

## REVISION OF SPECIFICATION / STR

**Item Name:** TECHNICAL SPECIFICATION OF CENTRE PIVOT LINERS & HALF CYLINDER WEAR FOR LOCOMOTIVES.

**Specification No:** MP.0.40.99.02

1. RDSO is reviewing the specification/STR to cater to the latest technological developments in the field, modify clauses not relevant in the present context and making them more enabling with focus on functional requirements.
2. It is requested that your comments / suggestions with regard to improvements /modifications in specification / STR of the abovementioned item may be submitted in the following format along with the justification for the changes required.

### **Part A: Basic Information**

SN	Particulars	Information
1.	Name	
2.	Designation	
3.	Professional Qualification	
4.	Organization / Firm's Name	
5.	Address for Correspondence	
6.	Contact No.	
7.	Email ID	
8.	Whether firm is registered with RDSO for the subject item. If yes, details like date of registration, current status etc. If no, firm's experience in manufacturing of subject item or similar item	
8.	Whether any technical document/Report/Study to support suggested changes is available / enclosed for better appreciation	

### **Part B: Comments / suggestions on the specification**

SN	Clause No. of RDSO STR/ Spec	Clause, as it exists in RDSO STR/ Spec	Clause , as it should read after incorporation of comments /suggestions in the RDSO Spec / STR	Justification for changes

**Comments may be sent to following address within one month from the date of publication on [rdso.indianrailways.gov.in](http://rdso.indianrailways.gov.in)**

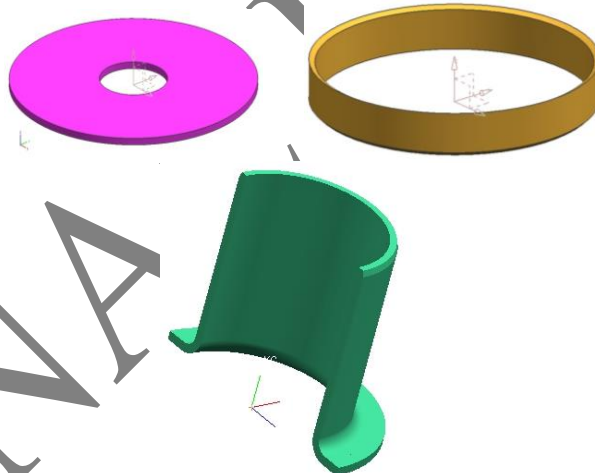
Jt. Director/MP(VDG)  
Research Designs and Standards Organization,  
Manak Nagar, Lucknow – 226011

Email: [sanjai.govil@gov.in](mailto:sanjai.govil@gov.in)



भारत सरकार रेल मन्त्रालय  
GOVERNMENT OF INDIA  
MINISTRY OF RAILWAYS

TECHNICAL SPECIFICATION OF  
CENTRE PIVOT LINERS & HALF CYLINDER WEAR  
FOR LOCOMOTIVES



SPECIFICATION No. MP.0.40.99.02  
(Révision – 03)

March' 2021

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# TECHNICAL SPECIFICATION OF CENTRE PIVOT LINERS & HALF CYLINDER WEAR FOR LOCOMOTIVES

## 1. SCOPE

- 1.1 This Specification covers the technical requirements relating to material, construction and testing for non-metallic Centre Pivot liners and Half Cylinder Wear (HCW) used in locomotive bogies. However, this specification does not include all the necessary provisions required for a supply contract.
- 1.2 The centre pivot liners are fitted in centre pivot bowl, which transmits the tractive and braking forces and also bears the vertical load of superstructure. However, HCW is fitted in the pivot housing of four bar mechanism, which bears only tractive and braking forces of the locomotive.
- 1.3 During service, the Centre pivot liners are subjected to static and dynamic loadings in compressive mode. The horizontal liner is subjected to a maximum loading of about 55 t, while vertical liners are subjected to a maximum loading of about 25 t.  
  
