

Elastomeric Bridge Bearing



ELASTIC MODULUSE TEST 10MPa to 20MPa

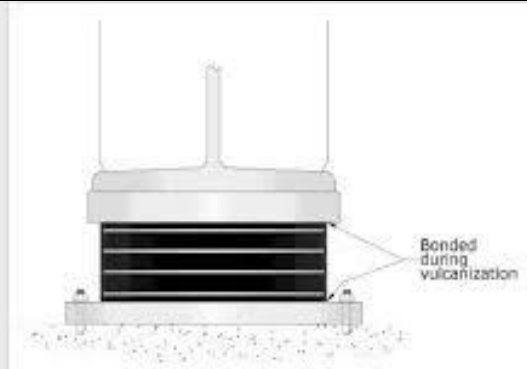
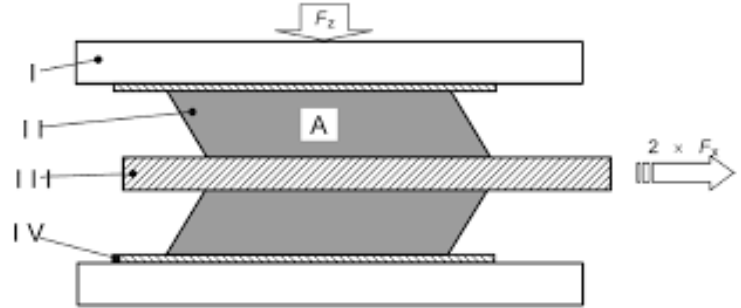


FIGURE - C

Ultimate Compression Strength 60MPa

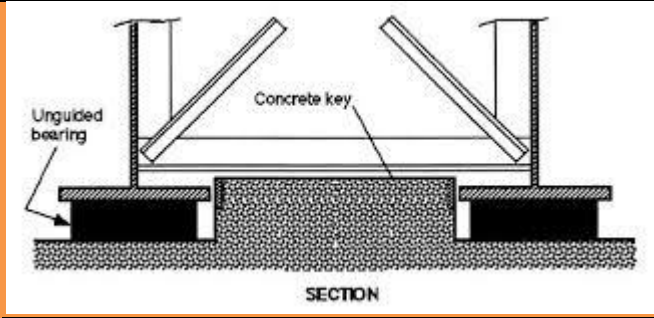
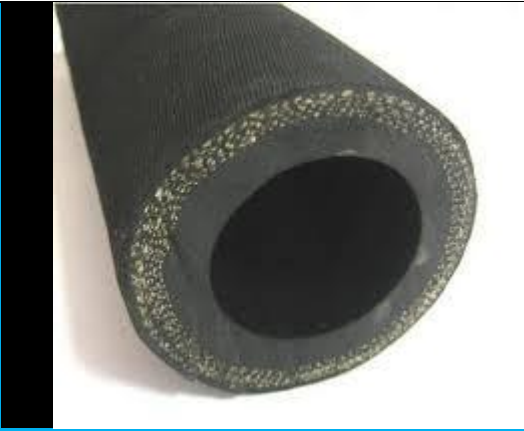
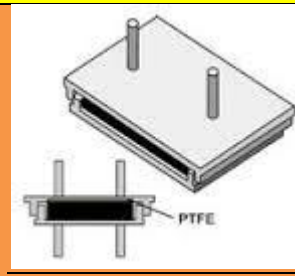
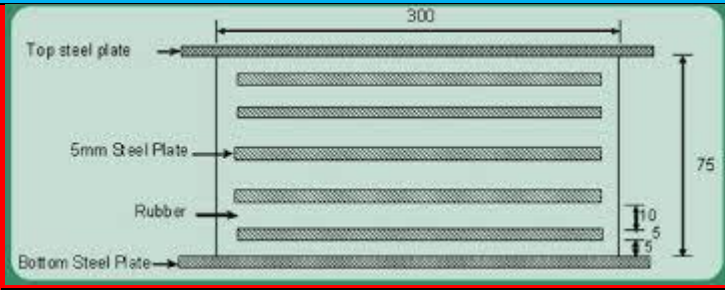
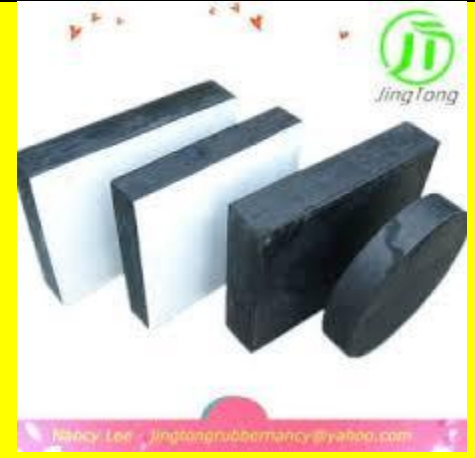


