwise.

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.

The leather test labs must also confirm that there is no split leather being used to manufacture leather bellows.

4.1.1 Physical properties (Routine & Acceptance):

The material used for the manufacture of bellows shall conform to the following requirements:

S.No.	Property	Requirement
1	Crackiness of the grain	Shall not crack on single folding
2	Tensile strength (kgf/ sq cm)	210 (min.) *
3	Tensile elongation at 1 kg/sq. mm, force after 15 min., %	25-30*
4	Tearing strength, kg/cm of thickness, Min	45*
5	Water penetration time	Penetration time : Min. 90 minutes, test as per EN345 S3

* This test shall be conducted on finished leather by extracting, a sample of leather as per the clause no. applicable in the specification IS : 5914-1970.

4.1.2 Accelerated ageing test (Type test):

After ageing for 72 hrs. at $100 \pm 1^\circ\text{C}$ in an air oven, tensile strength shall not vary $\pm 10\%$ from the values obtained before ageing.

4.1.3 Swelling test (Type test):

The swelling as determined to IS: 3400 (part VI) using an immersion time of 24 hours at 27+1°C, in a fluid consisting of 70 parts pure ISO-octane (2:2:4 trimethyle pentane) and 30% parts of pure toluene, shall not be more than 70%.

4.1.4 Chemical tests (Routine & Acceptance): Following tests shall be conducted

- (a) Chromium content percent by mass, in. - 3.5.
- (b) Solvent extractable substances, percent by mass – 3.0 to 7.0
- (c) pH of water solubles - not below 3.5.

4.2 Material of critical components other than leather such as spring, plate ASM, Plate spring bearing (as advised in relevant material specification) shall be tested in reputed laboratory. **(Routine & Acceptance)**

4.3 Tests for Finished Bellows

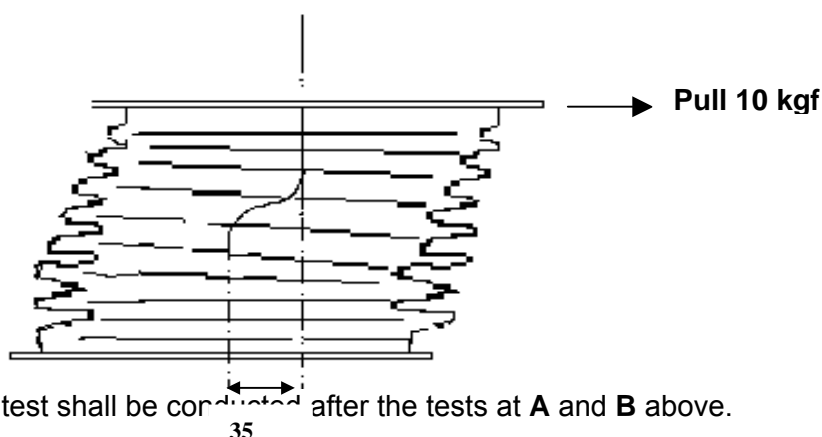
These tests will be carried out on finished bellows. The manufacturer will supply a sufficient number of pieces to conduct the tests.

4.3.1 Appearance & Dimensional check (Routine and Acceptance test): 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. Various dimensions shall be checked to ensure their conformity with the relevant drawings and specification.

4.3.2 Maximum stretch test (Routine and Acceptance test):

A. The bellow without assembly shall be stretched using 250-kg weight on the bottom periphery. In the stretched condition, angular twist of 5 ° shall be given, while keeping an offset of 250 mm between top and bottom openings. 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 35 mm.



Leak and balloon test shall be conducted after the tests at **A** and **B** above.

4.3.3 Minimum Amount of transverse movement shall not be < 35 mm. (test) :

The bellow without assembly shall be stretched fully and hold it for some time. Release the bellow & allow it to settle down freely for a few minutes. The free height of the bellow after measurement shall not be less than 200 mm. This test shall be done at factory premises.

4.3.4 Leak and balloon test (Routine and acceptance test) :

This test shall be carried out on leather bellow without assembly. A suitable test rig shall be provided by the manufacturer to build up air pressure inside the bellow. The bellow shall neither allow any appreciable air leak nor balloon up when air under pressure of 0.5 PSI is maintained inside.

