

**Laboratory** Tii Techno Testing Services Pvt. Ltd., No. 238/16, Aathanencheri Village, Padappai, Sriperumbudur, Kancheepuram District, Tamil Nadu

**Accreditation Standard** ISO/IEC 17025: 2005

**Certificate Number** TC-6618 (in lieu of T-3086, T-3087, T-4278) **Page 1 of 14**

**Validity** 22.08.2018 to 21.08.2020 **Last Amended on** --

Sl.	Product / Material of Test	Specific Test Performed	Test Method Specification against which tests are performed	Range of Testing / Limits of Detection
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**CHEMICAL TESTING**

<b>AT LABORATORY</b>				
<b>I.</b>	<b>METALS &amp; ALLOYS</b>			
<b>1.</b>	<b>Low Alloy Steel</b>	C	IS 8811	0.0132 % to 1.12 %
		Si	ASTM E 415	0.0253 % to 1.513 %
		Mn	Optical Emission Spectrometer	0.155 % to 2.5 %
		P		0.0033 % to 0.09 %
		S		0.001 % to 0.064 %
		Cr		0.017 % to 3.5 %
		Mo		0.0008 % to 0.55 %
		Ni		0.034 % to 3.8 %
		Al		0.013 % to 1.648 %
		Cu		0.015 % to 0.5 %
		Ti		0.0004 % to 0.385 %
		Nb		0.001 % to 1.61 %
		V		0.0009 % to 0.579 %
		B		0.0002 % to 0.007 %
		Sn		0.0015 % to 0.202 %
		Co		0.008 % to 0.379 %
		W		0.005 % to 0.269 %
<b>2.</b>	<b>Stainless Steel</b>	C	IS 9879	0.011 % to 0.36 %
		Si	ASTM E 1086	0.20 % to 1.47 %
		Mn	Optical Emission Spectrometer	0.20 % to 8.78 %
		P		0.010 % to 0.0552 %
		S		0.0009 % to 0.31 %
		Cr		3.18 % to 27.0 %
		Mo		0.072 % to 6.77 %
		Ni		0.21 % to 27 %
		Cu		0.061 % to 3.59 %

**Ravi Johri**  
Convener

**Alok Jain**  
Program Manager

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		Ti		0.001 % to 0.93 %
		Nb		0.003 % to 0.99 %
		N		0.009 % to 0.247 %
		Al		0.0026 % to 0.03 %
		V		0.0240 % to 0.0890 %
		Sn		0.0059 % to 0.0228 %
		As		0.004 % to 0.0072 %
		W		0.046 % to 0.11 %
		B		0.0004 % to 0.0027 %
		Co		0.022 % to 0.15 %
		Ta		0.0017 % to 0.007 %
3.	Tool Steel	C	TII -OES-T-01/13	0.36 % to 1.70 %
		Si	Issue Date- 10.03.2013,	0.16 % to 1.023 %
		Mn	Issue No. 01	0.23 % to 0.45 %
		P	Revision No. 03	0.011 % to 0.047 %
		S	Revision Date: 06.04.2018	0.001 % to 0.063 %
		Cr	Optical Emission	3.51 % to 12.87 %
		Mo	Spectrometer	0.59 % to 10.35 %
		Ni		0.074 % to 0.15 %
		Cu		0.030 % to 0.14 %
		W		0.006 % to 19.56 %
		Co		0.008 % to 8.74 %
		V		0.38 % to 4.29 %
4.	Free Cutting Steel	C	Tii-OES-FC-03/15	0.071 % to 0.41 %
		Si	Issue Date-04.03.2015,	0.003 % to 0.55 %
		Mn	Issue No. 01	0.43 % to 1.73 %
		P	Revision No. 02	0.014 % to 0.085 %
		S	Revision Date: 06.04.2018	0.028 % to 0.34 %
		Cr	Optical Emission	0.049 % to 0.17 %
		Mo	Spectrometer	0.009 % to 0.29 %
		Ni		0.017 % to 0.10 %
		Al		0.001 % to 0.060 %
		Cu		0.014 % to 0.19 %

