

<b>Laboratory</b>	<b>Chemical Testing Laboratory, Technical Services Department, BHEL, Bhopal, Madhya Pradesh</b>		
<b>Accreditation Standard</b>	<b>ISO/IEC 17025: 2005</b>		
<b>Discipline</b>	<b>Chemical Testing</b>	<b>Issue Date</b>	<b>03.02.2015</b>
<b>Certificate Number</b>	<b>T-0132</b>	<b>Valid Until</b>	<b>02.02.2017</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. PAINTS AND SURFACE COATING</b>				
<b>1.</b>	<b>Paints, Enamel &amp; Varnishes</b>	Wt. in kg/ 10	IS 101 (Part 1/sec 7): 1987(RA 2007)	8.0 kg to 15.0 kg
		Non volatile matter %	IS 101 (Part 8/sec 2): 1990 (RA 2007)	(20 to 80) by wt.
		Volatile matter %	IS 101 (Part 2/sec 2)1986 (RA 2007)	(20to 80) by wt.
		Scratch hardness	IS101 (Part 5/sec 2) 1988 (RA 2004)	100 g to 2000 g
		Consistency	IS 3944: 1982 (RA 2005)	30 s to 120 s
		Dry film thickness	IS 101 (Part 3/sec 2)1989 (RA 2004)	1.0 micron to 200 micron
		Resistance to corrosion	IS 101 (Part 6/sec 1) 1988 (RA 2005)	Humidity: 80 to100%RH Temp: 42 °C to 48 °C Qualitative
		Resistance to salt spray	IS 101 (Part 6/sec1)1988 (RA 2005)	Qualitative
		Gloss	IS 101 (Part 4/sec 4)1988 (RA 2007)	1.0 to 99 unit
		Drying time	IS 101 (Part 3/sec 1)1986 (RA 2007)	Qualitative
		Compatibility	ASTM D 3359: 2009	Qualitative
		Resistance to acid	IS 2932: 1993 (RA 2003)	Qualitative
		Resistance to alkali	IS 2932: 1993 (RA 2003)	Qualitative
		Resistance to chemical	IS 14209: 1994 (RA 2004)	Qualitative
		Pot life	IS 14209: 1994 (RA 2004)	4.0 to 12.0 hrs
Color	IS 5: 1994 (RA 2007)	Qualitative		

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	<b>Paints, Enamel &amp; Varnishes</b>	Finish	IS101 (Part 3/sec 4) 1987 (RA 2004)	Qualitative
		Pigment content	IS 101 (Part 8/sec 2) 1990 (RA 2000)	10 % to 60 %
		Volume solid %	IS 101 (Part 8/sec 6)1990 (RA 2007)	20 % to 60 %
		Resistance to heat	IS 101 (Part 7/sec 3)1990 (RA 2005)	Qualitative

## **II. METALS AND ALLOYS**

<b>1. Stainless Steel</b>	Carbon	Glow Discharge Optical Emission Spectroscopy ( LECO)	0.01 % to 0.05 %
		IS 9879: 1998	0.051% to 0.10 %
		ASTM E 1086: 08	0.11 % to 0.30 %
	Sulfur	IS 9879: 1998	0.01 % to 0.03 %
		ASTM E 1086: 08	0.031% to 0.07 %
	Phosphorus	IS 9879: 1998	0.010% to 0.030 %
		ASTM E 1086: 08	0.031% to 0.07 %
Manganese	IS: 9879 - 1998	0.10% to 1.0 %	
	ASTM E 1086 : 08	1.10% to 2.50 %	
		2.51% to 5.00 %	
		5.10% to 10.0 %	
Nickel	IS 9879 - 1998	3.0 % to 10.0 %	
	ASTM E 1086 -08	10.1% to 25.0 %	
Vanadium	IS 9879 - 1998	0.03% to 0.10 %	
	ASTM E 1086 -08	0.11% to 0.30 %	
Molybdenum	IS 9879 - 1998	0.1 % to 1.0 %	
	ASTM E 1086 -08	1.01% to 6.00 %	
Copper	IS 9879 - 1998	0.03% to 0.10 %	
	ASTM E 1086 -08	0.11% to 2.0 %	

