

सत्यमेव जयते

GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

TECHNICAL SPECIFICATION
FOR
SPHERIBLOCS USED ON
THREE PHASE DRIVE ELECTRIC LOCOMOTIVES (WAP5, WAP7 &
WAG9)

Specification No. RDSO/2007/EL/SPEC/0051 (Rev. '2')

October 2012

Approved by	Signature
Sr. EDSE	<i>P. K. Prasad</i>

ELECTRICAL DIRECTORATE
RESEARCH DESIGNS AND STANDARDS ORGANISATION
LUCKNOW-226011

Prepared by <i>MSD</i> ST-1012	Checked by <i>Shubrata</i> 1/10/12	Issued by <i>[Signature]</i> 16/11/12
--------------------------------------	--	---

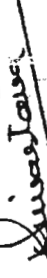
Status of Revision

S.N.	Date of Revision	Page No.	Revision	Reasons for Revision
1.	MAY'2007	All	0	First Issue
2.	FEB'2012	All	1	<ol style="list-style-type: none"> 1. Specified value of modulus at 100% Elongation is not achievable. 2. Only nominal value of density has been given and there was no range. 3. Use of standard Spheriblocs as comparator in place of standard surface pad. 4. In order to avoid duplicity, to delete STR as Sec B, which is a separate document STR 50 since Aug'2008.
3.	Oct'2012	All	2	<ol style="list-style-type: none"> 1. Density of the rubber before ageing should be 1.2 g/cm³ (max.) in place of 1.2 g/cm³ (min.). 2. Typographical errors : <ol style="list-style-type: none"> a. Nitrite shall be nitrile b. Standard Pad shall be Spheribloc

Prepared by



Checked by



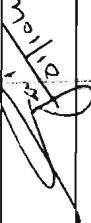


Issued by



CONTENTS

S. No.	DESCRIPTION	PAGE No.
1.	GENERAL	4
2.	SCOPE OF SUPPLY	4
3.	CLIMATIC, ENVIRONMENTAL AND WORKING CONDITIONS	4-5
4.	MATERIAL	5-6
5.	CONSTRUCTION AND FINISH	6
6.	DRAWINGS	6
7.	INSPECTION, TESTS AND ACCEPTANCE	6-9
8.	SUPPLY OF DOCUMENTS	9
9.	MARKING	9
10.	GUARANTEE / DEFECT LIABILITY	9
11.	PACKAGING AND DELIVERY	10
12.	STORAGE	10

Prepared by 	Checked by 	Issued by 
--	---	--

1.0 GENERAL:

This specification outlines the requirements of rubber bonded elastic Spheriblocs used on WAP5/WAG9/WAP7 three phase electric locomotives. Three types of Spheriblocs are used in following applications as described below:

- 1.1 Axle Guide Rod Spheribloc for WAP5/WAG9/WAP7 Locomotives: The axle guide rod, which is bolted to the axle box housing and to the bogie frame, provides a longitudinal guide for the axle box housing. The guide rod is fitted with Spheriblocs at each end, which provide positive longitudinal guidance while allowing negligible resistance to lateral movement. Spheribloc fitted in the guide rods allow the axle lateral movement without undue restrictions.
- 1.2 Traction Motor Support Arm Spheribloc for WAG9 and WAP7 Locomotives: Mounting plate of traction motor is supported by torque arm; Spheriblocs are fitted at the both end of torque arm.
- 1.3 Traction Motor Spheribloc and Traction Motor Support Arm Spheribloc for WAP5 Locomotives: Traction motor support arm is fitted with bogie frame mounting lug through TM support Spheribloc and other side of traction motor is fitted on the center transom mounting lug of bogie through 2 nos. of TM mounts Spheriblocs.
- 1.4 Gear Case Spheribloc for WAP5 Locomotives: Gear case, fitted to each axle of bogie is suspended in the bogie frame at the nose end by support arm. The arm is fitted with spheribloc to allow for twist and movement of axle.