4.3.5 Endurance test (Type test) :

The finished bellow without assembly will be subjected to 100,000 'bellowing operations stretching the bellow from 280 mm to 360 mm. The number of cycles per minute shall be 45 ± 5 for the first 50,000 operations and 100 ± 6 cycles per minute for rest of the operations. After the trials the bellow will be inspected for any cracks or collapse of the bellows, opening of stitches in leather bellows, and any other visible physical deterioration.

The finished assembled bellow will be subjected to bellowing operation not less than 30 mm for 5000 cycles. After that bellow will be disassembled and shall be inspected for any cracks or collapse of the bellows, opening of stitches in leather bellows, and any other visible physical deterioration of other components..

4.3.6 Test for fitment at site (special test for development order only):

The finished assembled bellows shall be visually inspected for any physical damages or deterioration before fitment. Correct fitment of bellow shall be verified after fitment on the locomotive, ensuring that there is no mechanical damage during fitment.

5.0 Inspection:

5.1 Prototypes for development: Prototype samples will be inspected by representative of the Indian 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, as specified in this specification, as well as special tests, to be stipulated by RDSO for ascertaining the suitability of the prototype, shall also be conducted, either at the premises of the manufacturer or in a reputed test laboratory, at the cost of the manufacturer. In addition, the authority 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 the workmanship.

5.2 Acceptance:

The inspection shall be done as per IS:2500 (part-I)-1973 titled 'Sampling inspection tables part I - inspection by attributes and by count of defects' at AQL of 1 per cent and third level inspection as per table 1 with single sampling plans.

6.0 Warranty:

The leather bellow shall be warranted for satisfactory and trouble free operation for a period of 36 months from the date of receipt or 24 months from the date of commissioning in service whichever is earlier.

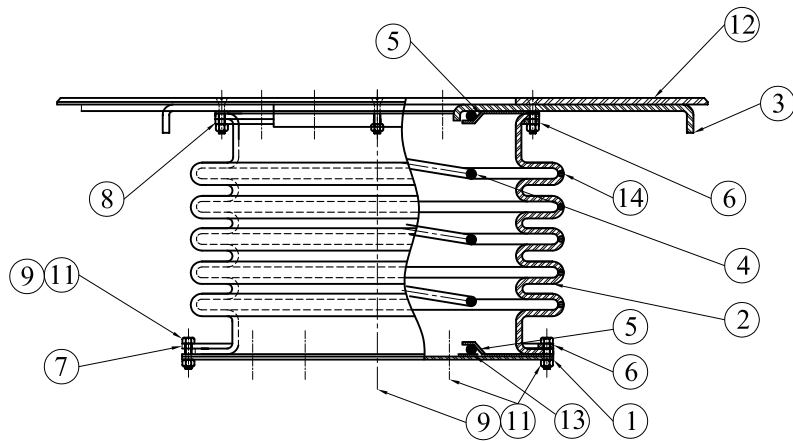
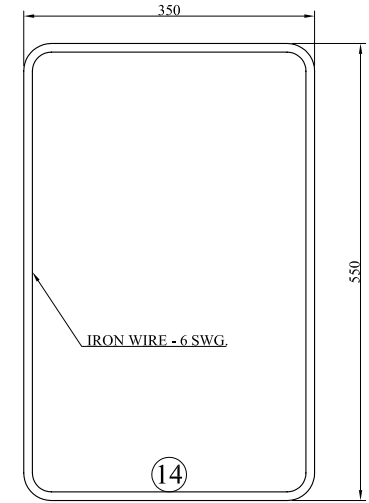
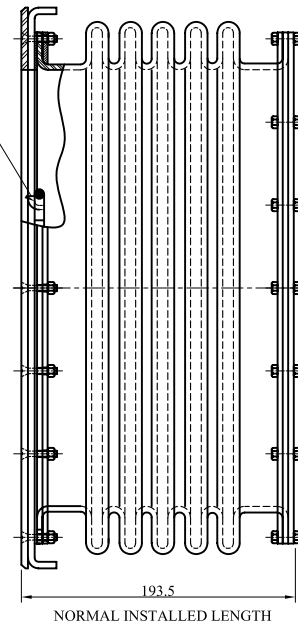
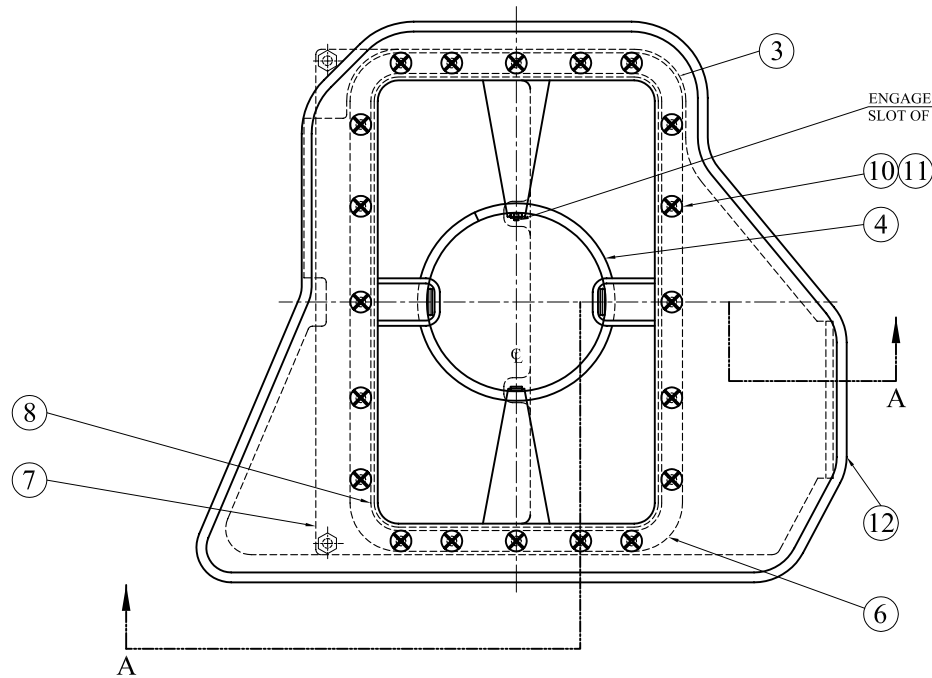
7.0 Marking:

The Bellows shall be clearly embossed with the name of the manufacturer, month & year of manufacture and the letter IR on base plate as well as on the leather bellow.

8.0 Packing:

The bellows shall be packed as to permit convenient handling and to protect against losses or damages during transit and storage.





SECTION A-A

NOTE : - ALL DIMENSIONS ARE IN mm. UNLESS OTHERWISE SPECIFIED.

	50	
	25	
	6.3	
	0.8	*SURFACE ROUGHNESS TO IS:3073
	0.1	WELDING SYMBOLS TO IS:813
SYMBOL	Raum (MAX)	TOLERANCES ON UNTOLERANCED DIMENSIONS TO IS: 2101 ()

14		WIRE ENCLOSURE - 6 SWG	5			
13	DLW 17272336	SHIM	1			
12	40058479	WEAR PLATE	1			
11	9416513	NUT - 3/8 - 16 SLFLKG	31			
10	156567	SCREW - 3/8 - 16 FCR	20			
9	179843	BOLT - 3/8 - 16 HEX	11			
8	40024798	CLAMP RING - HALF	1			
7	40024796	CLAMP RING - HALF	1			
6	40024795	CLAMP RING - HALF	2			
5	40024794	RETAINER - SPRING	2			
4	40024793	SPRING	1			
3	40058538	PLATE SPRING BEARING	1			
2	SK.DP- 3916	DUCT-FLEXIBLE AIR	1			
1	40023926	PLATE ASM	1			