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5.	Aluminium Base	Pb	ASTM E 1251 Optical Emission Spectrometer	0.0126 % to 0.198 %
		Cu		0.0203 % to 4.51 %
		Mg		0.02 % to 6.00 %
		Si		0.028 % to 17.08 %
		Fe		0.07 % to 1.37 %
		Mn		0.03 % to 0.91 %
		Ni		0.0154 % to 0.20 %
		Zn		0.13 % to 7.82 %
		Pb		0.008 % to 1.1 %
		Ti		0.016 % to 0.22 %
		Cr		0.010 % to 0.30 %
		Zr		0.0004 % to 0.032 %
		Cd		0.0011 % to 0.0208 %
		V		0.005 % to 0.052 %
		Co		0.003 % to 0.045 %
		Sn		0.0139 % to 0.261 %
		Sb		0.03 % to 0.123 %
Bi	0.0202 % to 0.552 %			
P	0.001 % to 0.016 %			
Be	0.0003 % to 0.038 %			
6.	Copper Base	Sn	TII -OES-Cu-02/13 Issue Date- 10.03.2013, Issue No. 01 Revision No. 02 Revision Date: 06.04.2018 Optical Emission Spectrometer	0.0164 % to 11.5 %
		Pb		0.003 % to 21.42 %
		Fe		0.0012 % to 4.5 %
		Ni		0.00173 % to 14.96 %
		Al		0.001 % to 9.19 %
		Sb		0.0025 % to 0.60 %
		P		0.0011 % to 0.50 %
		Bi		0.0113 % to 0.851 %
		Zn		0.002 % to 42.00 %
		Mn		0.002 % to 4.34 %
		Co		0.002 % to 0.0751 %
Ag	0.0008 % to 0.049 %			
S	0.0012 % to 0.63 %			

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		As		0.0011 % to 0.125 %
		Cd		0.0028 % to 0.0155 %
		Si		0.001 % to 0.203 %
		Se		0.0114 % to 0.133 %
		Mg		0.0003 % to 0.0241 %
7.	Nickel Base	C	Tii-OES-Ni-05/16	0.018 % to 0.1452 %
		Si	Issue Date- 18.12.2015,	0.0576 % to 1.188 %
		Mn	Issue No. 01	0.02799 % to 1.111 %
		P	Revision No. 01	0.00297 % to 0.0319 %
		S	Revision Date: 06.04.2018	0.018 % to 0.0242 %
		Cr	Optical Emission	0.324 % to 24.134 %
		Mo	Spectrometer	0.0648 % to 18.172 %
		Al	ASTM E 3047	0.1656 % to 1.5224 %
		Cu		0.0115 % to 34.76 %
		Ti		0.0234 % to 3.311 %
		Co		0.0171 % to 14.641 %
		Fe		0.8253 % to 7.073 %
		Nb		0.003 % to 3.872 %
		W		0.0189 % to 5.995 %
8.	Titanium Base	Al	ASTM E 2994	0.040 % to 6.39 %
		Fe	Optical Emission	0.19 % to 0.23 %
		Mo	Spectrometer	0.0006 % to 0.003 %
		V		0.001 % to 3.99 %
		Sn		0.005 % to 0.007 %
		C		0.008 % to 0.014 %
		Ni		0.005 % to 0.026 %
		Cr		0.014 % to 0.026 %
9.	Cast Iron	C	ASTM E 1999	1.86 % to 3.68 %/1.4 %
		Cr	Optical Emission	0.03 % to 1.53 %
		Cu	Spectrometer	0.0245 % to 0.345 %
		Mg		0.001 % to 0.055 %
		Mn		0.0297 % to 1.028 %
		Mo		0.001 % to 0.101 %