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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
	Stainless Steel	Titanium	IS 9879 -1998 ASTM E 1086- 08	0.02% to 0.30 %
		Niobium	IS 9879 -1998 ASTM E 1086 – 08	0.05% to 0.50 % 0.51% to 1.00 %
2.	Carbon Steel & Low Alloy Steel	Carbon	Glow Discharge OpticalEmission Spectroscopy (LECO) IS 8811 : 1998 (RA 2006) ASTM E 415 – 08	0.01 % to 0.10 % 0.11 % to 0.50 % 0.51% to 1.0 %
		Silicon	IS 8811 : 1998 (RA 2006) ASTM E 415 – 08	0.05 % to 0.50 % 0.51% to 1.00 %
		Manganese	IS: 8811 : 1998 (RA 2006) ASTM E 415 - 08	0.05% to 0.50 % 0.51% to 1.00 % 1.00% to 2.50 %
		Phosphorus	IS 8811 : 1998 (RA 2006) ASTM E 415 - 08	0.005% to 0.050 % 0.051% to 0.090 %
		Chromium	IS 8811 : 1998 (RA 2006) ASTM E 415 - 08	0.05 % to 0.50 % 0.51 % to 1.50 % 1.51 % to 5.00 %
		Nickel	IS 8811 : 1998 (RA 2006) ASTM E 415 - 08	0.05% to 0.50 % 0.51% to 1.50 % 1.51% to 4.00 %
		Vanadium	IS: 8811 : 1998 (RA2006) ASTM E 415 – 08	0.05% to 1.00 %
		Molybdenum	IS 8811 : 1998 (RA 2006) ASTM E 415 – 08	0.05% to 1.00 % 1.01% to 3.00 %
		Copper	IS 8811 : 1998 (RA 2006) ASTM E 415 – 08	0.03 % to 0.10 % 0.11% to 2.0 %

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3.	Carbon Steel & Low Alloy Steel	Titanium	IS 8811:1998 (RA 2006) ASTM E 415-8	0.02 % to 0.30 %
		Niobium	IS 8811 : 1998 (RA 2006) ASTM E 415 – 08	0.05 % to 0.50 % 0.51 % to 1.00 %
	Carbon Steel & Low Alloy Steel	Carbon	ASTM : E-1019 -08 IS 228 (Part 20): 2003 C& S determinator	0.01% to 0.30 % 0.31 % to 0.50 % 0.51% to 1.00 % 1.01 % to 3.00 %
		Sulfur	ASTM : E-1019 -08 IS 228 (Part 20): 2003 C& S determinator	0.01% to 0.05 % 0.051% to 0.08 %
		Silicon	IS 228 (Part 8): 1989 (RA 2004)	0.05 % to 0.50 % 0.51% to 1.00 %
		Manganese	IS 228 (Part 2): 1987 (RA 2002)	0.05% to 0.20 % 0.21% to 1.00 % 1.01 % to 3.00 %
		Phosphorus	IS 228 (Part 3): 1987 (RA 2002)	0.01 % to 0.05 % 0.051% to 0.09 %
		Nickel	IS 228 (Part 5): 1987 (RA 2002)	0.10% to 0.50 % 0.51% to 2.00 % 2.01% to 5.00 %
		Chromium	IS 228 (Part 6): 1987 (RA 2002)	0.10 % to 0.50 % 0.51 % to 2.00 % 2.01 % to 5.00 %

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4.	<b>Plating Thickness (Zn, Ni, Cr, Ag, Au, Cu, and Sn)</b>	Thickness	ASTM B568-98 (Reapproved 2009)	0.001 µm to 40 µm
5.	<b>Oxygen Content of Copper</b>	Oxygen Content	ASTM E 2575-08	0.00001% to 2 %
6.	<b>Copper and its alloys</b>	Bismuth	TSD/01518 Rev 00 Issue date: 31.10.14	0.001 % to 0.10%
		Antimony	TSD/01518 Rev 00 Issue date: 31.10.14	0.001 % to 0.50%
		Aluminum	TSD/01518 Rev 00 Issue date: 31.10.14	0.01 % to 11.0%
		Arsenic	TSD/01518 Rev 00 Issue date: 31.10.14	0.01% to 0.15%
		Iron	TSD/01518 Rev 00 Issue date: 31.10.14	0.01 % to 5.00%
		Lead	TSD/01518 Rev 00 Issue date: 31.10.14	0.001 % to 10.0%
		Nickel	TSD/01518 Rev 00 Issue date: 31.10.14	0.01 % to 5.00%
		Phosphorus	TSD/01518 Rev 00 Issue date: 31.10.14	0.001 % to 1.0%
		Tin	TSD/01518 Rev 00 Issue date: 31.10.14	0.001 % to 15.0%
		Zinc	TSD/01518 Rev 00 Issue date: 31.10.14	0.01 % to 6.0%

