SINGAPORE LABORATORY ACCREDITATION SCHEME

Accredited Laboratory SAC-SINGLAS

Schedule

Professional Testing Services Pte Ltd
32 Kian Teck Road
Singapore 628779

Certificate No. : LA-1995-0088-G

Issue No. : 23

Date : 02 May 2019

FIELD OF TESTING : Mechanical Testing

MATERIALS/ PRODUCTS TESTED	TESTS/ PROPERTIES	STANDARD METHODS/ TECHNIQUES
A. METALS & METALS PRODUCTS (*) Specification	1. Tension Test (i) Tension on test plates & tubular sections at ambient temperature in the range of 0 kN to 2000 kN with controlled strain rate & cross-head movement, including yield & proof stress (ii) Ultimate tensile strength of re-bar in the range of 0 kN to 2000 kN	ASTM A370-2018 ASTM B557-2015 ASTM E8/E8M-2016a ASME IX-2017 *AWS D1.1/D1.1M-2015 (Errata 2016) *AWS D1.4/D1.4M-2018 *AWS D1.6/D1.6M-2017 *AWS D1.2/D1.2M-2014 *API 1104-2013 (Addendum 2-2016) BS EN ISO 6892-1: 2016 *NKK Rules Part K Chapter 2.3.1: 2018 AS 1391: 2007 (R2017) AS 2205-2.1: 2003 AS 2205-2.2: 2003 ASTM F606/F606M-2016 BS EN ISO 898-1: 2013 (Sect 8.1, 8.2, 8.5) BS EN ISO 898-2: 2012 BS 4190: 2014 BS 4449: 2005+A3: 2016 BS 3692: 2014 API 1104-2013 (Addendum 2-2016) SS 560: 2016 BS EN ISO 15630-1: 2010 MS ISO 15630-1: 2012 * MS 144: 2014 * MS 146: 2014 JIS Z 2241: 2011 (Errata 2012) BS EN ISO 6892-1: 2016 SS 2 Part 1: 1999 SS 2 Part 2: 1999

Schedule

Accredited Laboratory SAC-SINGLAS

Certificate No. : LA-1995-0088-G Issue No. : 23

Date : 02 May 2019 Page : 2 of 9

MATERIALS/ PRODUCTS TESTED	TESTS/ PROPERTIES	STANDARD METHODS/ TECHNIQUES
	(iii) Modulus of elasticity on test pieces In the range of 0 kN to 2000 kN	SS 2 Part 3: 1987 BS EN ISO 6892-1: 2016 BS 4449: 2005 + A3: 2016 SS 18 Part 1: 1999
	(iv) Tensile Test at Elevated Temp. (up to 750ºC) in the range of 0 kN to 250 kN with controlled strain rate &cross-head movement, including yield & proof stress	ASTM E21-2017 BS EN ISO 6892-2: 2018
	(v) Through Thickness Tensile Test	ASTM A770 / A770M-2003 (Reapproved 2018) BS EN 10164: 2018 *Lloyd's Chapter 3, Sect 8: 2017 *ABS Pt. 2, Chapter 1, Sect 1-17: 2019
	(vi) All Weld Tensile Test	ASME IX-2017 *AWS D1.1/D1.1M-2015 (Errata 2016) BS EN ISO 9018: 2015
	2. Hardness Tests (i) Vickers Hardness test in the range of 0.3 kgf to 50 kgf	ASTM E92-2017 ASTM A370-2018 ASTM E140-2012b^{E1} ASTM E384-2017 BS EN ISO 9015-1: 2011 BS EN ISO 6507-1: 2018 AS 1817 Pt 1: 2003 (R2017)
	(ii) Rockwell Hardness 'C' Scale	ASTM E18-2019 BS EN ISO 6508-1: 2016
	(iii) Brinell Hardness	ASTM E10-2018 BS EN ISO 6506-1: 2014 AS 1816.1: 2007 (R2017)
	3. Compression Test (i) Compression strength, up to 600 kN in loading	ASTM E9-2009 (Reapproved 2018)

