

Laboratory Chemical and Metallurgical Services, T.S. 63 A, Sidco Industrial Estate, Ekkduthangal, Chennai, Tamil Nadu

Accreditation Standard ISO/IEC 17025: 2005

Certificate Number TC-5039 (In lieu of T-0475 & T-0474) Page 1 of 8

Validity 13.12.2016 to 12.12.2018 Last Amended on 27.02.2017

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

A.	<u>CHEMICAL TESTING (BY OES METHOD)</u>			
I.	METALS & ALLOYS			
1.	Carbon Steel	C	IS: 8811	0.005 % to 2.00 %
		Si	& ASTM E 415	0.005 % to 3.50 %
		Mn		0.005 % to 3.00 %
		P		0.001 % to 0.90 %
		S		0.001 % to 0.60 %
		Cu		0.005 % to 2.00 %
		Pb		0.005 % to 2.50 %
2.	Alloy Steel	C	IS: 8811	0.005 % to 1.00 %
		Si	& ASTM E 415	0.005 % to 3.50%
		Mn		0.005 % to 1.00 %
		P		0.001 % to 0.09 %
		S		0.001 % to 0.06 %
		Cr		0.005 % to 4.0 %
		Ni		0.005 % to 5.00 %
		Mo		0.005 % to 1.00 %
		Cu		0.005 % to 1.0 %
		Al		0.005 % to 0.2 %
		V		0.005 % to 0.5 %
		N		0.005 % to 0.02 %
		As		0.005 % to 0.02 %
3.	Stainless Steel	C	IS:987	0.005 % to 0.1 %
		Si	& ASTM E 1086	0.005 % to 0.6 %

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Accreditation Standard ISO/IEC 17025: 2005

Certificate Number TC-5039 (In lieu of T-0475 & T-0474) **Page 2 of 8**

Validity 13.12.2016 to 12.12.2018 **Last Amended on** 27.02.2017

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		Mn		0.005 % to 1.8 %
		P		0.001 % to 0.05 %
		S		0.001 % to 0.03 %
		Cr		5.00 % to 26.00 %
		Ni		5.00 % to 22.00 %
		Mo		0.005 % to 4.0 %
		Cu		0.005 % to 3.0 %
		Al		0.005 % to 0.02 %
		V		0.005 % to 0.4 %
		Nb		0.006 % to 0.3 %
4.	Tool Steel	C	IS:9879	0.005 % to 1.0 %
		Si		0.005 % to 0.5 %
		Mn		0.005 % to 0.5 %
		P		0.001 % to 0.05 %
		S		0.001 % to 0.04 %
		Cr		0.005 % to 5.0 %
		Mo		0.005 % to 6.0 %
		V		0.005 % to 2.0 %
		Co		0.005 % to 5.0 %
		W		0.005 % to 18.0 %
5.	Cast Iron	C	IS :15338	0.005 % to 3.5 %
		Si		0.005 % to 3.0 %
		Mn		0.005 % to 0.7 %
		P		0.001 % to 0.11 %
		S		0.001 % to 0.10 %
		Cr		0.005 % to 0.05 %
		Ni		0.005 % to 0.5 %
		Mo		0.005 % to 0.2 %

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Accreditation Standard ISO/IEC 17025: 2005

Certificate Number TC-5039 *(In lieu of T-0475 & T-0474)* **Page 3 of 8**

Validity 13.12.2016 to 12.12.2018 **Last Amended on** 27.02.2017

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		Cu		0.005 % to 0.4 %
		Pb		0.005 % to 0.05 %
		Ti		0.002 % to 0.02%
6.	Aluminium & its Alloys	C	ASTM E 1251-11	0.010 % to 5.0 %
		Si		0.015 % to 0.3 %
		Mg		0.015 % to 3.0 %
		Zn		0.015 % to 6.0 %
		Ni		0.01 % to 1.0 %
		Mn		0.015 % to 1.0 %
		Fe		0.01% to 0.3 %
		Ti		0.005 % to 0.06 %
		Cr		0.008 % to 0.2 %
		Zr		0.0015 % to 0.050 %
		Be		0.001 % to 0.050 %
7.	Copper & its Alloys	Sn	BS EN 15079	0.05 % to 12.0 %
		Pb		0.05 % to 9.0 %
		Zn		0.05 % to 40.0 %
		Si		0.04 % to 0.2 %
		Al		0.020 % to 7.5 %
		Ni		0.005 % to 4.0 %
		Mn		0.020 % to 1.0 %
		S		0.008 % to 0.07 %
		Fe		0.020 % to 2.0 %
		P		0.005 % to 1.0 %
		Sb		0.020 % to 0.2 %
		As		0.010 % to 0.30 %

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Accreditation Standard ISO/IEC 17025: 2005