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		Ni		0.0263 % to 2.02 %
		P		0.0353 % to 0.243 %
		Si		1.175 % to 3.03 %
		S		0.0075 % to 0.223 %
		Sn		0.0005 % to 0.0102 %
		Ti		0.080 % to 0.146 %
		V		0.0005 % to 0.0208 %
10.	Iron Base Alloy (Low Alloy Steel, Stainless steel, Tool Steel, Free Cutting Steel, Cast Iron)	C, Si, Mn, P, S, Cr, Mo, Ni, Al, Ti, Nb, V, B, As, Sn, W, Co, Zn, N	ASTM E 1916 Portable Optical Emission Spectrometer Handheld XRF	Qualitative
11.	Copper Base Alloy	Sn, Pb, Fe, Ni, Al, Sb, P, Bi, Zn, Mn, Co, Ag, S, As, Cd, Si, Se	ASTM E 1916 Portable Emission Spectrometer Handheld XRF	Qualitative
12.	Aluminium Based Alloy	Cu, Mg, Si, Fe, Mn, Ni, Zn, Pb, Ti, Cr, Zr, Cd, V, Co, Sn, Sb	ASTM E 1916 Portable Emission spectrometer Handheld XRF	Qualitative
13.	Nickel Based Alloy	C, Si, Mn, P, S, Cr, Mo, Al, Cu, Ti, B, Co, Fe, Nb, V, W	ASTM E 1916 Portable Emission Spectrometer Handheld XRF	Qualitative
14.	Carbon Steel	C	IS 228 (Part -1)	0.05% to 2.50 %
		Si	IS 228 (Part -8)	0.10 % to 2.50%
		S	IS 228 (Part -9)	0.01 % to 0.25%
			IS 12308 (Part-2)	0.005 % to 0.25%
		P	IS 228 (Part-3)	0.01 % to 0.25 %
			ASTM E350	0.005 % to 0.10%
		Mn	IS 228 (Part -12)	0.01 % to 3.00%
			ASTM E 350	0.01 % to 3.00 %

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15.	Stainless Steel	C	IS 228 (Part-1)	0.01% to 0.15 %
		Si	IS 228 (Part-8)	0.10 % to 2.50%
		S	IS 228 (Part-9)	0.01 % to 0.25%
			IS 12308 (Part-2)	0.005 % to 0.25%
		P	IS 228 (Part-3)	0.01 % to 0.25 %
			ASTM E353	0.005 % to 0.10%
		Mn	IS 228 (Part-12)	0.01 % to 3.00%
			ASTM E 353	0.01 % to 3.00 %
		Cr	IS 228 (Part-6)	1.00 % to 26.00%
		Ni	IS 228 (Part-5)	1.00 % to 18.00 %
16.	Cast Iron & SG Iron	C	IS 12308 (Part 11)	0.01% to 4.50 %
		Si	IS 12308 (Part -6)	0.10 % to 6.00%
		S	IS 12308 (Part -2)	0.005 % to 0.25%
			IS 228 (Part -9)	0.01% to 0.25%
		P	IS 12308 (Part -5)	0.01 % to 0.50 %
			ASTM E 351	0.005 % to 0.30%
		Mn	IS 12308 (Part 3)	0.01 % to 3.00%
			ASTM E 351	0.01 % to 3.00 %

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**CHEMICAL TESTING**

AT SITE				
I.	METALS & ALLOYS			
1.	Iron Base Alloy (Low Alloy Steel, Stainless steel, Tool Steel, Free Cutting Steel, Cast Iron)	C, Si, Mn, P, S, Cr, Mo, Ni, Al, Ti, Nb, V, B, As, Sn, W, Co, Zn, N	ASTM E 1916 Portable Optical Emission Spectrometer Handheld XRF	Qualitative