Half cylinder wear is subjected to static and dynamic radial loading in compressive mode on the inner wall. The maximum loading on HCW is about 44 t.
- 1.4 The components shall have low coefficient of friction, excellent wear & oil resistant and tear strength properties. They shall be capable of withstanding wide climatic variations prevailing in the country without deterioration and without any marked change in characteristics.

## 2. DEFINITIONS

- i. Wherever "Inspecting Agency" has been mentioned in this document, it shall be taken as "Authorised Inspecting Agency" mentioned in the purchase order.
- ii. Wherever "RDSO Drawing" has been specified in this document, it shall be taken as the latest revision of RDSO's relevant Centre pivot liner / Half cylinder wear drawing.
- iii. Wherever "Liners" has been specified in this document, it shall be taken as "Centre Pivot Liners" and "HCW" shall be taken as "Half cylinder wear".

## 3. INSTRUCTIONS FOR THE PURCHASER

1. The manufacturer shall be an Approved Vendor for supply of Centre Pivot Liners / Half cylinder wear, whatever applicable.
2. Inspection of Centre Pivot Liners / Half cylinder wear shall be carried out as per the instructions given in the Vendor Directory. The Purchaser shall clearly indicate this in the Purchase Order.
3. The material, manufacturing and testing of the components shall conform to this specification. The Purchaser shall clearly indicate this in the Purchase Order.

## 4. REFERENCE TO SPECIFICATIONS AND STANDARDS

This specification draws reference to specifications and standards given below:

Sl. No.	Specification No.	Description
1.	ASTM D 256	Standard Test Methods for determining the Izod Pendulum Impact Resistance of Plastics
2.	ASTM D 792	Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
3.	ASTM D 2240	Standard Test Method for Rubber Property—Durometer Hardness
4.	ASTM D 638	Standard Test Method for Tensile Properties of plastics
5.	ASTM D 695	Standard Test Method for Compressive Properties of Rigid Plastics
6.	ASTM D 3418	Standard Test Method for Transition Temperatures and Enthalpies

		of Fusion and Crystallization of Polymers by Differential Scanning Calorimetry
7.	ASTM D 790	Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
8.	ASTM D 570	Standard Test Method for Water Absorption of Plastics
9.	ISO 815-1:2019	Rubber, vulcanized or thermoplastic — Determination of compression set — Part 1: At ambient or elevated temperatures
10.	ISO 7148-2	Plain bearings - Testing of the tribological behaviour of bearing materials -Part 2: Testing of polymer-based bearing materials
11.	ASTM D 1894	Standard Test Method for Static and Kinetic Coefficients of Friction of Plastic Film and Sheet
12.	IS: 3400 (Part 6)	Methods of test for vulcanized Rubbers-Determination of the effect of liquids

## 5. DEVIATION(s)

If deviation(s) from original design, material specifications, dimensions etc. are desired by the manufacturer, specific proposals with reasons shall be submitted to the purchaser. The manufacturer shall not commence manufacture of Centre Pivot Liners / half cylinder wear till clear authorization for acceptance of the deviation is granted by the purchaser.

## 6. QUALITY ASSURANCE PLAN

- 6.1 The manufacturer shall submit Quality Assurance Plan (QAP) of Centre Pivot Liners / Half cylinder wear as per the standard format for approval. QAP shall cover all aspects of process / quality control requirement to obtain quality product.
- 6.2 The manufacturer shall proceed for manufacturing of Centre Pivot Liners / Half cylinder wear only after approval of QAP. The firm shall strictly follow the stipulations of QAP.
- 6.3 Any changes incorporated in the manufacturing procedure/ Machinery & Plants associated with the manufacture of components shall be duly incorporated by the manufacturer in QAP.