2.0 SCOPE OF SUPPLY:

Quantities of different spheriblocs for different types of locomotives are as follows:-

2.1 For WAG9 / WAP7 Locos:-


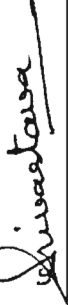

SN	Application	ABB's Drawing No.	Quantity per loco
2.1	Axle Guide Rod / Traction Motor Support arm	IA016-00005 (Rev.3)	36

2.2 For WAP5 Locos:-

SN	Application	ABB's Drawing No.	Quantity per loco
2.2.1	Gear Case	IA016-00005 (Rev.3)	08
2.2.2	Axle Guide Rod	IA016-00003 (Rev.1)	16
2.2.3	Traction Motor support arm	IA016-00269 (Rev.3)	12

3.0 CLIMATIC, ENVIRONMENTAL AND WORKING CONDITIONS:

The spheriblocs are subjected to heavy dynamic cyclic load. This load can be considered as continuous within the limits specified as maximum axial and radial force in

Prepared by	Checked by	Issued by
		

the ABB's relevant drawings. The spheriblocs shall be suitable for operation under tropical conditions of high temperature, high humidity, heavy rainfall and fungus conductive environment.

3.1 Maximum atmospheric temperature:

- a) Under Sun 70°C
b) In Shade 50°C

3.2 Humidity: 100% saturation during rainy season.

3.3 Rain Fall: Very heavy in certain areas.

3.4 Atmosphere during hot weather: Extremely dusty and desert terrain in certain areas.

3.5 Coastal Area: Spheriblocs will be designed to work in coastal areas in humid and salt laden atmosphere.

4.0 **MATERIAL:**

4.1 Rubber: The supplier shall select the elastomeric material based on the requirements of this specification and their experience with similar applications / products. This may include natural rubber, chloroprene or nitrile butadiene synthetic rubbers. 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.

Properties of rubber used for spheriblocs are given below:-

Properties of rubber before ageing:

SN	Properties	Permissible Value
1	Hardness	65 ± 3 Shore A
2	Tensile strength	200 kg/cm ² (min.)
3	Stretch (elongation) at break	250% (min.)
4	Modulus at 100% elongation	30 kg/cm ² (min.)
5	Compression set (residual compressive deformation after 24 +0/-2 hours at 70 ± 1 °C)	< 22%
6	Density	1.2 g/cm ³ (max.)
7	Ash contents	5% (max)
8	Resistance to ageing	7 days at 70 +1/-0 °C
9	Bond strength	500 PSI (min.)

Variation in physical properties of rubber after ageing at 70±1 °C for 7 days in an air oven.

SN	Properties	Permissible Variation
Prepared by		
	Checked by <i>Shrivastava</i>	Issued by <i>[Signature]</i>

1	Hardness	≤ 5 Shore A
2	Tensile strength	± 25%
3	Stretch (elongation)at break	+10% / -30%
4	Modulus at 100% elongation	± 20%

4.2 Steel. The metal part shall be manufactured from mild steel with the minimum yield stress of 200MPa and shall conform to IS:1875, Cl.4. The surface shall be electroplated (Zn) according to IS:1573 and IS:9839 to achieve the finish specified on the drawing. Proposals for an alternative corrosion protection, if any, may be submitted for approval of the RDSO. The profile of the metal components shall be selected to ensure that the load is distributed evenly over the elastomer. The bond shall be at least as strong as the parent elastomer itself.

The metal parts shall be shot/grit blasted to IS:9139 Grade S M 300 or G M 30 and chemically cleaned before bonding with the rubber. It has to be ensured before bonding that the metal surface is free from rust, moisture and other foreign matter. The process adopted for bonding of rubber to metal shall be a proven one using suitable bonding agents to achieve the required bond strength.

5.0 CONSTRUCTION AND FINISH:

The Spheriblocs shall be manufactured in accordance with ABB's Drawings as indicated in para 2 above. All spheriblocs shall fully comply with the dimensions and tolerances on the relevant drawing. The metal part shall be chemically bonded with rubber. The rubber shall be smooth and free from pinholes, blisters and other visual tears. The manufacturer shall prepare a "standard Spheribloc" and have it approved by RDSO/Lucknow. This Spheribloc shall serve as a comparator for surface defects. Spheriblocs shall be resistant to organic fecals, waste products, oils, acids and ageing. Manufacturer should indicate the values and standards to meet the parameters for their product along with their offers as indicated in the specification and ABB's relevant drawings.

6.0 DRAWINGS:




The firm should submit the manufacturing drawings of Spheriblocs for RDSO's approval before manufacture. Notwithstanding any approval to drawings / designs by RDSO, the firm shall be solely responsible for performance of the product.

