

Laboratory R & D Laboratory, Vardhman Special Steels Limited, C-58, Focal Point, Ludhiana, Punjab

Accreditation Standard ISO/IEC 17025: 2005

Certificate Number TC-7438

Page 1 of 3

Validity 22.06.2018 to 21.06.2020

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
-----	----------------------------	-------------------------	---	--

CHEMICAL TESTING

I.	METALS & ALLOYS			
1.	Carbon Steel & Alloy Steel	Carbon Sulphur Oxygen Nitrogen	ASTM E 1019	0.010 % to 3.50 % 0.004 % to 0.400 % 0.0005 % to 0.004 % 0.0030 % to 0.0500 %
		Oxygen Nitrogen Hydrogen	ASTM E 1019 IS 228 (Part 22)	0.0005 % to 0.0040 % 0.0030 % to 0.0500 % 0.0001 % to 0.0006 %
		Aluminum	ASTM E 415	0.002 % to 1.30 %
		Arsenic		0.002 % to 0.100 %
		Boron		0.0003 % to 0.010 %
		Carbon		0.010 % to 1.5 %
		Calcium		0.0002 % to 0.0050 %
		Chromium		0.01 % to 3.50 %
		Cobalt		0.002 % to 0.20 %
		Copper		0.01 % to 1.0 %
		Manganese		0.010 % to 2.0 %
		Molybdenum		0.005 % to 1.0 %
		Niobium		0.001 % to 0.10 %
		Nickel		0.005 % to 5.0 %
		Phosphorous		0.003 % to 0.100 %
		Sulphur		0.003 % to 0.350 %
		Antimony		0.001 % to 0.10 %
		Silicon		0.01 % to 2.0 %
		Tin		0.001 % to 0.100 %
		Titanium		0.001 % to 0.40 %
		Vanadium		0.001 % to 0.40 %

Laboratory R & D Laboratory, Vardhman Special Steels Limited, C-58, Focal Point, Ludhiana, Punjab

Accreditation Standard ISO/IEC 17025: 2005

Certificate Number TC-7438

Page 2 of 3

Validity 22.06.2018 to 21.06.2020

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
<u>MECHANICAL TESTING</u>				
I. MECHANICAL PROPERTIES OF METALS				
1.	Ferrous Material & Products	Brinell Hardness	IS 1500 (Part 1)	120 HBW to 550 HBW (10 / 3000)
		Rockwell Hardness (HRBW and HRC)	IS 1586 (Part 1)	20 HRBW to 100 HRBW 20 HRC to 70 HRC
		Tensile Test Ultimate Tensile Strength Yield Stress %Elongation % Reduction in area	IS 1608	50 MPa to 1500 MPa 50 MPa to 1350 MPa 2.00 % to 50.00 % 2.00 % to 70.00 %
		Charpy 'U' Notch Impact	IS 1499	2 to 300 J / (-100 °C to Ambient Temperature)
		Izod Impact	IS 1598	2 to 168 J at ambient temperature
II. METALLOGRAPHY				
1.	Ferrous Material & Products	Average Grain Size	ASTM E 112 IS 4748 (By Microscopic Method)	Qualitative ASTM No.: 1 to 10 Magnification: 100x
		Inclusion Rating	IS 4163 ASTM E 45 Method 'A'	Qualitative (Thin & Heavy: A, B, C & D: 0 to 5) Magnification: 100x
		Depth of Decarburization	IS 6396 (By Microscopic Method)	0.01 mm to 1 mm Magnification: 100x
		Microstructural Analysis	ASM Handbook (Vol. 09) - 2004“ Metallography & Microstructures“	Magnification 50x , 100x & 200x, 400x, 500x, 1000x, 2000x (Qualitative)

Laboratory R & D Laboratory, Vardhman Special Steels Limited, C-58, Focal Point, Ludhiana, Punjab

Accreditation Standard ISO/IEC 17025: 2005

Certificate Number TC-7438

Page 3 of 3

Validity 22.06.2018 to 21.06.2020

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
2.	Steel	Carbide structure by means of diagram series	SEP 1520 (Microscopic Examination)	Qualitative (CN: 4.0 to 4.9, 5.0 to 5.9) (CZ: 6.0 to 6.9, 7.0 to 7.9) Magnification 100x & 1000x

Naveen Jangra
Convenor

Anuja Anand
Program Manager