Laboratory	**Raghavendra Spectro Metallurgical Laboratory, 326, Cross-9, Phase 4, Peenya Indl. Area, Bangalore, Karnataka**		
Accreditation Standard	**ISO/IEC 17025: 2005**		
Discipline	**Chemical Testing**	**Issue Date**	**24.02.2014**
Certificate Number	**T-0371**	**Valid Until**	**30.01.2016**
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S.No.	Product / Material of Test	Specific Test Performed	Test Method Specification against which tests are performed	Range of Testing / Limits of Detection
I. METALS & ALLOYS				
1.	**Iron & Its Alloys**	Carbon	IS:8811-1998/ IS:9879-1998	0.017% to 4.0%
		Manganese		0.07% to 10.0%
		Phosphorous		0.001% to 0.3%
		Sulphur		0.001% to 0.34%
		Silicon		0.005% to 3.00%
		Copper		0.004% to 3.35%
		Nickel		0.007% to 30.00%
		Chromium		0.019% to 25.00%
		Molybdenum		0.002% to 10.0%
		Vanadium		0.003% to 3.0%
		Titanium		0.002% to 0.8%
		Aluminium		0.005% to 1.20%
		Cobalt		0.05% to 10.0%
		Niobium		0.001% to 1.10%
		Lead		0.003% to 0.34%
		Boron		0.0001% to 0.10%
		Tungsten		0.01% to 19.0%
		Magnesium		0.01% to 0.20%
2.	**Aluminium & Its Alloys**	Manganese	ASTM E 1251-2011	0.015% to 3.0%
		Silicon		0.001% to 20.0%
		Copper		0.01% to 8.0%
		Nickel		0.03% to 1.838%
		Chromium		0.015% to 1.00%
		Titanium		0.005% to 0.250%

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	Aluminium & Its Alloys	Tin	ASTM E 1251-2011	0.01% to 2.0%
		Lead		0.001% to 1.0%
		Magnesium		0.01% to 12.0%
		Zinc		0.005% to 8.00%
		Iron		0.100% to 1.500%
3.	**Copper & Its Alloys**	Phosphorus	Optical Emission Spectrometer DV-6 RSML/SOP/01	0.002% to 1.0%
		Sulphur		0.005% to 0.50%
		Silicon		0.005% to 3.0%
		Nickel		0.005% to 30.00%
		Chromium		0.005% to 2.00%
		Aluminium		0.001% to 12.0%
		Cobalt		0.001% to 1.00%
		Tin		0.01% to 13.0%
		Lead		0.01% to 12.0%
		Magnesium		0.001% to 0.1%
		Zinc		0.001% to 40.0%
		Iron		0.005% to 4.95%
4.	**Tin & Its Alloys**	Lead	Optical Emission Spectrometer DV-4 RSML/SOP/02	0.10% to 45.0%
		Antimony		0.10% to15.0%
		Arsenic		0.001% to 0.50%
		Bismuth		0.001% to 0.25%
		Copper		0.005% to 0.90%
		Iron		0.001% to 0.10%

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	Tin & Its Alloys	Zinc	Optical Emission Spectrometer DV-4 RSML/SOP/02	0.001% to 0.10%
		Cadmium		0.01% to 0.10%
		Aluminium		0.001% to 0.10%
		Nickel		0.001% to 0.20%
5.	**Nickel & Its Alloys**	Carbon	Optical Emission Spectrometer DV-4 RSML/SOP/03	0.001% to 1.00%
		Manganese		0.001% to 2.00%
		Phosphorus		0.001% to 0.25%
		Sulphur		0.001% to 0.20%
		Copper		0.005% to 30.00%
		Chromium		0.001% to 35.0%
		Molybdenum		0.001% to 10.0%
		Titanium		0.001% to 2.00%
		Aluminium		0.04% to 2.00%
		Cobalt		0.002% to 20.0%
		Niobium		0.001% to 2.0%
		Lead		0.001% to 1.00%
		Tungsten		0.01% to 20.0%
		Iron		0.10% to 30.00%
6.	**Zinc & Its Alloys**	Lead	Optical Emission Spectrometer DV-4 ASTM E 536-05	0.008% to 0.6%
		Tin		0.005% to 0.3%
		Cadmium		0.005% to 0.4%
		Copper		0.003% to 4.60%
		Iron		0.001% to 0.40%
		Aluminium		0.005% to 8.70%
		Magnesium		0.005% to 0.10%
		Titanium		0.001% to 0.10%