Certificate Number TC-5039 (In lieu of T-0475 & T-0474) Page 4 of 8

Validity 13.12.2016 to 12.12.2018 Last Amended on 27.02.2017

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8.	Nickel & its Alloys	C	CMS/SOP/OES/NI	0.008 % to 0.15 %
		Mn		0.020 % to 1.5 %
		Si		0.010 % to 0.05 %
		Fe		0.050 % to 2.0 %
		Cu		0.020 % to 35.0 %
		Al		0.010% to 0.05 %
		Co		0.030% to 0.05 %
B.	CHEMICAL TESTING (BY WET METHOD)			
I.	METALS & ALLOYS			
1.	Fe Base Alloys			
a.	Carbon Steel	C	IS:228 (Part1)	0.010 % to 0.50 %
		Si	IS:228 (Part8)	0.010 % to 3.00 %
		Mn	IS:228 (Part2)	0.010 % to 3.00 %
		P	IS:228 (Part3)	0.005 % to 0.090 %
		S	ASTM E 350/2001 & IS:228 (Part9)	0.005 % to 0.090 %
b.	Alloy Steel/SS	C	IS:228 (Part1)	0.010 % to 2.70 %
		Si	IS:228 (Part8)	0.010 % to 2.50 %
		Mn	IS:228 (Part2)	0.010 % to 2.00 %
		P	IS:228 (Part3)	0.005 % to 0.50 %
		S	ASTM E 350/2001 & IS:228 (Part9)	0.005 % to 0.50 %
		Cr	IS:228 (Part6)	0.10 % to 20.00%
		Ni	IS:228 (Part5)	0.10 % to 10.00%
		Mo	IS:228 (Part7)	0.10 % to 3.00%
c.	Cast Iron	C	IS:228 (Part1)	1.00 % to 3.5 %
		Si	IS:228 (Part8)	0.010 % to 3.8 %

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Accreditation Standard ISO/IEC 17025: 2005

Certificate Number TC-5039 *(In lieu of T-0475 & T-0474)* **Page 5 of 8**

Validity 13.12.2016 to 12.12.2018 **Last Amended on** 27.02.2017

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		Mn	IS:228 (Part2)	0.010 % to 2.5 %
		P	IS:228 (Part3)	0.005 % to 0.50 %
		S	ASTM E 350/2001 & IS:228 (Part9)	0.005 % to 0.50 %
		Cr	IS:228 (Part6)	0.10 % to 4.0%
		Ni	IS:228 (Part5)	0.010 % to 4.5%
2.	Copper & its Alloys	Cu	IS:4027 (Pt-1) IS:3685	0.010 % to 99.90 %
		Pb	IS:4027 (Pt-1) IS:3685	0.01 % to 10.00 %
		Sn	IS:4027 (Pt-5) IS:3685	0.01 % to 10.00 %
		Zn	IS:4027 (Pt-6) IS:3685	0.01 % to 50.0 %
		Fe	IS:4027 (Pt-8) IS:3685	0.01 % to 1.00 %
		Al	IS:3685 ASTM E54/2001	0.01 % to 15.00 %
		Mn	IS:4027 (Pt-2), IS:3685	0.01 % to 6.00 %
		P	IS:4027 (Pt-3)	0.005 % to 1.00 %
		Ni	IS:4027 (Pt-1)-1987 IS:3685	0.01 % to 2.00 %
3.	Aluminium Base Alloy	Si	IS:504 (Part1)	0.01 % to 1.00 %
		Cu	IS:504 (Part3) & ASTM E34/2001	0.01 % to 6.00 %
		Mn	IS:504 (Part5)	0.01 % to 0.80 %
		Mg	IS:504 (Part6) & ASTM E34/2001	0.01 % to 6.00 %
		Fe	IS:504 (Part2)	0.01 % to 1.00 %
		Ni	IS:504 (Part7)	0.01 % to 1.00 %
		Zn	IS:504 (Part4)-2002	0.01 % to 0.5 %

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Accreditation Standard ISO/IEC 17025: 2005
Certificate Number TC-5039 (In lieu of T-0475 & T-0474) **Page 6 of 8**
Validity 13.12.2016 to 12.12.2018 **Last Amended on** 27.02.2017

