

<b>Laboratory</b>	<b>TCR Engineering Services Private Limited, Plot No. EL-182, MIDC, TTC Industrial Area, Electronic Zone, Mahape, Navi Mumbai, Maharashtra</b>		
<b>Accreditation Standard</b>	<b>ISO/IEC 17025: 2005</b>		
<b>Discipline</b>	<b>Mechanical Testing</b>	<b>Issue Date</b>	<b>27.02.2016</b>
<b>Certificate Number</b>	<b>T-0368</b>	<b>Valid Until</b>	<b>26.02.2018</b>
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<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 MATERIAL</b>				
<b>1.</b>	<b>Ferrous &amp; Non Ferrous Metals</b>	Tensile Test	ASTM A 370: 2015	10 kN to 950 kN
		Yield Strength (0.2 & 1 % Yield Stress)	E 8: 2015a B 557: 2015	2 % to 80 % 2 % to 65 %
		Ultimate Tensile Strength	BS EN 10002-1: 2001	1 kN to 350.0 kN
		Elongation	IS 1608: 2005	2 % to 80 %
		Reduction Area	ASME Sec IX: 2015 ISO 6892-1: 2009 ISO 898-1: 2013	2 % to 65 %
		Elevated Tensile Test (80°C to 800°C)	ASTM E 21: 2009 EN 10002-5: 1991	10 kN to 950 kN 5 kN to 45 kN
		YS /(0.2 & 1 % Yield Stress)	ISO 6892-2: 2011	25 kN to 240 kN
		Ultimate Tensile Strength		
		Elongation		2 % to 80 %
		Reduction Area		2 % to 65 %
		Fatigue Test	ASTM E 606: 2012	5 kN to 45 kN
		LCF & HCF	ASTM E 466: 2015	25 kN to 240 kN
		Tension-Tension	IS 5074: 1969	
Tension-Compression	BS 7448 (Part 1 to 4)			
Compression-Compression	(I-1991, II-1997, III-2005, IV-1997)			
CTOD	ASTM E 399: 2012e3			
KIC & JIC	ISO 15653: 2010			
Proof Load Test (For BOLT & NUTS)	IS 1367 (Part 6): 1994 IS1367 (Part 3): 2002 ASTM A 370: 2015	10 kN to 950 kN		

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	<b>Ferrous &amp; Non Ferrous Metals</b>	Brinell hardness	ASTM A 370: 2015 IS 1500 (Part 2): 2013 ASTM E10: 2015	100 HBW to 400 HBW (2.5 /187.5 ) 50 HBW to 303 HBW (2.5/62.5) 50 HBW to 125 HBW (2.5/31.25)
		Vickers' Hardness	IS 1501 (Part 1): 2013 IS 1501 (Part 2): 2013 ASTM E 384: 2011e1	40 HV5 to 700 HV5 80 HV10 to 600 HV10 HV 0.1,0.2,0.3, 0.5, 1.0 – (50 to 800)
		Rockwell Hardness	IS 1586 (Part 2): 2012 ASTM E 18: 2015	30 HRB to 100 HRB 20 HRC to 70 HRC
		Bend Test	IS1599: 2012 ASTM A 370: 2015 ASTM E 290: 2014 ASTM E 190: 2014 ASME Sec IX: 2015 BS EN 910: 1996	Qualitative (Mandrel Diameter: 10 mm to 275 mm)
		IZOD Impact Test (At Ambient Temp.)	IS 1598: 1977 (RA 2003)	2 J to 150 J / (2 J to 120 J)
		Charpy V-Notch Impact Test (+)50 °C to (-)196 °C	ASTM A 370: 2015 ASTM E 23: 2012c BS EN875: 1995 BS EN 10045-1: 1990 IS 1757: 1998 DIN-EN-ISO-148-1: 2011	2 J to 250 J/ (2 J to 250 J) 2 J to 400 J (2 J to 350 J)

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	<b>Ferrous &amp; Non Ferrous Metals</b>	Flattening Test (Tubes & Pipes)	ASTM A 370: 2015 ASTM B 111: 11 IS 2328: 2005 IS 2501: 95 (RA 2006)	Qualitative (OD : 6 mm to 600 mm)
		Flaring / Drift Test (Tubes)	ASTM A 370: 15 ASTM B 153: 11 IS 2335: 2005 IS 2501: 1995 (RA 2006)	Qualitative (OD: 10 mm to 168 mm)
		Erichson Cupping Test (Ferrous Sheet)	IS 10175 (Part 1): 1993 (RA 2003) ISO 8490: 1986	Qualitative (Thickness : 0.20 mm to 2 mm)
		Pneumatic Pressure Test (3.18 mm to 25.4 mm OD /Pipes /Tubes)	IS 2501: 1995 (RA 2006) ASTM B 75: 2011 ASTM B 111 : 2011	Qualitative (2 kg/cm <sup>2</sup> to 15 kg/cm <sup>2</sup> )
		Hydraulic Pressure Test (6.0 mm to 168.3mm OD /Tubes/Pipes/Fittings)	ASTM A 530: 12 ASTM A 450: 15 ASTM A 999: 2014 ASTM B 75M : 2011 ASTM B 111: 2011 ASTM E 1003: 2013	Qualitative (2 kg/cm <sup>2</sup> to 70 kg/cm <sup>2</sup> ) (5 kg/cm <sup>2</sup> to 250 kg/cm <sup>2</sup> ) (20 kg/cm <sup>2</sup> to 600 kg/cm <sup>2</sup> ) (20 kg/cm <sup>2</sup> to 1000 kg/cm <sup>2</sup> )
		HIC Test	NACE TM 0284: 2011	Qualitative
		SSCC	NACE TM 0177: 2005 ASTM G 39-99: 2011 ISO 11439: 2013 IS 15490: 2004 ASTM B 858: 06	Qualitative