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	Zinc & Its Alloys	Nickel	Optical Emission Spectrometer DV-4 ASTM E 536-05	0.001% to 0.10%
		Manganese		0.001% to 0.20%
		Antimony		0.008% to 2.00%
7.	**Plain Carbon & low alloy steel**	Carbon	IS:228-87 part1(R2008)	0.05% to 2.5%
		Silica	IS:228-89 part8(R2009)	0.05% to 5.00%
		Manganese	IS:228-87 part2(R2008) ASTM E350-12	0.10% to 1.5%
				0.10% to 2.50%
		Sulphur	IS:228-89 part9(R2009)	0.01% to 0.25%
		Phosphorus	IS:228-87 part3(R2007) ASTM E350-12	0.01% to 0.25%
				0.02% to 0.25%
		Chromium	IS:228-87 part6(R2009)	0.1% to 50.0%
		Nickel	IS:228-87 part5(R2009) ASTM E 350-12	0.1% to 5.0%
		Molybdenum	IS:228part7-1990(R2012) ASTM E 350 – 12	0.05% to 2.5%
				0.01% to 1.50%
8.	**Copper & its alloy**	Copper	IS:440:1964(R2006)	99.20% to 99.99%
			IS:3685-1966 (R2006)	50% to 99.9%
			IS:7212-1974 (R2010)	0.1% to 50%
		Iron	IS:4027-PT8-1991(R2007)	0.01% to 0.05%
			IS:3685-1966(R2006)	0.05% to 0.1%
			IS:3685-1966(R2006)	0.1% to 10.00%
		Lead	IS:3685-1966(R2006)	1% to 27%
		Nickel	IS:440-1964(R2006)	0.1% to 40%
			IS:3685-1966(R2006)	0.1% to 40%
		Phosphorus	IS:440-1964(R2006)	0.01% to 0.5%

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	Copper & its alloy	Silicon	IS:3685-1966(R2006)	0.01% to 0.8%
			IS:3685-1966(R2006)	0.01% to 1.00%
		Tin	IS:4027-pt 5-1987(R2006)	0.5% to 20.0%
			IS:3685-1966 (R2006)	0.1% to 1.0%
		Zinc	IS: 3685-1966(R2006)	1.0% to 40.0%
9.	**Aluminium & its alloy**	Copper	IS:504-(P3)-2002	0.01% to 0.1%
			IS:504-(P3)-2002	0.1% to 5.00%
		Silicon	IS:504-(P1)-2002	0.02% to 0.3%
			IS:504-(P1)-2002	0.3% to 35.00%
		Manganese	IS:504-(P5)-2002	0.1% to 1.5%
		Magnesium	IS:504-(P6)-2002	0.1% to 11.00%
		Zinc	IS:504-(P4)-2002	0.01% to 0.1%
			IS:504-(P4)-2002	0.1% to 5.00%
		Nickel	IS:504- (P7)2002	0.1% to 5.00%
		Iron	IS:504-(P2)-2002	0.03% to 0.10%
			IS:504-(P2)-2002	0.01% to 5.00%
		Tin	IS:504- (P9)2002	0.1% to 0.5%
10.	**Stainless Steel**	Carbon	ASTM E 353-2006	0.03% to 2.00%
		Silicon	ASTM E 353-2006	0.5% to 4.00%
		Manganese	IS: 228 part2-1987 (R 2008)	0.10% to 2.00%
		Sulphur	IS:228 part9-1989 (R 2009)	0.01% to 0.40%
		Phosphorus	ASTM E 353-2006	0.002% to 0.25%
		Chromium	IS:228 part6-1987(R2009)	0.1% to 25.0%
		Nickel	IS:228 part5-1987(R2009)	0.1% to 25.0%
		Molybdenum	IS:228 part7-1990(R2012) ASTM E 350-2012	0.1% to 2.5%