## 7. MATERIAL

The material used in the manufacture of Centre Pivot Liners / Half cylinder wear shall be “Non-metallic, Wear Resistant, and Self Lubricated” like Polyamide PA6 or nylon alloy, or as specified in the relevant RDSO drawing. The material, as mentioned by the manufacturer of Centre Pivot Liners / Half cylinder wear in their QAP, must be supplied by the primary manufacturer of the raw material. Appropriate lubricant such as MOS2 shall be added by the manufacturer to get the desired self lubricating properties.

Before offering the material for tests, the Centre Pivot Liners / Half cylinder wear manufacturer shall have a suitable tie-up in the form of a written Memorandum of Understanding (MoU) with the primary manufacturer of basic raw material covering supplies and technical support.

The material shall conform to the properties given in Para 10.

Use of regenerated / re-constituted material is not permitted.

Unless otherwise specified in the purchase order, the colour of Centre Pivot Liners / Half cylinder wear shall be the natural colour of the raw material.

## 8. DIMENSIONS AND TOLERANCES

The Centre Pivot Liners shall conform to the dimensions and tolerances as given in the relevant RDSO drawing.

The Half cylinder wear shall conform to the dimensions and tolerances as given in the RDSO drawing No. SK.VL-705 (Rev - Latest) and dimensions with asterisk mark shall be measured with the fixture as given in the drawing.

## 9. MANUFACTURING PROCESS AND FINISH

The Centre Pivot Liners / Half cylinder/ wear shall be smooth, free from air bubbles, surface streaks, splash marks, pinholes, voids, crazing, blistering etc. All the edges shall be neatly finished and shall be free from flash. The Horizontal liner shall be manufactured by either injection moulding or by casting and vertical liner shall be manufactured by either injection moulding or by centrifugal casting. However, half cylinder wear and shall be manufactured by either injection moulding or by centrifugal casting.

The machining on Centre Pivot Liners / Half cylinder wears after moulding is permitted, if required. However, the finished dimensions must conform to the relevant RDSO drawings.

## 10. TECHNICAL REQUIREMENTS

### Physical Properties

The physical properties of the material shall be checked from the finished product wherever practicable and the remaining checks shall be carried out from the test specimen prepared under the identical conditions of moulding of component using the same raw material. The checks shall be conducted as per methods given in the standards mentioned below and their values shall conform to the following limits:

Sr.	Property	Test Method	Unit	Permissible limit
1.	Specific Gravity	ASTM D 792	-	1.12 – 1.25
2.	Hardness	ASTM D 2240	Shore 'D'	80 – 90
3.	Tensile Strength at Yield	ASTM D 638	MPa	70 (Minimum)
4.	Compressive Strength at 5% deflection	ASTM D 695	MPa	85 (Minimum)
5.	Izod Impact Strength (Notch)	ASTM D 256	Joules/ m	25 (Minimum)
6.	Melting Point	ASTM D 3418	°C	200 (Minimum)
7.	Flexural Modulus	ASTM D 790	MPa	2700 (Minimum)
8.	Water Absorption at 23°C temperature after 24 hrs. immersion	ASTM D 570	%	0.6 (Maximum)
9.	Coefficient of Friction (between polymer and steel)	ASTM D 1894	-	0.15 (Maximum)
10.	Compression set at 80° ± 1°C for 24 (+0 /-2) hours)	ISO-815	%	30 (Maximum)
11.	Wear rate*	ISO 7148-2 (Pin-on-disc Method)	µm/km	12 (Maximum)

\*Wear rate test shall be done with a Pin-on-disk apparatus taking the following test conditions:

1.	Contact pressure	3 Mpa
2.	Pin (specimen) diameter	6 mm
3.	Sliding velocity	0.33 m/s
4.	Counter face material	Ground Steel C35
5.	Counter face hardness	160 BHN
6.	Counter face roughness	0.7-0.9 µm (perpendicular to machining grooves)
7.	Environmental condition	Laboratory atmosphere of 23±2°C ambient temp. & 50±5% relative humidity
8.	Testing period	24 hours
9.	Lubrication	No