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**ELECTRICAL TESTING**

I.	INSULATING MATERIALS & INSULATORS			
1.	Mineral Insulating Oil (Transformer Oil)			
a.	Liquid Dielectric Materials (Mineral Insulating Oil in equipment)	Appearance	IS 335	Qualitative
		Break Down Voltage	IS 6792	5 kV to 100 kV / 1.0
		Water Content Test	IS 13567	>0.1 ppm /0.001
		Neutralization Number (Acidity)	IS 1448 (Part 2)	0.0001 & above mg-KOH/g/0.0001
		Sediment & Sludge	IS 1866	Qualitative
		Specific Resistivity Test(at 27°C & 90°C)	IS 6103	10 <sup>9</sup> to 10 <sup>15</sup> Ω. cm / 1 % of value
		Tan Delta Test (at 90°C)	IS 6262	10 <sup>-6</sup> to 10 <sup>-2</sup> / 0.000001 – 0.01
		Interfacial Tension	IS 6104	0-90 mN/m / 1.0
		Flash Point	IS 1448 (Part 21)	90 °C to 370°C
		Density	IS 1448 (Part 16)	0.8 g/cm <sup>3</sup> to 1.0 g/cm <sup>3</sup>
		Kinematic Viscosity	IS 1448(Part 25)	1 cSt to 50 cSt 27 °C & 40 °C
		Dissolved Gas Analysis	IS 10593	0.6 µl/l to 5000 µl/l
		Methane (CH <sub>4</sub> )	IS 9434	
		Ethane (C <sub>2</sub> H <sub>6</sub> )		0.1 µl/l to 5000 µl/l
	Ethylene (C <sub>2</sub> H <sub>4</sub> )		0.2 µl/l to 5000 µl/l	
	Acetylene (C <sub>2</sub> H <sub>2</sub> )		0.4 µl/l to 5000 µl/l	
	Propane (C <sub>3</sub> H <sub>8</sub> )		0.5 µl/l to 5000 µl/l	
	Hydrogen (H <sub>2</sub> )		0.2 µl/l to 100000 µl/l	
	Oxygen (O <sub>2</sub> )		50 µl/l to 100000 µl/l	
	Nitrogen (N <sub>2</sub> )		50 µl/l to 100000 µl/l	
	Carbon Monoxide (CO)		0.2 µl/l to 100000 µl/l	
	Carbon Dioxide (CO <sub>2</sub> )		50 µl/l to 100000 µl/l	



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**MECHANICAL TESTING**

I.	<b>MECHANICAL PROPERTIES OF METALS</b>			
1.	<b>Ferrous &amp; Non-Ferrous Alloys Castings, Welded Products, Semi &amp; Rolled products</b>	Tensile Strength 0.2% offset method % Elongation % Reduction area Flat : Upto 40mm Round: Upto $\phi$ 40mm	IS 1608 ASME (Sec IX) ASTM A370 ASTM E8/E8M ASTM B557M	20 kN to 1000 kN 0.1 kN to 5 kN 2 kN to 100 kN 1 % to 70 % 1 % to 70 %
2.	<b>Steel Plates Bar and Rods &amp; Welds</b>	Bend Test Transverse Bend Test (Flat : Upto 40 mm Round: $\phi$ 16 mm)	IS 1599 ASME (Sec IX)	Qualitative (Mandrel Dia:- 24mm, 30 mm, 20 mm, 90mm, 70 mm, 140 mm)
3.	<b>Ferrous material</b>	Charpy Impact Test 'V' notch	IS 1757(Part-1) ASTM E 23	3 J to 450 J (-)196 °C to Ambient Temperature
4.	<b>Ferrous and non ferrous alloys</b>	Brinell Hardness Test	IS 1500[Part-1] ASTM E10	180 HBW to 500 HBW ( $\phi$ 10 mm / 3000 kgf) 125 HBW to 400 HBW ( $\phi$ 2.5 mm / 187.5 kgf)
		Rockwell Hardness Test	IS 1586 [Part-1 ] ASTM E18	20HRB to 90 HRB 20HRC to 65 HRC
		Vickers Hardness Test Micro Vickers Hardness Test	IS 1501[ Part-1] ASTM E384	HV5(180 HV to 480 HV) HV10(180 HV to 500 HV) HV30(180 HV to 500 HV) HV0.5(200 HV to 790 HV) HV1(190HV to 570 HV)
5.	<b>Steel Tubes</b>	Flattening test & Flaring Test	IS 2328 ASTM A370 ASTM A 450/ASTM A530	Qualitative ( $\phi$ 50mm to 400mm)