REF NO	EMD/IR PART NO	DESCRIPTION	NO OFF	WT(kg) EACH	MATL	SPEC
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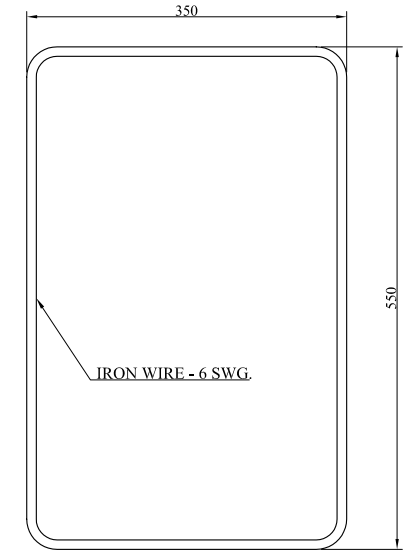
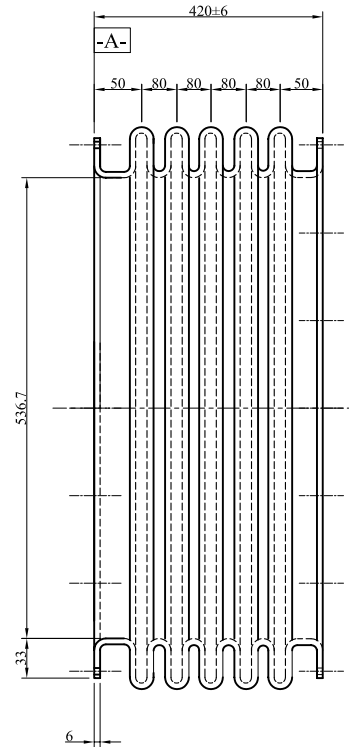
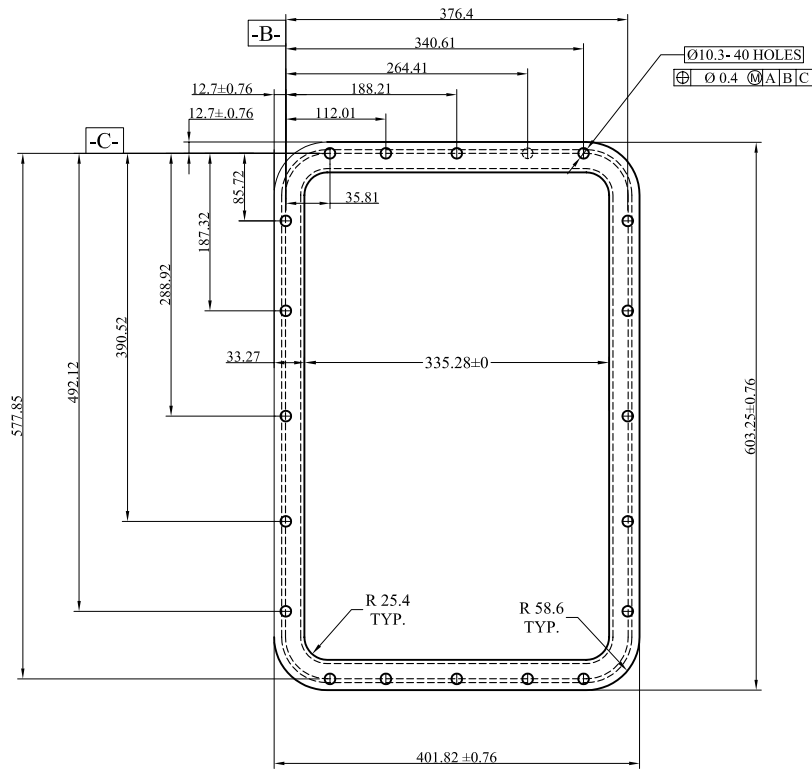
APPLICABLE FOR	WDG4 & WDP4 LOCO	TM - AIR DUCT BOOT ASM
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SCALE		REF:	FIRST ISSUED
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INDIAN RLYS	DRG. NO.	SK.DP-3915	SUPERSEDES
RDSO (MP)	NO.		SUPERSEDEDBY

D	A.K.TALUKDER
C	S.K. VAISH
APPD	
Dt	FEB-2009

ALT	NO. OF PLACES	REF. NO.	DESCRIPTION	ALT.NOTE NO.	SIGN	DATE
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NOTE : - ALL DIMENSIONS ARE IN mm. UNLESS OTHERWISE SPECIFIED.

	50	
	25	
	6.3	
	0.8	*SURFACE ROUGHNESS TO IS:3073
	0.1	WELDING SYMBOLS TO IS:813
SYMBOL	Raum (MAX)	TOLERANCES ON UNTOLERANCED DIMENSIONS TO IS: 2101 ()

ALT	NO. OF PLACES	REF. NO.	DESCRIPTION	ALT. NOTE NO.	SIGN	DATE

3	6-PLY POLYSTER THREAD OF Gr. 'S'	-	IS:4229-1992			
2	6 SWG WIRE ENCLOSURE	5	IS:7887-1992			
1	LEATHER BELLOW	1	RDSO SPEC. NO.MP-0.2400.57			
REF NO	PART NO	DESCRIPTION	NO OFF	WT(kg) EACH	MATL	SPEC
APPLICABLE FOR WDG4 & WDP4 LOCOS		DUCT FLEXIBLE AIR (LEATHER)				
SCALE		REF:	FIRST ISSUED			
INDIAN RLYS RDSO (MP)		DRG. NO.	SK.DP-3916		SUPERSEDES SUPERSEDED BY	

D	A.K.TALUKDER
C	S.K. VAISH
APPD	
Dt	FEB.-2009