### Oil Resistance Test

The swelling as determined by the method given in IS: 3400 (Part 6) using an immersion period of 72 (+0 / -2) hours at  $100 \pm 1^{\circ}$  C shall not be more than the limits given below:

Sl.	Volume Swelling Medium	Permissible Limit
1.	In Lubrex -150	5 % (Maximum)
2.	In Grease (Servogem 2 or 3)	5 % (Maximum)

### 11. LOT SIZE, SAMPLING AND CONFIRMATORY TESTS

The Inspecting Agency for the purpose of inspection of the product in reference to a Purchase Order shall carry out the checks as given below:

- .1 The Inspecting Agency shall verify the following aspects before carrying out inspection of centre pivot liners:
  - i. The delivery period of the Purchase Order is valid.
  - ii. Check the records of Internal inspection carried out at various stages of manufacture of the product by the manufacturer's quality control department for the product being offered, and confirm that the results of the internal inspection records are in order.
  - iii. The measuring instruments, gauges, testing facilities, etc are in working order and they are calibrated.
  - iv. The latest copies of all reference specifications mentioned in this specification are available with the manufacturer.
- .2 The lot size of Centre Pivot Liners/ half cylinder wear to be offered in one inspection shall be 50 nos. or full quantity if the order is for less than 50 nos.
- .3 The sample size, which shall be randomly drawn by the Inspecting Agency from each lot of Centre Pivot Liners / Half cylinder wear offered for inspection for verification of various properties is detailed below. The following tests shall be carried out on the finished product wherever practicable and the remaining checks shall be carried out from the test specimen prepared under the identical conditions of moulding of Centre Pivot Liners / Half cylinder wear, using the same raw material. The samples shall be tested as per the test method specified in Para 10 and the values shall conform to the corresponding permissible values. Check sheets as per enclosed proforma 1 to 3 shall be prepared.

Sl.	Test	Sample Size
1.	Visual check	05 Nos.
2.	Dimensional check	05 Nos.
3.	Specific Gravity	02 Nos.
4.	Tensile Strength at yield	02 Nos.
5.	Hardness	05 Nos.
6.	Compression Set	02 Nos.
7.	Water Absorption Test	02 Nos.
8.	Compressive Strength	02 Nos.

9.	Izod Impact Strength (Notch)	02 Nos.
10.	Flexural Modulus	02 Nos.

If the quantity offered for inspection is less than 50 nos., the sample sizes will be as per a lot of 50 nos. as mentioned above.

#### **Additional Tests for Prototype Approval:**

In addition to the tests mentioned above, the following tests shall be carried out at the time of prototype approval, or if there is any quality issues, arising from failures in field or design review or design change.

Sl.	Test	Sample Size
1.	Type of Polymer (Polymer identification)	01 No.
2.	Coefficient of Friction (between polymer and steel)	02 Nos.
3.	Wear rate	02 Nos.
4.	Melting point	02 Nos.
5.	Oil Résistance Test	02 Nos.

The Manufacturer shall be responsible for carrying out these tests. Check sheet as per enclosed proforma 4 shall be prepared. Manufacturers not having facility for any of these additional tests shall arrange for them at any NABL accredited laboratory or some overseas laboratory of international repute.

#### **11.4 Acceptance Criteria**

1. The manufacturer shall not withdraw the material offered for inspection during the course of inspection. Any move by the manufacturer in any way, to withdraw the material / interfere / hinder with the inspection, shall render rejection of the entire quantity of material offered for inspection.
2. If any sample fails in one or more criteria given in Para 10 of this specification, double the sample size shall be drawn and tested against the criteria in which the failure had occurred. If all the samples of double sampling pass the criteria, the entire quantity shall be accepted.
3. Failure of any sample out of the double lot of samples will, however, result in rejection of the entire offered quantity. The intimation of the failure and rejection shall also be sent to the purchaser.
4. In the event of rejection, the entire quantity offered for inspection shall be made un-usable for Railway application in presence of the Inspecting Agency.