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11.	**Cast Iron**	Carbon	IS:12308-1991(P11)(R2006)	1.5% to 4.5%
		Silicon	IS:12308-1991(P6)(2006)	0.1% to 6.0%
		Manganese	IS:12308-1991(P10)(R2006)	0.1% to 7.0%
		Sulphur	IS:12308-1987(P2)(2007)	0.005% to 0.25%
		Phosphorus	IS:12308-1991(P5)(2006)	0.01% to 0.5%
		Chromium	IS:12308-1997(P8)(2007)	0.1% to 28.0%
		Nickel	IS:12308-1991(P7)(2006)	0.5% to 36.0%
12.	**Metals**	Lead	IEC62321/Edition1.0, 2008-12 / ICP - OES	10mg/kg to 40,000 mg/kg
		Cadmium	IEC62321/Edition1.0, 2008-12 / ICP - OES	10 mg/kg to 500 mg/kg
		Mercury	IEC62321/Edition1.0, 2008-12 / ICP - OES	10 mg/kg to 2000 mg/kg
		Hexavalent Chromium	EPA3060A/ ICP OES	10 mg/kg to 2000 mg/kg
II. POLLUTION & EFFLUENTS				
1.	**Effluent Water**	Suspended Solids	APHA-2540D 20th Edition	5 mg/l to 1000 mg/l
		Dissolved Solids	APHA-2540C 20th Edition	10 mg/l to 3000 mg/l
		Temperature	IS3025(P9)-1984 (R 2012)	-
		pH Value	IS 3025(Part 11), 1983 (R 2012)	0 to 14
		Oil and Grease	IS 3025(Part 39) 1991 (R 2009)	1 mg/l to 50 mg/l
		Total residual chlorine	IS3025(Part26)1986, (R 2009)	0.1 mg/l to 5 mg/l
		Chemical Oxygen demand	ASTM D 1252-06(2012)	5 mg/l to 500 mg/l
		Arsenic(as As)	ASTM D 1976:2012	0.005 mg/l to 10 mg/l
		Mercury(as Hg)	ASTM D 1976:2012	0.001 mg/l to 10 mg/l

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	Effluent Water	Lead(as Pb)	ASTM D 1976:2012	0.1 mg/l to 100 mg/l
		Cadmium(as Cd)	ASTM D 1976:2012	0.1 mg/l to 100 mg/l
		Hexavalent Chromium(as Cr)	IS 302 (Part 52) : 2003	0.01 mg/l to 20 mg/l
		Total Chromium (as Cr)	ASTM D 1976:2012	0.1 mg/l to 100 mg/l
		Copper(as Cu)	ASTM D 1976:2012	0.1 mg/l to 100 mg/l
		Zinc(as Zn)	ASTM D 1976:2012	0.1 mg/l to 100 mg/l
		Nickel(as Ni)	ASTM D 1976:2012	0.1 mg/l to 100 mg/l
		Boron(as B)	ASTM D 1976:2012	0.1 mg/l to 100 mg/l
		Cyanide(as CN)	IS 3025(Part27)1986 (R 2009)	0 to 10 mg/l
		Chloride(as Cl)	IS 3025(Part32)1988 (R 2009)	5 mg/l to 1500 mg/l
		Fluoride(as F)	IS 3025(Part60)2008	0.1 mg/l to 50 mg/l
		Dissolved Phospates(as P)	IS 2488 – 3 : 1968	0.5 mg/l to 50 mg/l
		Sulphate(as SO4)	IS 3025(Part24) 1986 (R 2009)	5 mg/l to 1200 mg/l
		Sulphide(as S)	IS 3025(Part29) 1986 (R 2009)	0.5 mg/l to 50 mg/l
		Selenium(as Se)	ASTM D 1976:2012	0.05 mg/l to 10 mg/l
2.	**Wear Metals in Oils**	Aluminium	ASTM D 5185-2013	0.5mg/kg to 2000mg/kg
		Barium	ASTM D 5185-2013	0.5mg/kg to 2000mg/kg
		Boron	ASTM D 5185-2013	0.5mg/kg to 2000mg/kg
		Cadmium	ASTM D 5185-2013	0.5mg/kg to 2000mg/kg
		Calcium	ASTM D 5185-2013	0.5mg/kg to 2000mg/kg
		Chromium	ASTM D 5185-2013	0.5mg/kg to 2000mg/kg
		Copper	ASTM D 5185-2013	0.5mg/kg to 2000mg/kg
		Iron	ASTM D 5185-2013	0.5mg/kg to 2000mg/kg
		Lead	ASTM D 5185-2013	0.5mg/kg to 2000mg/kg
		Lithium	ASTM D 5185-2013	0.5mg/kg to 2000mg/kg
		Magnesium	ASTM D 5185-2013	0.5mg/kg to 2000mg/kg

