

<b>Laboratory</b>	<b>Metallurgical Laboratory, Heavy Vehicles Factory, Avadi, Chennai, Tamil Nadu</b>		
<b>Accreditation Standard</b>	<b>ISO/IEC 17025: 2005</b>		
<b>Discipline</b>	<b>Mechanical Testing</b>	<b>Issue Date</b>	<b>18.09.2016</b>
<b>Certificate Number</b>	<b>T-0951</b>	<b>Valid Until</b>	<b>17.09.2018</b>
<b>Last Amended on</b>	<b>22.09.2016</b>	<b>Page</b>	<b>1 of 3</b>

<b>S. No.</b>	<b>Product / Material of Test</b>	<b>Specific Test Performed</b>	<b>Test Method Specification against which tests are performed</b>	<b>Range of Testing / Limits of Detection</b>
<b>I. MECHANICAL PROPERTIES OF METALS</b>				
<b>1.</b>	<b>Ferrous Metals</b>	Brinell Hardness	IS 1500 (Part 1): 2013 ASTM E-10: 2015a	186 HBW to 559 HBW (5 mm/7357.5 N) 188 HBW to 544 HBW (10mm/29430 N)
		Rockwell Hardness 'C' Scale	IS 1586 (Part 1): 2012 ASTM E18: 2016	20 HRC to 70 HRC
		Vickers Hardness	IS 1501: 2013 ASTM E 384: 2016	245 HV <sub>1</sub> to 852 HV <sub>1</sub> 545 HV <sub>5</sub> to 730 HV <sub>5</sub> 193 HV <sub>10</sub> to 544 HV <sub>10</sub>
		Micro hardness	ASTM E-384: 2016 IS 1501 (Part 1): 2013 ASTM E 92 : 2016	300 HV <sub>0.01</sub> to 867 HV <sub>0.01</sub> 300 HV <sub>0.05</sub> to 2000 HV <sub>0.05</sub> 300 HV <sub>0.1</sub> to 867 HV <sub>0.1</sub>
<b>2.</b>	<b>Ferrous &amp; Non Ferrous Metals</b>	Rockwell Hardness 'B' Scale	IS 1586 (Part 1): 2012 ASTM E18: 2016	35 HRB to 100 HRB
		Tensile Test	IS 1608: 2005 (RA 2011)	40 kN to 900 kN
		Yield Stress		120 N/mm <sup>2</sup> to 1861 N/mm <sup>2</sup>
		UTS		127 N/mm <sup>2</sup> to 2068 N/mm <sup>2</sup>
		% Elongation		2 % to 90 %
		% Reduction in Area		10 % to 75 %
		Bend Test	IS 1599: 2012 IS 2329: 2012	Qualitative (Mandrel dia 30 mm)

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	<b>Ferrous &amp; Non Ferrous Metals</b>	Charpy 'U' Notch	IS 1499: 1977 (RA 2009)	1 kgf-m to 30 kgf-m (at room temperature)
		Charpy 'V' Notch	IS 1757: 1988 (RA 2009)	1 kgf-m to 30 kgf-m (at room temperature)
<b>3.</b>	<b>Ferrous Springs</b>	Spring Rating for Tension	IS 7907: 2004	25 kgf to 225 kgf
		Spring Rating for Compression	IS 7906: 2004	25 kgf to 225 kgf
<b>II. METALLOGRAPHY</b>				
<b>1.</b>	<b>Ferrous &amp; Copper Alloys</b>	Macro Etching Test	IS 11371-85 (RA 2012) IS 13015-91 (RA 2012) IS 13484: 1992 (RA 2007) ASTM E 340: 2015	Qualitative (Magnification: 10X)
<b>2.</b>	<b>Cast Iron, Ferrous &amp; Copper Alloys</b>	Micro Structures	ASTM E 3-01 (RA 2007) ASTM E 407: 2007 ASTM Atlas Vol. 9/88 ASTM E 1951-02: (2007)	Qualitative (Magnification 50X to 1000X)
<b>3.</b>	<b>Cast Iron</b>	Form Size Distribution	ASTM A 247: 2010 IS 7754: 75 (RA 2012)	Form: I to VII Size: 1 to 8 Distribution: A to E
<b>4.</b>	<b>Steel</b>	Grain Size by comparison method	IS 4748: 2009 ASTM E-112: 2013 GOST 5639: 1982	Qualitative (GS ASTM 00 to 10)
		Inclusion content by method 'A'	IS 4163: 2004 (RA 2010)	Qualitative (Magnification 20X to 100X, ASTM No.0.5-3.0 Type A to D)

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	<b>Steel</b>	Total Case Depth by microscopic method	IS 6416: 1988 (RA 2012) ASTM E 1077: 2014 IS 13691: 93 (RA 2012)	0.02 mm to 3.6 mm (Magnification : 100X)
		Decarburized layer	ASTM E 1077: 2014 IS 6396: 2000 (RA 2012) ISO 3887: 2003	Qualitative (Magnification : 100X, DC Layer from 0.02 mm to 1.8 mm)
<b>III. RUBBER &amp; RUBBER PRODUCTS</b>				
<b>1.</b>	<b>Rubber</b>	Tensile Strength	IS 3400 (Part 1): 2012 GOST. 270-1973	1.25 N/mm <sup>2</sup> to 1125 N/mm <sup>2</sup>
		% Elongation		1 % to 1150 %
		Accelerated Aging	IS 3400 (Part 1): 2012 GOST. 9.024 -1974	(-)60 °C to (+)100 °C max
		Density	IS 3400 (Part 9): 2003	0.8 g/cc to 2.5 g/cc
		Hardness	GOST. 263-1975 ASTM D 2240: 2015 IS 3400 (Part 23): 2002	10 Shore A° to 90 Shore A°

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