**Adhesion Strength
(Stripping Test) at 4MPa
VL and 3MPa HL**



Shear Modulus Test 5MPa VL and HL load 2H

Plot No 5-24-1223/5/1, Ambedkar Nagar,
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Technical Details

Sr No.	Test	Unit	Specification and Testing Method	Specimens	
1	Hardness	IRHD	IS: 3400 (Part II) Cl.5.1.2.2	4.0mm (min) thickness of Test specimen	
2	Tensile Strength	MPa	IS:3400 (Part I) Table 1 Type -1	Thick- 2.0 ± 0.20 mm	
3	Elongation at Break	%		Width 6.0 ± 0.40 mm Bench Mark-25.0mm (max)	
4	Adhesion Strength (Metal to Rubber)	KN/M	IS:3400 (Part XIV) Cl.3.3	Length -125mm Width-25mm	
5	Ash Content	%	IS:3400 (Part XXII) Cl. A-8.3.1 IS	1 g (min)	
6	Polymer Identification	Chemically		0.5 g (min)	
7	Percentage of Polymers	%		1 g (min)	
8	Compression Set	%	IS: 3400 (Part X) Cl. 5.1	Thick - 12.5 ± 0.50 mm Dia- 29 ± 0.50 mm	
9	Elastic Modulus	MPa	IRC 83 (Part II) 1987, UIC 772 -2R and MORTH	2 Nos from Finish Product	
10	Shear Modulus	MPa		One Specimen size of 100x200mm (Cutting Piece from Finish product.)	
11	Ultimate Compression Strength	MPa			Two Specimen size of 100x 100mm (Cutting from Finish Product)
12	Stripping Strength (Adhesion Strength)	MPa			
13	5MPa and 15 MPa Deflection Test	MPa	IRC 83 (Part II) 1987, and MORTH	100% on finish Product.	

Sr No.	Test	Calculation
1	Cross Section	Thickness x Width of Dumbbell.
2	Tensile Strength	$\text{Tensile Strength} = \frac{\text{Breaking Load}}{\text{Cross Section}}$
3	Elongation at Break	$\text{EB} = \frac{\text{Breaking Length} - \text{Bench Mark (Initial Length)}}{\text{Bench Mark (Initial Length)}} \times 100$
4	Adhesion Strength	$\text{Adhesion Strength} = \frac{\text{Separation Load}}{\text{Width of Specimen}}$
5	Ash Content	$\text{Ash Content} = \frac{W3 - W1}{W2 - W3} \times 100$ <p>W1- Empty Crucible Wt. W2- Crucible + Sample Wt. W3- Crucible + after ignition</p>
6	Polymers Percentage	
i	Acetone Extraction for 96 cycles for 16 hours	$\text{Other Ingredient} = \frac{W1 - W2}{W1} \times 100$ <p>W1- Sample Weight W2- After Acetone Extraction</p>
ii	Carbon Extraction for 2 hours	$\text{Carbon} = \frac{W1 - W2}{W1} \times 100$ <p>W1- Sample Weight after acetone extraction. W2- After carbon Extraction</p>
iii	Ash Content	$\text{Ash Content} = \frac{W3 - W1}{W2 - W3} \times 100$ <p>W1- Empty Crucible Wt. W2- Crucible + Sample Weight after carbon extraction. W3- Crucible + after ignition</p>
7	Polymer Identification as per (ASTM D297 and IS:3400 (Part XXII))	
	Solution II- Initial Color – Green when react with fumes of sample should turn in to red	