7.0 INSPECTION, TESTS AND ACCEPTANCE:

7.1 Type Tests:

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

7.1.1 Dimension check:

Prepared by	Checked by	Issued by
		

The prototype spheriblocs shall be checked for dimensions as per ABB's above relevant drawings.

7.1.2 Load Deflection Characteristics:

The load deflection characteristics of prototype sample shall be checked in Radial, Axial, Torsional (α) and Conical (β) deflections for conformance of the stiffness values as per ABB's above relevant drawings. The loads to be applied for test for each types of spheriblocs is given below:-

SN	Mode	Spheribloc as per cl. 2.1 & 2.2.1			Spheribloc as per cl. 2.2.2			Spheribloc as per cl. 2.2.3		
		Max. load	Starting from	Step size	Max. load	Starting from	Step size	Max. load	Starting from	Step size
1	Radial	140kN	0	20kN	80kN	0	10kN	66kN	0	11kN
2	Axial	30kN	0	6kN	20kN	0	5kN	17kN	0	4kN
3	Torsional	+700Nm	0	140Nm	+170Nm	0	85Nm	-	-	-
	(α)	-700Nm	0	140Nm	-170Nm	0	85Nm	-	-	-
4	Conical	+580Nm	0	145Nm	-	-	-	-	-	-
	(β)	-580Nm	0	145Nm	-	-	-	-	-	-

The condition of rubber of spheribloc should be checked periodically for various defects like cracks, de-bonding, crushing, crumbling etc.

7.1.3 Tests for rubber properties:

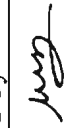
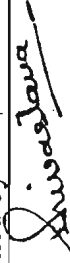
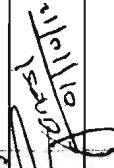
The tests shall be carried out to verify that the rubber used on prototype spheriblocs meets the properties declared by the firm and approved by RDSO as per IS 3400 (refer to clause 4.1). For this purpose the supplier shall prepare two samples of size 2 x 250 x 250 mm of the rubber compound prepared for batch production. Test specimens for compression set and bond strength test shall also be prepared as per IS 3400 part-10 & part-14 respectively by using same rubber compound as that of finished product with same degree of vulcanization. To assess the bond strength, method 'B' as given in IS 3400 part-14 shall be followed. All precautions taken for metal preparation and bonding for preparing test piece shall also be followed for batch production. The un-vulcanised rubber disc for preparing the test piece shall be taken from the rubber compound prepared for batch production (sample shall be selected at random from the lot). However, purchaser reserves the right to cut any finished Spheribloc, if needed.

For the purpose of conforming / co-relating the composition of the test specimens with that of the finished product, following tests shall be performed both on test slab /specimen and the finished product and shall comply the requirements as given under:-

- Specific gravity : The results shall be within ± 0.02
- Percent Ash content : The results shall be within ± 1.0

7.1.4 Endurance Test:

Endurance test of prototype sample of different types of Spheriblocs mentioned at clause 2.1, 2.2.1, 2.2.2 and 2.2.3 shall be carried out as per test parameters given

Prepared by	Checked by	Issued by
		

11. PACKAGING AND DELIVERY:



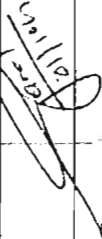
The spheriblocs shall be prepared and packed in such a manner as will properly protect them from damage or deterioration during transit and storage prior to installation. The storage period of at least 24 months shall be considered.

12. STORAGE:

Rubber, whether under storage or in use, continue to deteriorate and ultimately may become unserviceable. The deterioration may be the result of one particular factor or a combination of factors viz: the action of oxygen, ozone, light, heat, humidity etc. The deleterious effects of these factors may, however, be minimized by adopting appropriate conditions of storing and duration of storage. This guideline proves suitable conditions for the storage of rubbers in all forms.