#### **11.5 Stamping**

Centre Pivot Liners / Half cylinder wear, which have been inspected and passed, shall be double stamped by the Inspecting Agency. The entire quantity of Centre Pivot Liners / Half cylinder wear from which the sampling has been taken shall be stamped (single stamp mark) by the Inspecting Agency. Double stamping mark is to identify the samples, which were drawn for inspection for future reference in the event of any dispute.

## 12. FIELD TRIAL

12.1 Qualifying Quantity and Qualifying period for approval as a 'Developmental vendor' shall be '03 loco sets' and 'One Year' for 'Half Cylinder wear' and '05 loco sets' and 'One Year' for 'Centre Pivot Liner'.

12.2 Field trial performance feedback format is enclosed as Proforma-5.

12.3 After successful completion of field trial approval may be considered.

## 13. MARKING

Each Centre Pivot Liners / Half cylinder wear shall be marked by hot punching containing the following information by embossing with letter height of 4 mm (min.) at the location specified in relevant drawing:

Drawing number

Manufacturer's name (initial / trade mark)

Serial No.

Month and Year of manufacture

## 14. PACKING

The Centre Pivot Liners / Half cylinder wear shall be suitably packed in cardboard boxes to protect them against damage during transit and storage.

## 15. STORAGE

The Centre Pivot Liners / Half cylinder wear shall be stored in a cool and dry place.

## 16. PREFERENCE TO MAKE IN INDIA

The government of India policy on 'Make in India' shall apply.

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## GENERAL CHECK SHEET

Srl.	Description	Observations
1.	Name of Component	
2.	Firm's Name & address	
3.	Date (Period) of Inspection	
4.	Contract Details as per P.O.	
	a) Purchase Order No. & Date	
	b) Order placing Authority	
	c) Specification No.	
	d) Drawing No.	
5.	Quantity on Purchase Order	
6.	Quantity offered for Inspection	
7.	Consignee	
8.	Validity of D.P. of P.O.	
9.	Remarks on internal checks carried out by the firm	
10.	Remarks on calibration of Measuring Instruments & Testing Facilities	
11.	Tie-up with raw material Supplier with memorandum of understanding (MOU) : Yes/No	

Quality Control Manager of Firm	Authorized Representative of Inspecting Agency

**REGULAR CHECK SHEET**

**i. Specific gravity (Specified Value: 1.12 to 1.25)**

Property	Test method	Observed Value		Remarks
		Sample 1	Sample 2	
Specific Gravity	ASTM D 792			
		Mean Value:		

**ii. Hardness (Specified Value: 80-90 Shore D)**

Property	Test method	Observed Value										Remarks
		Sample 1					Sample 2					
		a	b	c	d	e	a	b	c	d	e	
Hardness (Shore D)	ASTM D 2240											
		Mean Value:										

**iii. Tensile Strength at Yield (Specified Value: 70 MPa (minimum))**

Property	Test method	Observed Value										Remarks
		Sample 1					Sample 2					
		a	b	c	d	e	a	b	c	d	e	
Tensile Strength at Yield (MPa)	ASTM D 638											
		Mean Value:										

**iv. Compressive Strength at 5% deflection (Specified Value: 85 MPa (minimum))**

Property	Test method	Observed Value										Remarks
		Sample 1					Sample 2					
		a	b	c	d	e	a	b	c	d	e	
Compressive Strength at 5% def. (MPa)	ASTM D 695											
		Mean Value:										

<b>Quality Control Manager of Firm</b>	<b>Authorized Representative of Inspecting Agency</b>

v. Izod Impact Strength [Notch] (Specified Value: 25 J/m (minimum))

Property	Test method	Observed Value								Remarks	
		Sample 1				Sample 2					
		a	b	c	d	e	a	b	c		d
Izod impact Strength (J/m)	ASTM D 256										
		Mean Value:									

vi. Flexural modulus (Specified Value: 2700 MPa (minimum))