8	Compression Set	<p>Initial Thick –Recover Thick</p> $CS = \frac{\text{Initial Thick} - \text{Recover Thick}}{\text{Compressed Thick}} \times 100$ <p>Note: Compressed Thickness is 25% of Initial Thickness</p>
Sr No.	Test	Calculation
9	Physical Properties After Ageing	
i	Change in Hardness	$\frac{\text{Hardness After Ageing} - \text{Hardness Before Ageing}}{\text{Hardness Before Ageing}} \times 100$
ii	Change in Tensile Strength	$CTS = \frac{\text{Tensile Strength After Ageing} - \text{Tensile Strength Before Ageing}}{\text{Tensile Strength Before Ageing}} \times 100$
iii	Change in Elongation at Break	$CEB = \frac{\text{Elongation at Break After Ageing} - \text{Elongation at Break Before Ageing}}{\text{Elongation at Break Before Ageing}} \times 100$
10	Elastic Modulus	
i	Pad Area (Effective area of Bearing excluding cover common to that of laminate)	<p>A=l x b</p> <p>l- Length</p> <p>b- Width</p>
ii	Pressure (Kg/cm ²)	<p>1 MPa = 10.1936 Kg/cm²</p> <p>$\alpha m, 2MPa = \text{Initial Load (as per IRC 83 (Part II) 1987}$</p> <p>$2x 10.1936x \text{ Pad Area}$</p> <p>2MPa = $\frac{\text{Initial Load}}{\text{Vertical Cylinder Area}}$</p> <p>N test, 20MPa=Max Load (as per IRC 83 (Part II) 1987</p> <p>$20x 10.1936x \text{ Pad Area}$</p> <p>20MPa = $\frac{\text{Max Load}}{\text{Vertical Cylinder Area}}$</p>
iii	Load on Bearing	Pressure x Vertical Cylinder Area
iv	Average	$\text{Average} = \frac{\text{Deflection (D1 + D2+D3+D4)}}{4}$
v	Strain	$\text{Strain} = \frac{\text{Deflection (Average)}}{\text{Total Rubber Thick x 2}}$
vi	Stress MPa	$\text{Stress MPa} = \frac{\text{Pressure Kg/cm}^2}{10.1936 x \text{ Pad Area}}$

		Vertical Cylinder Area
Sr No.	Test	Calculation
Vii	Elastic Modulus	$E_a = \frac{\alpha_{20MPa} - \alpha_{10MPa}}{\frac{E \text{ at } 20MPa - E \text{ at } 10MPa}{\text{Stress } 20 \text{ MPa} - \text{Stress } 10 \text{ MPa}}}$ $E_a = \frac{\text{Strain at Stress } 20MPa - \text{Strain at Stress } 10 \text{ MPa}}{\text{Stress } 20 \text{ MPa} - \text{Stress } 10 \text{ MPa}}$
11	Shear Modulus	
i	Pad Area (Effective area of Bearing excluding cover common to that of laminate)	A=l x b l- Length b- Width
ii	Load on Bearing	Pressure x Horizontal Cylinder Area
iii	Strain	$\text{Strain} = \frac{\text{Deflection (mm)}}{\text{Total Rubber Thick}}$
Vi	Stress MPa	$\text{Stress MPa} = \frac{\text{Load on Bearing}}{2 \times 10.1936 \times \text{Pad area}}$
vii	Shear Modulus	$G = \frac{\tau \text{ at } \gamma 1 - \tau \text{ at } \gamma 0.2}{\gamma 1 - \gamma 0.2}$ $G = \frac{\text{Stress at Strain } 1 - \text{Stress at Strain } 0.2}{\gamma \tau \text{ Strain } 1 - \text{Strain } 0.2}$
12	Shape Factor	Ratio of the one loaded surface area to the surface area free to bulge, for an internal layer of elastomeric (excluding side cover) $S = \frac{\text{Effected area (lxb)}}{(l+b) \times 2 \times \text{Thickness of Individual Elastomer (in cm)}}$ l = Length of Steel Laminate b = Width of Steel Laminate
13	Ea Elastic Modulus	$E_a = \frac{1}{0.2/(S)^2 + 0.0005}$