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6.	Ferrous and nonferrous Pipes and Tubes (Including Welded Pipes)	Drift expanding Test	IS 2335	Qualitative
		Rebend Test	IS1786	Qualitative (Ø40 mm, Ø50 mm, Ø70 mm)
		Fracture Test	ASME (SEC IX):2017 (QW 180)	Qualitative
7.	Ferrous & Non-Ferrous Alloy Products, Semi Finished Products	Fatigue Test	ASTM E466 ASTM E647	Upto 500 kN
8.	Components - Metal/Alloys, Composites, Plastics and Polymers	Fracture toughness test (K1C)	ASTM E399	Upto 500kN
		Durability Test	ASTM F1798 ASTM F543 ASTM F1264/ASTM F382	0.1 kN to 10 kN 0.01 Hz to 1000 Hz
9.	Rubber Product	Tensile	IS 3400 (Part 1) ASTM D412-2016 (For Tensile Load Only)	0.1kN to 5kN Upto 100 kN
10.	Ferrous and Non Ferrous Pipes , Tubes (including Welded Pipes)	Pullout Test	ASME- Sec.VIII –Div-I	Qualitative (Upto 1000 kN)
11.	Ferrous and Non Ferrous Alloys Castings, Welded product Semi rolled products	Tear Test,	ASME (Sec IX)– 2017	Qualitative (Upto 1000 kN)
12.	Fasteners (External and Internal Threaded)	Proof Load for Bolt, nut, screw, stud	IS 1367 (Part 3) IS 1367 (Part 6)	Qualitative (Upto 1000 kN)
13.	Welded product	Tensile, Bend and Transverse Tensile, Transverse Bend	AWS D1.1 AWS D1.6 ISO 4136 ISO 517	Qualitative Upto 1000 kN

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		Fracture	AWS D1.1 AWS D1.6 ISO9017	Qualitative
14.	Fasteners (External and Internal Threaded)	Embrittlement Test	ASTM F606/F606M-2016	Qualitative
II.	<b>METALLOGRAPHY TEST</b>			
1.	Ferrous and nonferrous metals, alloys and welded joints	Macro examination/ analysis	ASTM E 340 ASTM E381 ASTM A 604 IS 7739 IS13015 IS11371 IS12573 IS3600 (Part 9) ASME SEC IX DIN EN ISO 15614-1 DIN EN 1321 BS EN ISO 9606	Qualitative (10X- 50X)
2.	Ferrous and nonferrous alloys	Microstructure	ASM Handbook Vol 9 IS 7739 IS 7754 IS 11959 IS3600 (Part 9) ASTM E 407 ASTM E3	Qualitative (50X-500X)
		Grain size / austenitic grain size by comparative method	ASTM E112 ISO643 for steel (Comparison method) IS 4748	Qualitative (1 to 10)

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3.	Case hardened steels	Case depth by Microscopic method	IS 6416 IS2639 IS 13691/ISO 3754	100x 0.1 mm to 4.0 mm
4.	Metallic / Non Metallic coatings on Ferrous, Aluminum, Copper Base	Coating thickness by Microscopic Method	ASTM B487 ISO 1463 IS 3203 IS101 Pt 3 Sec.2	Upto 0.3 mm
5.	Steel Products	Depth of Decarburization by Microscopic Method	IS 6396	100X 0.1 mm to 4 mm
		Inclusion rating method	IS 4163 ISO 4967	Qualitative (100X)
6.	Ferrous Metals/ SS weldments	Ferrite content test (microscopic Method)	ASTM E562	2 % to 100 %
7.	Cast Iron & its Alloys	Microstructure	ASTM A 247 IS7754	Qualitative (50X-500X)
		Graphite Flake, Nodules, type and size distribution	ASM Vol 9 ASTM A 247 IS1865	Qualitative (50X-500X)
8.	Duplex Stainless Steels	Detrimental intermetallic phases	ASTM A 923	Qualitative (50X-500X)
9.	Stainless Steel, Wrought/ Cast Products	Intergranular-corrosion Test	ASTM A 262 Practice-A Practice-B Practice-E	Qualitative (Upto 220 g)
10.	Ferritic Stainless Steel, Wrought/ Cast Products	Intergranular-corrosion Test	ASTM A 763 Practice-W Practice-Z	Qualitative
11.	Wrought Nickel Rich Chromium bearing alloys	Intergranular-corrosion Test	ASTM G28 (RA 2008) Method A	Upto 220 g
12.	Duplex Stainless Steel	Intermetallic Phase Susceptibility	ASTM A 923 - 2014 Method A Method C	Qualitative (Upto 220 g)