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7.	<b>Tin Base alloys</b>	Antimony	TSD/01518 Rev 00 Issue date: 31.10.14	0.1 % to 15%
		Lead	TSD/01518 Rev 00 Issue date: 31.10.14	0.01 % to 1%
		Copper	TSD/01518 Rev 00 Issue date: 31.10.14	1.0 % to 9.0 %
8.	<b>Conductors</b>	Cure test	IS 6181: 1971 (RA 2003)	Qualitative
		Resistance to insulating oil	IS 13730 (Part 0/Sec.1): 1998 (RA 2003) IEC:60851 (Part 4): 2005	Qualitative
		Resistance to solvent	IEC:60851 (Part 4): 2005	Qualitative
<b>III. PETROLEUM</b>				
1.	<b>Insulating oil</b>	Density at 29.5°C	IS 1448 (Part 32): 1992 (RA 2003)	800 to 950 kg./m <sup>3</sup>
		IFT at 27°C	IS 6104 : 1992 (RA 2006)	(0.04 to 0.075) N/m
		Moisture content	IS 13567: 1992 (RA 2003)	(02 to 50.0) mg/kg
		K.viscosity at 27 °C & at 40 ° C	IS 1448 (Part 25): 1976 (RA 2007)	(3 to 27.0) Cst
		Copper strip corrosion	IS 1448 (Part 15): 2004	Qualitative
		Neutralization value	IS 1448 (Part 2): 2007	(0.003 to 0.03) mgKOH/g
		Neutralization value after oxidation	IS 12422:1988 (RA 2008) IEC 61125 – 1992 -08	(0.02 to 0.4) mg KOH/g

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	<b>Insulating oil</b>	Sludge content after oxidation	IEC 60296-2003-11	0.1 % max
		Oxidation inhibitor	IEC 60666, 2010-04	Qualitative
		Total acidity After Ageing	IS 1448 (Part 2): 2007	0.004 to 0.05mgKOH /g
		Total sludge	IS 12177: 1987 (RA 2003)	0.05 % by mass. max
		Flash Point	IS 1448 (Part 21): 1992 (RA 2003)	40 °C to 400 °C
<b>2.</b>	<b>Transformer oil</b>	Dissolve gas analysis	IS 9434: 1992 (RA 2003) IEC 60567 – 2005 -06	0.1 to 5000 µl/L
		Methane		0.1 to 5000 µl/L
		Ethane		0.1 to 5000 µl/L
		Ethylene		0.1 to 5000 µl/L
		Acetylene		0.1 to 5000 µl/L
		Carbon Monoxide		0.1 to 5000 µl/L
		Carbon Dioxide		0.1 to 5000 µl/L
<b>IV. PAPER AND PULP</b>				
<b>1.</b>	<b>Kraft paper, crepe and tissue paper</b>	Conductivity of aqueous extract.	IS 9335 (Part 2): 1998 (RA 2007) IEC 60554-2,2001-11	10.0 ms /m max
		Ash content	IS 9335 (Part 2): 1998 (RA 2007) IEC 60554-2,2001-11	0.2% to 1.0 % (by mass)
		pH of aqueous extract	IS 9335 (Part 2): 1998 (RA 2007) IEC 60554-2,2001-11	2.0 to 14.0

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2.	<b>Press board and press paper</b>	Ash content	ISO 2144: 1997	0.2 % to 1.0 % (by mass)
		Conductivity of aqueous extract.	IEC 60641 (Part 2): 2004: 06	(0.3 to 10.0) ms /m
		Effect on insulating oil	BS EN 60763 (Part 2): 2007: 02	0.1 mg KOH/gm max
		Increase in acidity	IEC 60296 2003 – 11 IEC 62021-1, 2007	0.1 mgKOH /gm max
		Increase in sludge content	IEC 61125- 1992 – 08	0.05 % max
		pH of aqueous extract	IEC 60641 (Part 2): 2004 -06	2.0 to 14.0