Property	Test method	Observed Value										Remarks
		Sample 1					Sample 2					
		a	b	c	d	e	a	b	c	d	e	
Flexural modulus (MPa)	ASTM D 790											
		Mean Value:										

vii. Water absorption at 23<sup>0</sup>C for 24 hrs. immersion (Specified Value: 0.6 % (maximum))

Property	Test method	Observed Value						Remarks
		Sample 1			Sample 2			
Water absorption (%)	ASTM D570	a	b	c	a	b	c	
		Mean Value:						

ix. Compression Set at 80±1<sup>0</sup>C for 24(+0/-2) hrs. (Specified Value: 30 % (maximum))

Property	Test method	Observed Value						Remarks
		Sample 1			Sample 2			
		a	b	c	a	b	c	
Compression Set (%)	ASTM D 395							
		Mean Value:						

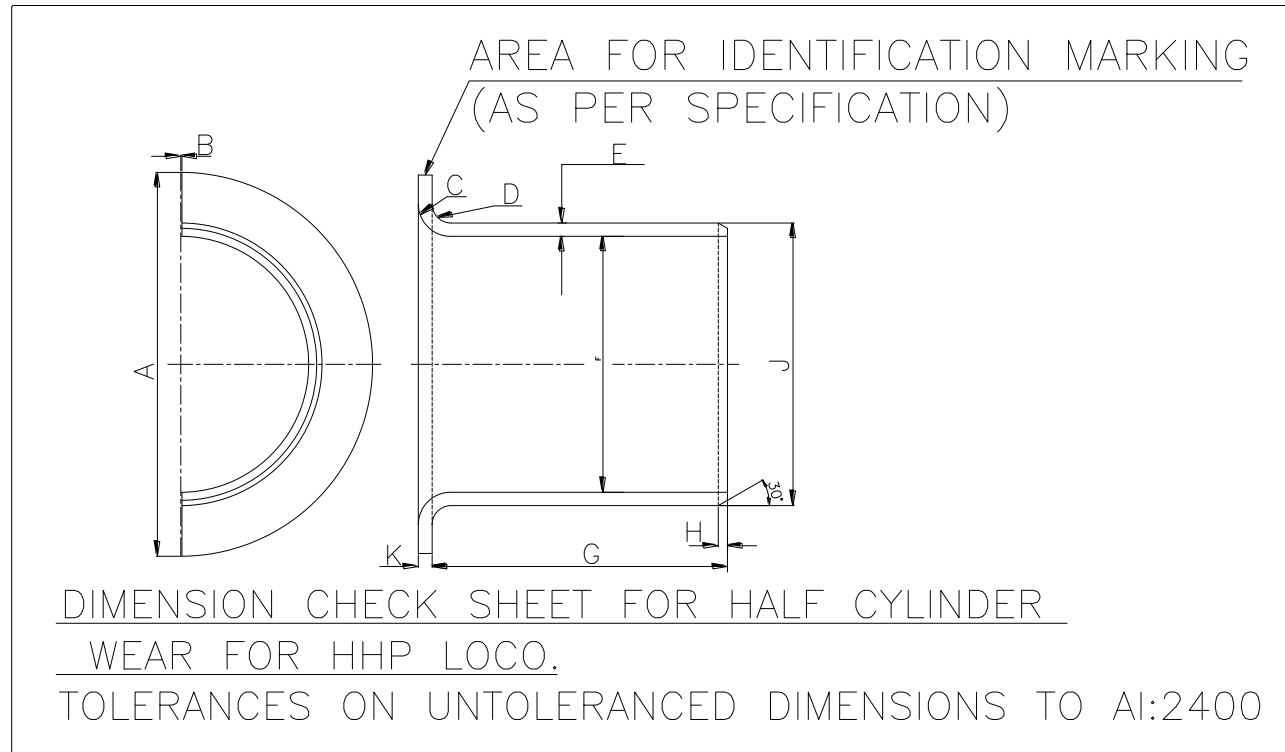
VISUAL AND DIMENSIONAL CHECK SHEET

x. Visual Check:

Parameter	Sample No.					Remarks
	1	2	3	4	5	
Visual Check						
Identification Marking						

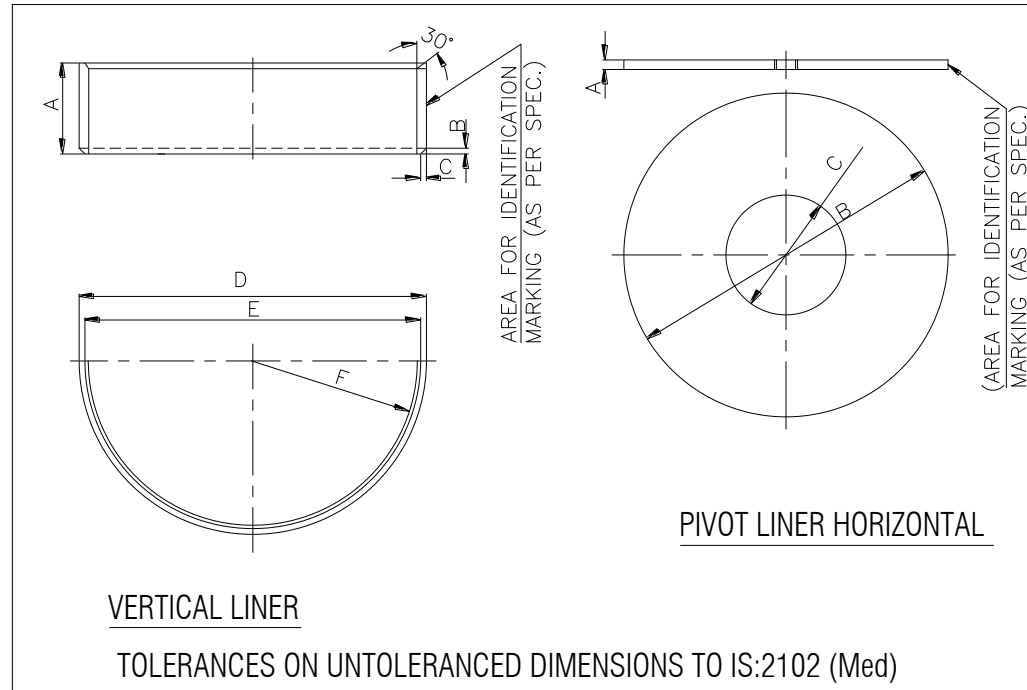
xi. Dimensional Check:

A. Dimension check sheet for Half cylinder Wears for HHP locomotives, as per Drawing No.SK.VL-705.



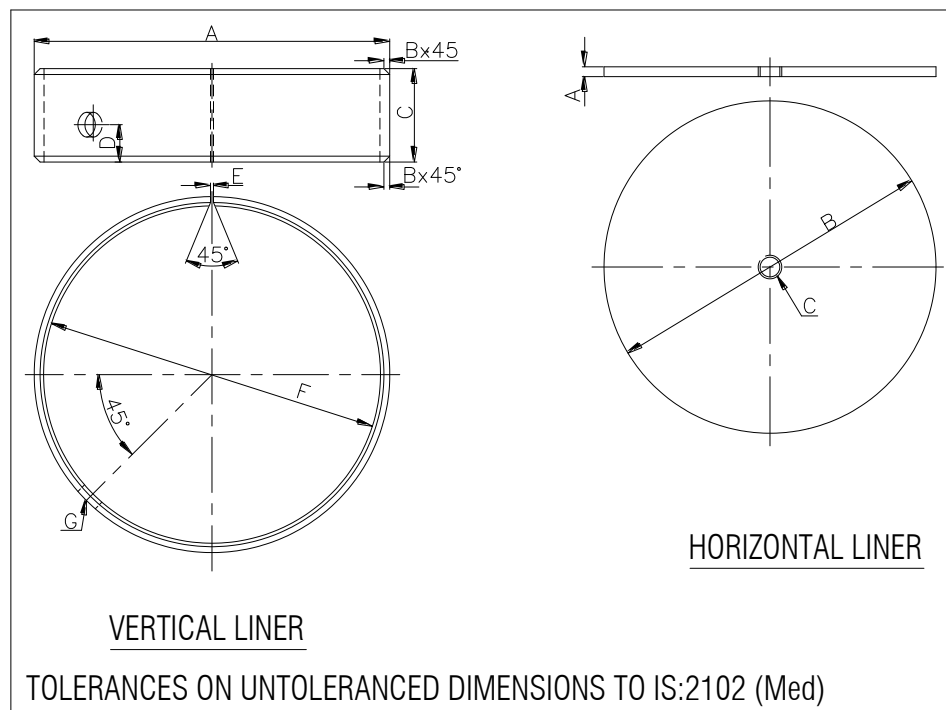
Locations	Dimension as per Drg. No.....	Sample No.				
		_____	_____	_____	_____	_____
A						
B						
C						
D						
E						
F						
G						
H						
J						
K						
Marking						
Remarks on Pass/Fails						

**B. Dimension check sheet for Centre Pivot Liners for locomotives, as per Drawing No. SK.DL-3255.**



Location	Dimension as per Drg. No.....	Sample No.				
		-----	-----	-----	-----	-----
A						
B						
C						
D						
E						
F						
Marking						
Remarks on Pass/Fails						

C. Dimension check sheet for Centre Pivot Liners for locomotives as per Drawing No. SK.VL-472.



Location	Dimension as per Drg.No. _____	Sample No.				
		_____	_____	_____	_____	_____
A						
B						
C						
D						
E						
F						
G						
Marking						
Remarks on Pass/Fails						

**Additional Tests for Prototype Approval:****i. Type of Polymer (Polymer identification)**

Name of polymer	Test method / document	Observation	Remarks

**ii. Coefficient of friction : (Specified Value: 0.15-0.2 (Maximum))**

Property	Test method	Observed Value						Remarks
		Sample 1			Sample 2			
Coefficient of friction	ASTM D 1894	a	b	c	a	b	c	
		Mean Value:						

**iii. Wear rate (Specified Value: 12  $\mu\text{m}/\text{km}$  (maximum))**

Property	Test method	Observed Value		Remarks
		Sample 1	Sample 2	
Wear rate (μm/km)	ISO 7148-2			
		Mean Value:		

**iv. Melting point (Specified Value: 200°C (minimum))**

Property	Test method	Observed Value		Remarks
Melting point (°C)	ASTM D 3418	Sample 1	Sample 2	
		Mean Value:		

- v. Oil resistance test at 100°C for 72 (+0/-2) hrs. immersion : Specified Value: In Lubrex-150 : 5 % swelling (maximum)  
In Grease [Servogem 2 or 3] : 5 % swelling (maximum)

Parameters	Test method	Observed Value						Remarks
		Sample 1			Sample 2			
Swelling in Lubrex-150 (%)	IS:3400 Part 6	a	b	c	a	b	c	
Mean Value:								
Parameters	Test method	Observed Value						
		Sample 1			Sample 2			
		a	b	c	a	b	c	
Swelling in Grease (Servo gem 2 or 3) (%)	IS:3400 Part 6							
		Mean Value:						

Quality Control Manager of Firm	Authorized Representative of Inspecting Agency

**PERFORMANCE FEEDBACK PROFORMA****PROFORMA- 5**

S.No.	Loco No. / Type	Fitment date	Make	Whether Still in Service (Y/N)	Removal Details		Life Obtained	Remarks
					Removal Date	Cause		
1.								
2.								
3.								
4.								
5.								
6.								
7.								