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	Wear Metals in Oils	Manganese	ASTM D 5185-2013	0.5mg/kg to 2000mg/kg
		Molybdenum	ASTM D 5185-2013	0.5mg/kg to 2000mg/kg
		Nickel	ASTM D 5185-2013	0.5mg/kg to 2000mg/kg
		Phosphorus	ASTM D 5185-2013	0.5mg/kg to 2000mg/kg
		Potassium	ASTM D 5185-2013	0.5mg/kg to 2000mg/kg
		Silicon	ASTM D 5185-2013	0.5mg/kg to 2000mg/kg
		Silver	ASTM D 5185-2013	0.5mg/kg to 2000mg/kg
		Sodium	ASTM D 5185-2013	0.5mg/kg to 2000mg/kg
		Sulphur	ASTM D 5185-2013	0.5mg/kg to 2000mg/kg
		Tin	ASTM D 5185-2013	0.5mg/kg to 2000mg/kg
		Titanium	ASTM D 5185-2013	0.5mg/kg to 2000mg/kg
		Vanadium	ASTM D 5185-2013	0.5mg/kg to 2000mg/kg
		Zinc	ASTM D 5185-2013	0.5mg/kg to 2000mg/kg
3.	**Potable Water**	Colour	IS 3025 Part 4 1983 RA 2012	5 to 500 Hazen Units
		Odour	IS 3025 Part 5 1983 RA 2012	Agreeable/Disagreeable
		Taste	IS 3025 Part 7 & 8 1984 RA 2012	Agreeable/Disagreeable
		Hexavalent Chromium Cr+6	IS 3025 Part 52 2003 RA 2009	0.01 to 20.0 mg/l
		Fluoride	IS 3025 Part 60 2008	0.1 to 50 mg/l
		pH	IS 3025(Part 11)1983 RA 2012	0 to 14
		Turbidity	IS 3025(Part 10)1984 RA 2012	0 to 100 NTU
		Total Hardness	IS 3025(Part 21)2009	1 to 1000 mg/l
		Iron	ASTM D 1976:2012	0.1 to 100 mg/l
		Chloride	IS 3025(Part 32)1988 RA 2009	5 to 1500 mg/l
		Residual Chlorine	IS 3025(Part26)1986 RA 2009	0.1 to 5 mg/l
		Total Dissolved Solids	IS 3025(Part 16)1984 RA 2012	10 to 3000 mg/l
		Calcium	IS 3025(Part 40)1991 RA 2009	5 to 500 mg/l