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Sr No.	Test	Calculation
14	Shear Modulus as per UIC 772-2R	$G = \frac{\tau \text{ at Tan30 Deg} - \tau \text{ at Tan15 Deg}}{\text{Tan30 Deg} - \text{Tan15 Deg}}$ $G = \frac{\text{Stress at Strain 30 Deg} - \text{Stress at Strain 15 Deg}}{\text{Strain 30 Deg} - \text{Strain 15 Deg}}$
15	Adhesion Strength Test as per UIC 772 – 2R	<p>10 MPa Vertical Load</p> <p>Horizontal Load – 2Tan γ (Total rubber thickness x 2)</p> <p>Vertical Load Should be 10 MPa which should be given through out the test and Horizontal Load shall be increased gradually up to max (2Tan γ) i.e. two times of total rubber thickness.</p>
16	Ultimate Compressive Strength as per UIC 772 -2R	<p>66 MPa Vertical Load</p> <p>1 MPa = 10.196 Kg/cm²</p> $66 \text{ MPa} = \frac{66 \times 10.1936 \times \text{Test Specimen area}}{\text{Vertical Cylinder area}}$ <p>Condition of Loading</p> <p>The ration of loading shall not exceed 10 MPa per minute the Vertical loading shall increase gradually up to 66 MPa</p>
17	Ultimate Compressive Strength as per IRC 83 (Part II) 1987	<p>60MPa Vertical Load</p> <p>1 MPa = 10.196 Kg/cm²</p> $60 \text{ MPa} = \frac{60 \times 10.1936 \times \text{Test Specimen area}}{\text{Vertical Cylinder area}}$ <p>Condition of Loading</p> <p>The ration of loading shall not exceed 10 MPa per minute the Vertical loading shall increase gradually up to 60 MPa</p>
18	Adhesion Strength as per IRC 83 (Part II) 1987	<p>4.MPa Vertical Load</p> <p>3MPa Horizontal Load</p> <p>1 MPa = 10.1936 kg/cm²</p> $4 \text{ MPa} = \frac{4 \times 10.1936 \times \text{test Specimen area}}{\text{Vertical Cylinder area}}$ $3 \text{ MPa} = \frac{3 \times 10.1936 \times \text{Test Specimen area}}{\text{Horizontal Cylinder area}}$

Sr No	Test	Unit	MOSRTH	Ref	IRC	Ref	UIC	Ref
1.Physical Properties – Before Ageing								
i	Hardness	IRHD	60+5		60+5		60+5	ISO 6446 Cl. 6.2.1 Table - 3
ii	Tensile Strength	MPa	17.0 (min)		17.0 (min)		13.0 (min)	ISO 6446 Cl. 6.2.2 Table - 3
iii	Elongation at Break	%	400(min)		400 (min)		400 (min)	
2	Adhesion Strength	Kn/m	7 (min)		7 (min)		7 (min)	ISO 6446 Cl.6.1.5 Table 3
3	Polymer		CR		CR		CR	ISO 6446 Cl. 4.1
4	Ash Content	%	5.0 (max)		5.0 (max)		Nil	
5	Compression Set	%	30 (max)		30 (max)		20 (max)	ISO 6446 Cl. 6.2.3 Table 3
6 Physical Properties – After Ageing								
i	Change in Hardness	IRHD	+15	Page 501	+15	Table 1 Cl.915.2	+15	ISO 6446 Cl. 6.2.4 Table 3
ii	Change in Tensile Strength	%	-15		-15		-15	
iii	Change in Elongation at Break	%	-40		-30		-40	
7	Elastic Modulus Ea	MPa	20 MPa	Page 508	20 MPa	Cl.10.5	11.0 MPa	UIC 772 2R Appendix-1 Cl.2.1.4.3
8	Shea Modulus	MPa	1.0 + 20%	Page 501	1.0 + 20%	Cl.9.2	1.0 + 15%	UIC 772 2R Appendix-1 Cl.3.1.3
9	Ultimate Compressive Strength	MPa	60 (min)	Page 508	60 (min)	Cl.12	66 (min)	UIC 772 2R Appendix-1 Cl.2.1.4.3

Sr No	Test	Unit	MOSRTH	Ref	IRC	Ref	UIC	Ref
10	Stripping Strength	MPa	VL-4MPa and HL- 3 MPa	Page 508	VL-4MPa and HL- 3 MPa		2xTan θ	UIC 772 2R Appendix-1 Cl.2.1.4.4
11	5 and 15 MPa Deflection Test	MPa	+20% of Mean Deflection		+20% of Mean Deflection			Nil
12	Dimension Test							
i	Length	Mm	+6	Page 503	+6		+5	UIC 772 2R Appendix-2 Cl. 2.2
ii	Width	Mm	+6		+6		+5	
iii	Thickness	Mm	+5%		+5%		+5%	

Thickness and Tolerance as per UIC 772 2R

≤ 30 mm	± 1.00 mm
≤ 50 mm	± 1.20 mm
≤ 80 mm	± 1.50 mm
≤ 120 mm	± 1.80 mm
> 120mm	± 1.50%