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13.	Stainless Steel, Duplex Stainless Steel	Pitting and Crevice Corrosion Test	ASTM G-48 Method A Method B Method E	Qualitative (Upto 220 g)
14.	Stainless Steel, Duplex Stainless Steel	Test for Resistance to Sulphide Stress Corrosion Cracking (SSCC) at 24°C	NACE TM 0177	Qualitative
15.	Steel Pipes and Pressure vessel plates	Test for Resistance to Hydrogen Induced Cracking (HIC)	NACE TM 0284	Qualitative
16.	Inorganic and Organic Coating Material (Plated and Painted)	Neutral Salt Spray Testing	ASTM B 117 ISO 9227	Qualitative
17.	Copper / Nickel/ Chromium Coatings on Steel, Zinc Alloys, Aluminium Alloys & Plastics and on Aluminium anodized samples	Copper Accelerated Acetic Acid Salt Spray Test (CASS Test)	ASTM B 368 ISO 9227	Qualitative
18.	Zn coating on Ferrous Alloys	Mass of Zn Coating	IS 6745 ASTM A 90/90M-13	0.001 g to 220 g
III.	<b>BUILDING MATERIALS</b>			
1.	Concrete Cube	Compressive Strength	IS 516	10 to 2800 kN
2.	Reinforced Steel	Ultimate Tensile strength	IS 1608	0 to 900 kN
		Yield Strength	IS 1608	0 to 900 kN
		% Elongation	IS 1608	8 % to 30 %

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**Accreditation Standard** ISO/IEC 17025: 2005

**Certificate Number** TC-6618 (in lieu of T-3086, T-3087, T-4278) **Page 14 of 14**

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Sl.	Product / Material of Test	Specific Test Performed	Test Method Specification against which tests are performed	Range of Testing / Limits of Detection
		Bend test	IS 1599	Qualitative (Visual)
		Rebend test	IS 1786	Qualitative (Visual)
		Mass per meter	IS 1786	0.20 Kg/m to 200 Kg/m
3.	<b>Burnt Clay Bricks</b>	Compressive strength	IS 3495 (Part 1)	5 kN to 2800 kN
		Water Absorption	IS 3495 (Part 2)	1 % to 25 %
		Efflorescence	IS 3495 (Part 3)	Qualitative
		Dimension	IS 1077	Up to 2500 mm
4.	<b>Solid Blocks/ Hollow Blocks</b>	Compressive Strength	IS 2185 (Part 1)	10 kN to 2800 kN
		Water Absorption	IS 2185 (Part 1)	1 % to 20 %
		Concrete block density	IS 2185 (Part 1)	1000 kg/m <sup>3</sup> to 2600 kg/m <sup>3</sup>
5.	<b>Fine Aggregate (River Sand, Msand and Crushing Sand)</b>	Seive analysis	IS 2386 (Part 1)	150 micron to 4.75 mm
		Specific gravity	IS 2386 (Part 3)	2 to 4
6.	<b>Soil</b>	Liquid Limit	IS 2720 (Part 5): 1985 (RA 2010)	5 % to 70 %
		Plastic limit	IS 2720 (Part 5)	5 % to 70%
		Light compaction	IS 2720 (Part 7)	MDD 1 to 2.5 g/ccOMC 1 % to 35 %
7.	<b>Concrete Paving Blocks</b>	Compressive Strength	IS 15658	10 kN to 2800 kN
		Water Absorption	IS 15658	0.1 % to 12 %