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	<b>Ferrous &amp; Non Ferrous Metals</b>	MgCl <sub>2</sub> CaCl <sub>2</sub>	ASTM G 36-94: 2013	Qualitative
		Salt Spray Test	ASTM B 117: 2011 BS EN ISO 3651-2: 1998 ISO 9227: 2012 IS 6910: 1985	Qualitative
<b>2.</b>	<b>Ferrous Metals</b>	Re-bend Test	IS 1786: 2008	Qualitative (Mandrel Diameter: 10 mm to 275 mm)
<b>3.</b>	<b>Non-Ferrous Metals</b>	Mercurous Nitrate Test (Copper & copper alloys)	IS 2305: 1988 ASTM B 154: 2012-E1	Qualitative Pipe O/D: (6.35 mm to 250 mm) 1 mm to 50 mm thick plate 5 mm Dia. To 150 mm Dia.
<b>4.</b>	<b>Zinc Coated Iron &amp; Steel</b>	Mass of Coating (stripping method) Pipe/Plate/sheet Wire	IS 6745: 1972 (RA 2006) ASTM A 90: 2013	10 gsm to 1200 gsm
<b>II. METALLOGRAPHY TEST</b>				
<b>1.</b>	<b>Ferrous Metals</b>	Micro Examination General structure Grain size (Comparison Method)	ASTM E311 / E 407: 07 (RA 2015) ASTM E 112: 13 IS 4748 : 2009	Qualitative Magnification: 50 X ,100 X, 200 X,500 X, 1000 X
		Microstructure of Graphite in Cast Iron	IS 7754: 1975 (RA 2003) ASTM A 247: 2010	Qualitative 50 X ,100 X, 200 X ,500 X, 1000 X
		Nodularity in SG Iron	IS1865: 1991 (RA 2005) ASTM A 247: 2010	Qualitative 100 X

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	<b>Ferrous Metals</b>	Decarburization (By Microscope)	IS 6396: 2000 ASTM E 1077: 2014	0.01 mm to 1.6 mm
		Case Depth (Micro) vicker's Hardness Method)	IS 6416: 1988 (RA 2003)	HV 0.05 to HV 1. 0.01 mm to 3.0 mm
		Case Depth (Microscope Method)		0.01 and above
		Thickness Of Coating (Microscope Method)	ASTM B 487: 85 (2013)	0.01 and above
		Inclusion Rating Test Method- A and D	ASTM E 45: 2013 IS 4163: 2004	Qualitative
		Ferrite Content Test (by Microscopic method)	ASTM E 562: 2011	2 % to 70 %
		Ferrite Content (by Ferrite scope)	ASTM A 799: 2010/ ASTM A 800: 2014	0.5 % to 70 %
		Macro etch Test	ASTM E 340: 2015 ASTM E 381-01: 2012 DIN BS EN 1321: 1996	Qualitative 10 X,15 X,20 X,30 X, 40 X
2.	<b>Stainless Steels</b>	IGC Tests IGC Practice A	ASTM A 262: 2015	Qualitative
		IGC Practice B		2 mpy to 100 mpy
		IGC Practice C		2 mpy to 100 mpy
		IGC Practice E		Qualitative
		IGC Practice F		Qualitative

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	Stainless Steels	IGC Method-A IGC Method-B IGC Method-C	ISO 3651 (Part 2): 1998	Qualitative
		IGC Test Practice W, Z	ASTM A 763: 2015	Qualitative
		X,Y		2 mpy to 100 mpy
		Pitting Corrosion (Method A,C,E)	ASTM G 48: 2015	Qualitative
		Crevice Corrosion (Method B,D,F)	ASTM G 48: 2015	Qualitative
		Detection of Detrimental intermetallic Phases Method A, B Method C	ASTM A 923: 2014	Qualitative 0.01 mdd to 10 mdd
3.	Nickel Base Alloys	IGC Method-A IGC Method-B IGC Method-C	ASTM G 28-02: 2015	2 mpy to 100 mpy

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