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	Potable Water	Copper	ASTM D 1976:2012	0.01 to 100 mg/l
		Manganese	ASTM D 1976:2012	0.05 to 100 mg/l
		Sulphate	IS 3025(Part 24)1986 RA 2009	1 to 1000 mg/l
		Nitrate	IS 3025(Part 34)1988 RA 2009	1 to 1000 mg/l
		Mercury	ASTM D 1976:2012	0.001 to 10 mg/l
		Cadmium	ASTM D 1976:2012	0.002 to 100 mg/l
		Arsenic	ASTM D 1976:2012	0.005 to 100 mg/l
		Cyanide	IS 3025(Part 27)1986 RA 2009	0 to 10 mg/l
		Magnesium	IS 3025 Part 46 1994 RA 2009	5 to 500 mg/l
		Phenolic Compounds	ASTM D 1783-01(2012)	0.001 to 0.50 mg/l
		Lead	ASTM D 1976:2012	0.005 to 10 mg/l
		Zinc	ASTM D 1976:2012	0.1 to 100 mg/l
		Alkalinity	IS3025(Part23) 1986 RA 2009	5 to 1000 mg/l
		Aluminium	ASTM D 1976:2012	0.01 to 100 mg/l
		Boron	ASTM D 1976:2012	0.05 to 100 mg/l
		Selenium	ASTM D 1976:2012	0.005 to 10 mg/l
III. PETROLEUM PRODUCTS				
1.	**Lube Oil**	Color	Visual	NA
		Flash Point by PMCC & COC	ASTM D 92-2012 & 93-2013	40°C to 360°C by COC Upto 100°C by PMCC
		Pour Point	ASTM D 97-2012	Ambient Temp to -40°C
		TBN	ASTM D 2896-07	≤300 mgKOH/gm
		TAN	ASTM D 664-11	0.1 to 250 mgKOH/gm
		Kin.Viscosity@ 40°C & 100°C	ASTM D 445-12	2 cst to 400 cst
		Viscosity Index	ASTM D 2270-10	-

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	Lube Oil	Sulphated Ash	ASTM D 874-13	0.001% to 0.005%
		Density Of LubeOil (Hydrometer)	ASTM D 1298-12	0.60 gm/cc to 1.0gm/cc
		Water Content KF Method	ASTM D 6304-07	10 mg/kg to 5000 mg/kg
		Sulphur	ASTM D 5185-13	0.5 ppm to 2000ppm
		Chlorine(By Bomb Method)	ASTM D 808-11	0.01% to 1.00%
2.	**Fuel Oil**	Density by Density Hydrometer	ASTM D 1298-12	0.7 g/cc to 1.2 g/cc
		Water Content	ASTM D 95-13	0.05% to 1.0 %
		Calorific Value by Bomb Calorimeter	ASTM D 240-09	Upto 10000cals/g
		Kin.Viscosity	ASTM D 445-12	2 cst to 4000 cst
		Flash Point by PMCC	ASTM D 93-13	Upto 100°C
IV. BUILDING MATERIALS				
1.	**Cement**	(opc/psc/ppc)		
		Loss on Ignition	IS 4032-1985 RA 2009	1.0% to 10%
		Silica(SiO2)	IS 4032-1985 RA 2009	0.5% to 35%
		Ferric Oxide Fe2O3	IS 4032-1985 RA 2009	0.1% to 10%
		Alumina Al2O3	IS 4032-1985 RA 2009	0.1% to 10%
		Calcium Oxide CaO	IS 4032-1985 RA 2009	1.0% to 80%
		Magnesia MgO	IS 4032-1985 RA 2009	0.1% to 10%
		Sulphuric Anhydride	IS 4032-1985 RA 2009	0.1% to 3.5 % when C3A≤5% 0.1% to 3.5 % when C3A≥5%

Laboratory	**Raghavendra Spectro Metallurgical Laboratory, 326, Cross-9, Phase 4, Peenya Indl. Area, Bangalore, Karnataka**		
Accreditation Standard	**ISO/IEC 17025: 2005**		
Discipline	**Chemical Testing**	**Issue Date**	**24.02.2014**
Certificate Number	**T-0371**	**Valid Until**	**30.01.2016**
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	Cement	Insoluble Residue	IS 4032-1985 RA 2009	With fly ash 0.1% to 4% Without fly ash 0.1% to 8%
		Sulphide Sulphur(slag)	IS 4032-1985 RA 2009	0.1% to 2%

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