- i) The rubber components should be stored in a cool place as far as practicable, preferably below 30°C.
- ii) They should be kept away from direct sunlight preferably in a dark place. Direct sunlight causes much faster degradation of the rubber components.
- iii) The humidity of the storage condition should not be such that condensation of moisture takes place on the surface of the components.
- iv) In the vicinity of these components, any loose electrical connections should be avoided, as these cause production of ozone, which adversely affects rubber.
- v) They should be stored away from contact with materials containing copper and manganese, which act as poisoning agents and result in their faster degradation.
- vi) Under no circumstances, rubber components should be stressed during storage. The portion under stress undergoes deformation with permanent set and leading to degradation. They should be stacked in such a way so that any super imposed stresses are substantially avoided.
- vii) Any contact with grease or oil should be avoided as these cause swelling, softening and deterioration of rubbers.
- viii) French chalk or soapstone or mica should liberally be applied on the surface of rubber components.
- ix) Great care is to be exercised so that the material is used in the order of their receipt in the stores i.e. 'first-come-first issue basis'. The rubbers whether under storage or in use continue to deteriorate. The only difference is that under service condition, deterioration is much faster. Every moment of storing is at the cost of useful life and prolonged storage of the material may render it unserviceable due to progressive deterioration

End

Prepared by	Checked by	Issued by
		

below. These tests are divided into force-controlled test and angle rotation controlled test. After completion of endurance test there should not be any permanent set and damage to rubber or steel. Complete endurance test shall be carried out with load cases on each prototype sample as described below. The tests frequency will be 1 Hz for endurance tests under radial forces and 0.5 Hz for endurance tests under angular twists.

Load case	Load cycles	Spheribloc as per cl. 2.1 & 2.2.1		Spheribloc as per cl. 2.2.2		Spheribloc as per cl. 2.2.3	
		Mean	Amplitude	Mean	Amplitude	Mean	Amplitude
Radial force	8×10^5	37 kN	+/-23 kN	20 kN	+/-20 kN	22 kN	+/-15 kN
Radial force	8×10^5	-9 kN	+/-23 kN	-20 kN	+/-20 kN	-8 kN	+/-15 kN
Radial force	2×10^5	14 kN	+/-38 kN	0 kN	+/-32 kN	7 kN	+/-21 kN
Radial force	5×10^3	11.5 kN	+/-57.5 kN	40 kN	+/-40 kN	40 kN	+/-33 kN
Torsional angle α	1×10^5	0	+/-1 deg.	0	+/- 1.5 deg.	-	-
Cardanic angle β	1×10^5	0	+/-2 deg.	0	+/-1.0 deg.	-	-

7.1.5 Field trial:

After passing type tests, two loco sets of the Spheriblocs will be subject to field trials for a period of at least six months which will form the basis of acceptance of the prototype. The performance of Spheriblocs shall be monitored jointly by users railway, RDSO & supplier. After completion of successful field trial, the remaining quantity of Spheriblocs will be manufactured incorporating all the modifications found necessary during the prototype test / field trial, by the firm without any additional cost.

7.2 Routine Tests:

7.2.1 Visual inspection shall be done on 100% basis.



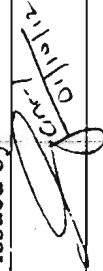
7.2.2 Dimensions shall be checked as per ABB's above relevant drawings from each lot on two Spheriblocs or 10% quantity, whichever is more.

7.2.3 The tests of the deflection characteristics over the entire force range up to the maximum force (according to para 7.1.2) shall be conducted on at least two samples from each batch of the rubber mix. This test shall include the confirmation of the radial stiffness Cr, the axial stiffness Ca and the angular stiffness M α and M β .

7.2.4 The rubber properties shall be verified on one sample from each batch of the rubber mix as per clause 7.1.3.

7.3 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

Prepared by	Checked by	Issued by
		

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.

8.0 SUPPLY OF DOCUMENTS: (In addition to these indicated in BID documents)

8.1 Along with Tender Offer:

- i) Technical details, composition and characteristics of the material to be used for manufacture of item
- ii) Source of raw materials.
- iii) Manufacturing process.
- iv) Type tests plan.
- v) Routine tests plan.
- vi) Details about similar items supplied for locomotives, if any.

8.2 Along with Supplies:

- i) Certificates of the results of all the tests performed in accordance with specifications duly signed by the purchaser's authorized representative.
- ii) Certificate of inspection/acceptance duly signed by the purchaser's authorized representative.
- iii) A certification of compliance shall be provided stating that the spheribloc comply with this specification and the relevant drawing.
- iv) Each certification so furnished shall be signed by an authorized representative of the manufacturer. This certification may be made the basis of the component acceptance and payment.