#### **V. BUILDING MATERIALS**

1.	<b>Epoxide glass fabric , fibric glass epoxide tube sheet and moulding</b>	Fire retardant test	IEC 60695-11-10 - 2003 -08	60.0 s max
		Glass content	IS 14399 (Part 1): 1990 (RA 2002)	20 to 45 %
		Density	BS 2782 (Part 6): 620d -1990, (RA 2005)	1.0 to 2.5 g/cc
		Specific gravity	IS 10192: 1992 (RA 2005)	1.0 to 2.5
2.	<b>Glass tape and Glass cloth</b>	Glass content	IS 5352 (Part 2): 1999 (RA 2004)	90 to 100 % min
		Conductivity of aqueous extract	IS 4420: 1989 (RA 2004)	(10.0 to 70.0) μmhos/cm
		pH of aqueous extract	IS 1390: 1983 (RA 2004)	2.0 to 14.0
	<b>Glass cord Glass braided sleeve</b>	Lubricant content	IS 5352 (Part 2): 1999 (RA 2004)	1.0 % to 2.5 %
		Glass content	IS 5352 (Part 2): 1999 (RA 2004)	90 to 100 % min



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	<b>Glass cord Glass braided sleeve</b>	Conductivity of aqueous extract pH of aqueous extract	IS 4420: 1989 (RA 2004) IS 1390; 1983 (RA 2004)	(10.0 to 70.0) $\mu$ mhos/cm 2.0 to 14.0
<b>3.</b>	<b>Epoxy glass reinforced laminated sheet</b>	Marten's heat distortion temp.	DIN 53462	R/T - 250 °C

#### **VI. PLASTICS AND RESINS**

<b>1.</b>	<b>Woven polyester tape</b>	Conductivity of aqueous extract pH of aqueous extract	IS 4420: 1989 (RA 2004) IS 1390 (RA 2004)	(10 to 70.0) $\mu$ mhos/cm 2.0 to 14.0
<b>2.</b>	<b>Polyester tape, Nylon, Isophthalate tape, Polymers, Rubbers, Plastics, Resins, Varnishes, PVC tubes, PTFE film &amp; tapes, Polyester film &amp; tapes, Polypropylene film, Acrylic resin (Perspex) and Cork sheet.</b>	Identification of materials by FTIR	TSD/01420 Rev 04 Revision date: 08/01/2011	Qualitative

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<b>3.</b>	<b>B stage resin impregnates insulating tapes &amp; folium.</b>	Substance	IEC 60371-2 ,2004 – 06	60 g/m <sup>2</sup> to 350 g/m <sup>2</sup>
		Mica	IEC 60371-2 ,2004 – 06	50 g/m <sup>2</sup> to 200 g/m <sup>2</sup>
		Glass / Polyester	IEC 60371-2 ,2004 – 06	15 g/m <sup>2</sup> to 50 g/m <sup>2</sup>
		Binder content	IEC 60371-2 ,2004 – 06	10 to 45% g/m <sup>2</sup>
		Breaking load	IEC 60371-2 -2004 IEC 60626 (Part 2): 2009	30 to150 N/ cm
		Resin flow	IEC 60371-2 ,2004 – 06	1 % to 70 %
		Volatile matter	IEC 60371-2 ,2004 – 06	0.20 % to 2.00 %
		Thickness	IEC 60371-2 ,2004 – 06	0.08 mm to 0.40 mm
<b>4.</b>	<b>Moulding micanite sheet</b>	Substance	IEC 60371-2 ,2004 – 06	530 g/m <sup>2</sup> to 590 g/m <sup>2</sup>
		Mica	IEC 60371-2 ,2004 – 06	89 % to 93 %
		Binder content	IEC 60371-2 ,2004 – 06	7 %to 11 %
		Volatile matter	IEC 60371-2 ,2004 – 06	1.0 % max.
		Mold ability	IS 2464 – 1963, RA 2008	Qualitative

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