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MECHANICAL TESTING

I.	PAINT & SURFACE COATING			
1.	Paint & Enamel	Consistency	IS: 101-(part-1/sec.-5)	Qualitative
		Viscosity (Flow cup)	IS: 3944	0-500 seconds
		Mass per ten liters	IS: 101-(part-1/sec.-7)	8.00 Kg/10L to 25.0 Kg/10L
		Drying time		
		Surface dry	IS: 101-(part-3/sec.-1)	Up to 24 hours
		Hard dry	IS: 101-(part-3/sec.-1)	Up to 50 hours
		Finish	IS: 101-(part-3/sec.-4)	Qualitative
		Gloss at 60°	IS: 101-(part-4/sec.-4)	10 to 90
		Fineness of Grind	IS: 101-(part-3/sec.-5)	0 to 100 microns
		Colour	IS: 5-2007	Qualitative
		Scratch hardness	IS: 101-(part-4/sec.-2)	PASS / FAIL
		Flexibility & adhesion	IS: 101-(part-5/sec.-2)	PASS / FAIL
		Flash point	IS: 101-(part-1/sec.-6)	Ambient to 60°C
		Volume solids	IS:101-(part-8/sec.-6)	10 % to 75%
		Accelerated storage stability at 60° C, 96 hours	IS: 2923-2003 Annex-F	PASS / FAIL
		Coating Thickness	ASTM D 7091-2013	1-500 microns
II.	METALS AND ALLOYS			
1.	Metals and Its Alloys	0.20 % Proof stress Yield Strength Tensile Strength %Elongation %Reduction Area	IS:1608-2005 ASTM A370 -2016 ASTM E8/E8M -2015a	2 to 360 KN(2 KN) 2 to 360 KN(2 KN) 2 to 360 KN(2 KN) 1 to 80 % 1 to 80 %
2.	Weldments	Transverse Tensile Strength	ASME SEC IX-2015 AWS D1.1-2015	2 to 360 KN(2 KN)

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Certificate Number TC-5039 *(In lieu of T-0475 & T-0474)* **Page 7 of 8**

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2.	Metals and Its Alloys & Weldments	Bend	IS:1599-2012 ASTM-E290-2014 ASTM A370-2016 ASTM SEC-IX-2015 AWS D1.1-2015	Mandral Dia 12 to 50 mm
3.	Rubber & Plastic Material	Tensile Strength & % EL at Break	ASTM D412-2014 ASTM D638-2014 IS:3400-2012	5 to 500kgf (5 kgf)
4.	Weld Metals	Fracture Test	ASTM SEC-IX-2015 AWS D1.1-2015	16.0 mm Thickness Max
5.	Concrete Cubes	Compressive Strength	IS:516-1959-RA-2008	5 to 1000 KN (5 KN)
6.	Metal Spring	Compression Load	IS:7906-PART-1-1997	5 to 1000 KN (5 KN)
7.	Metallic Material	Impact Charpy "U" Notch(2 mm) Impact Charpy "V" Notch(2 mm) (-20° C to Room Temperature) Izod Impact Test	IS:1499-1977-RA-2009 IS:1757-1988-RA-2009 & ASTM A370-2016 IS:1598-1977-RA-2009	300 Joules Max 300 Joules Max 168 Joules Max
8.	Metallic Material	Hardness- Brinell (3000 kg load)	IS:1500-2013	150-500 HBW, (HBW10/3000)
		Hardness- Rockwell "C" " Scale	IS:1586-2012	20 to 70 HRC
		Hardness- Rockwell "B" " Scale	IS:1586-2012	20 to 100 HRBW
		Hardness- Vickers	IS:1501-2013	Up to 750 HV30
		Hardness- Vickers	IS:1501-2013	Up to 450 HV5
9.	Non Metallic Material	Shore Hardness - A	ASTM D2240-RA-2015	SHORE "A" 5 to 95
		Shore Hardness - D	ASTM D2240-RA-2015	SHORE "D" 0 to 100

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Certificate Number TC-5039 (In lieu of T-0475 & T-0474) **Page 8 of 8**

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III. METALLOGRAPHY TEST				
1.	Ferrous & Non Ferrous Metals	Microstructure Analysis	IS:7739-75-RA-2012 ASTM VOLUME-09 ASTM-E562-2011	Magnification-500x Max
		Estimation of Average Grain Size	IS:4748-2009 (Comparison Method) ASTM E112-2013 (Microscopic Method) ASTM E1382-97-RA-15	Magnification-100x Max ASTM Grain Size 1-8.
		Coating Thickness	IS:3203-1982-RA-2012 (Microscopic Method) & ASTM B499-RA-2009	0.001 mm Min.
2.	Steel	Non Metallic Inclusion Rating	IS:4163-2004-RA-2012 ASTM E45-2013	Magnification-500x Max
		Determination of Case Depth	IS:6416-1988/RA-2007	Up to 2.0 mm
		Depth of Decarburization	IS:6396-2000-RA-2007 ASTM E1077-2014 (Microscopic Method)	0.001 mm to 2.0 mm.
3.	Weldments	Macro Etch Test	ASME SEC-IX-2015	Qualitative
4.	Ferrous & Non Ferrous Metals, Forging of Carbon, Billets, Blooms Low Casting Alloys, Steel bar	Macro Etch Test	ISO:11371-1985-RA2015 ASTM E381-96-RA-2012 IS:13015-91-RA-2007 ASTM E340-2015	Qualitative
5.	Austenitic Stainless Steel	Intergranular Corrosion Test (IGC)	ASTM A262-15 PRACTICE-A PRACTICE-B PRACTICE-C PRACTICE-E	250x & 500x 0.001g to 100g 0.001g to 100g Qualitative