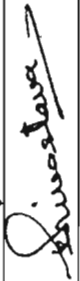

9.0 MARKING:

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

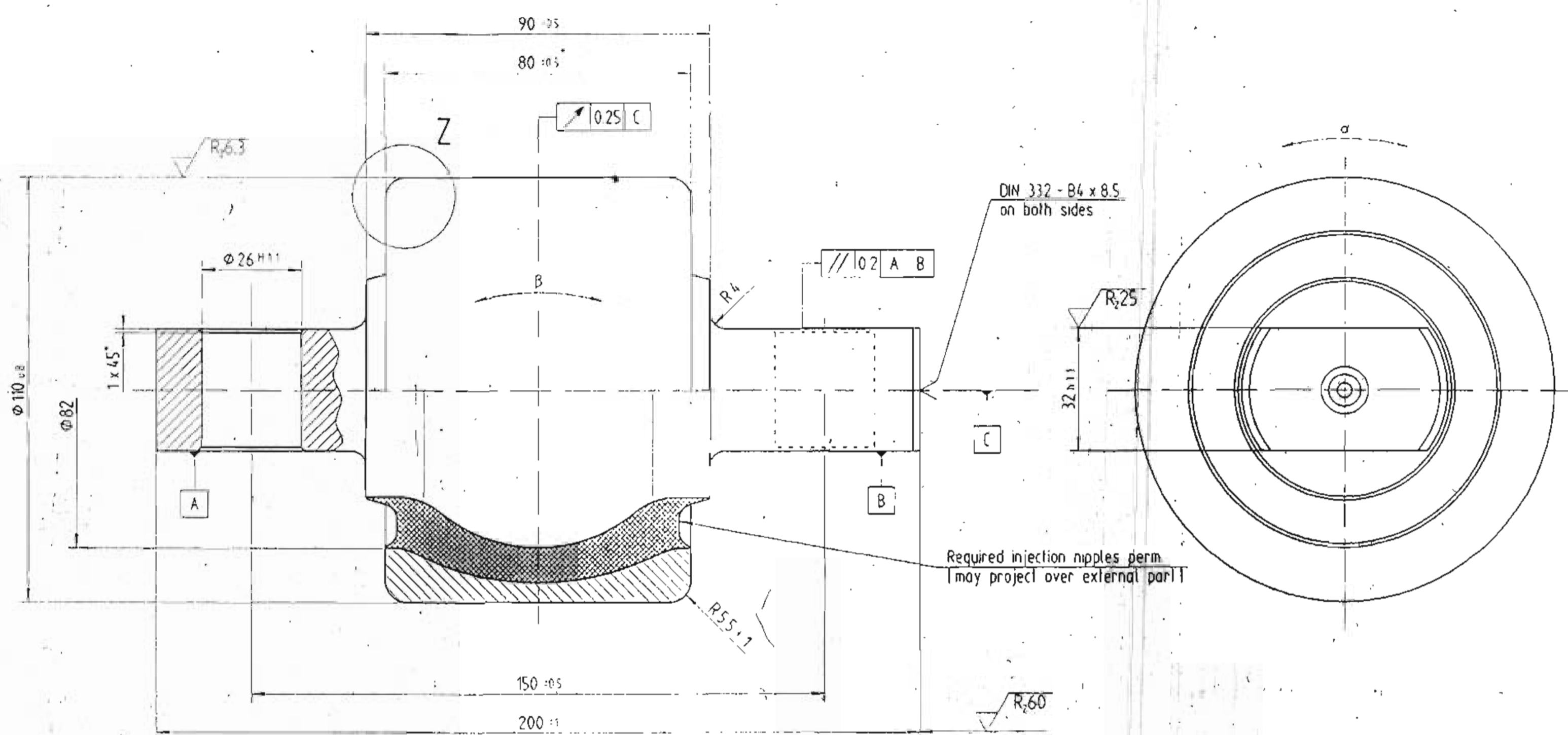
- a) Supplier's name/Trade mark
- b) Specification No.
- c) Serial No. / Batch No.
- d) Year and month of manufacture.

10. GUARANTEE / DEFECT LIABILITY:

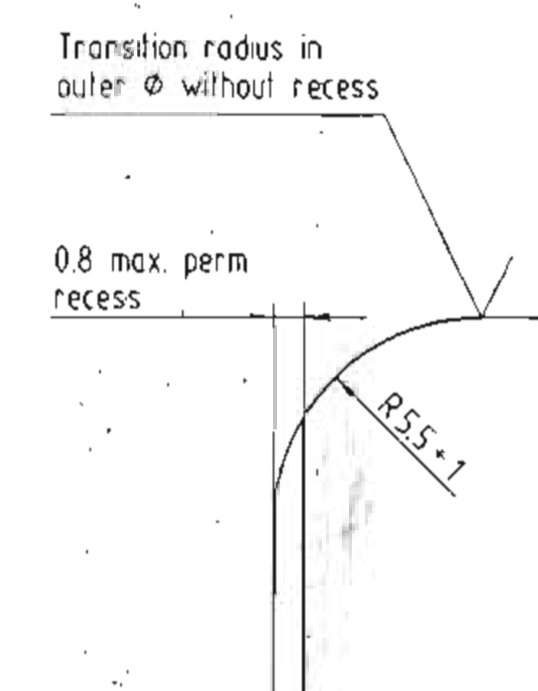
The Spheriblocs shall be guaranteed by the supplier for the period of 24 months from the commissioning or 36 months from the date of supply, whichever is earlier. All aspects of the design, workmanship and material will be covered by this guarantee. The Spheriblocs which fail during guarantee period must be replaced by the supplier at his cost.

Prepared by 	Checked by 	Issued by 
--	---	--

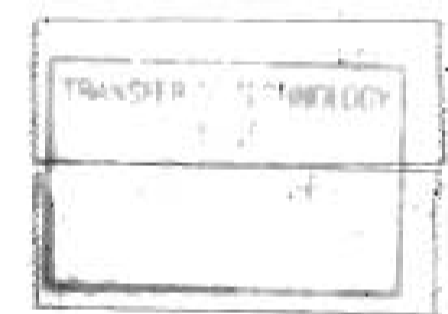
NEXT ASSY: IA 011-00150
 & IB 011-00185
~~IA 011-00194~~
 & IB 016-01453



Z
 5:1



Required injection nipples perm
 (may project over external part)



✓ (✓ R6.3 ✓ R25 ✓ R60)

Metal parts Fe / Zn 12 c.c. DIN 50 961
 Metal parts connected with each other by vulcanization

Finished dimension	Tolerance	Preliminary dimension	Layer thickness
Ø 110 ± 0.08	- 0.198 - 0.144	Ø 110.166 Ø 110.120	12 - 16

Loads:

Radial load $F_r = 60\,000\text{ N}$
 $F_{r\text{ max}} = 140\,000\text{ N}$

Axial load $F_a = 15\,000\text{ N}$
 $F_{a\text{ max}} = 30\,000\text{ N}$

Angular deflection $d/2 = \pm 14'$
 $B/2 = \pm 12'$

Stiffness:

Radial $C_r = 50\,000\text{ N/mm} = 20\%$

Axial $C_a = 8\,200\text{ N/mm} = 20\%$

$M_{60} = -51\text{ Nm/}^\circ$
 $M_{90} = -48\text{ Nm/}^\circ$

Temperature range -30° bis 70°C
 Resistant to organic waste product

ABB Transportation

THE ANGEL PRODUCTION

SPHERIBLOC

IA016-00005

1

GENERAL TOLERANCES	UK	FK	1A	We reserve all rights in this document and in the information contained therein. Reproduction, use or disclosure by third parties without express authority is strictly forbidden. Copyright ABB Henschel AG 1994.			
DIN ISO 2768 mS		D 1785					
LINEAR DIMENSIONS - SYMMETRY	Classification No.			Scale	1:1.5:1	Weight	6.0
DIN 8570 BF WELDMENTS	Gen Tolerances	Gen Tolerances	Gen Tolerances	Surfaces	Material / Semiproduct		
DIN 6930 g SHAPING			*	DIN ISO 1302			
DIN 6935 COIL BENDING	1994 Date Name Title			CAD 1668118010			
DIN 2310 II B THERMAL CUTTING	DRAWN: 14.04.94 CHECKED: 15.04.94 DATE: 17.10.94 H.S.			TOT 657 Spheribloc			
DIN 2310 II D PLASMA ARC CUTTING	DATE: 9.8.94 H.S.			ABB Henschel AG Kassel works			
	DATE: 9.8.94 H.S.			668-118.01-02			