Schedule

Accredited Laboratory SAC-SINGLAS

Certificate No. : LA-1995-0088-G Issue No. : 23

Date : 02 May 2019 Page : 3 of 9

MATERIALS/ PRODUCTS TESTED	TESTS/ PROPERTIES	STANDARD METHODS/ TECHNIQUES
	4. Shear Test	ASTM B565-2004 (Reapproved 2015) *SS 32 Part 1: 1999 ASME II Part A-2017, SA 263-265 ASTM A263-2012 ASTM A264-2012 ASTM A265-2012
	5. Impact Test (i) Charpy V-notch Impact tests from ambient temperature down to -110^{0}C & -196^{0}C	ASTM A370-2018 *AWS D1.1/D1.1M-2015 (Errata 2016) ASME IX-2017 ASTM E23-2018 BS EN ISO 148-1: 2016 AS 1544 Pt 2: 2003 (R2017)
	6. Bend Test / Roller Bend test	ASTM A370-2018 AWS D1.1/D1.1M-2015 (Errata 2016) ASME IX-2017 *API 1104-2013 (Addendum 2-2016) BS EN ISO 5173: 2010+A1: 2011 ASTM E190-2014 ASTM E290-2014 AS 2205-3.1: 2003 AS 2205-3.3: 2003 AWS D1.6/D1.6M-2017 AWS D1.2/D1.2M-2014 BS EN ISO 7438: 2016 AS 1085.20: 2012
	7. Bend Test / Rebend Test	SS 2 Part 1: 1999 SS 2 Part 2: 1999 SS 2 Part 3: 1987 *SS 32 Part 1: 1999 *SS 32 Part 2: 1986 BS 4449: 2005+A3: 2016 *SS 18 Part 1: 1999 SS 427: 1998 SS 560: 2016 BS EN ISO 15630-1: 2010 MS ISO 15630-1 :2012 * MS 144: 2014 * MS 146: 2014

MATERIALS/ PRODUCTS TESTED	TESTS/ PROPERTIES	STANDARD METHODS/ TECHNIQUES
	8. Fracture Test	*AWS D1.1/D1.1M-2015 (Errata 2016) ASME IX-2017 BS EN ISO 9017: 2018 AWS D1.6/D1.6M-2017 AWS D1.2/D1.2M-2014
	9. Flattening Test	ASTM A370-2018 *ABS Pt. 2, Chapter 3, Sect 5-19: 2019 *Lloyd's Chapter 2, Sect 4.2: 2017 API 5L: 2018 (Errata 1 2018) BS EN ISO 8492: 2013
	10. Flaring/Flanging Test (up to outside diameter of 2 inches)	ASTM A370-2018 *ABS Pt. 2, Chapter 3, Sect 5-23 & 25: 2019 *Lloyd's Chapter 2, Sect 4.3 & 4.4: 2017 BS EN ISO 8493: 2004 BS EN ISO 8494: 2013
	11. Nick-Break Test	ASTM A370-2018 *API 1104-2013 (Addendum 2-2016)
	12. Microscopic Examination Macroscopic examination on welds	ASTM E381-2017 ASME IX-2017 *AWS D1.1/D1-1M-2015 (Errata 2016) *API 1104-2013 (Addendum 2-2016) BS EN ISO 17639: 2013 AS 1085.20: 2012 AS 2205.5.1: 2003
	13. Macro-etching metals & alloys	ASTM E340-2015 ASME IX-2017 *AWS D1.1/D1.1M-2015 (Errata 2016) AS 2205-5.1: 2003

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	14. Determination of Metal Composition	
	(i) Carbon and low-alloy steels Elements: Al, B, C, Cr, Co, Cu, Mn, Mo, N, Ni, Nb, P, Si, S, Sn, Ti, V, W	ASTM A751-2014a ASTM E415-2017 AS 1085.20: 2012 BS EN 10351: 2011 CR 10320: 2004 * MS ISO 15630-1: 2012 * MS ISO 15630-2: 2012 * MS 144: 2014 * MS 145: 2014 * MS 146: 2014
	(ii) Stainless Steels Elements: Cr, Ni, Mo, Mn, Si, N, Cu, C, P, S	ASTM A751-2014a ASTM E1086-2014
	(iii) Steel, Stainless Steel, Iron, Nickel & Cobalt Alloys Elements: C, S, N, O	ASTM E1019-2018 ISO 15350: 2000 ISO 15351: 1999 ISO 17053: 2005
	(iv) Nickel & Nickel Alloys Elements: Al, B, C, Ca, Cr, Co, Cu, Fe, Mg, Mn, Mo, Ni, Nb, P, S, Si, Sn, Ti, Ta, W, V, Zr	PTS-M001 (Spark OES Method) ASTM E2594-2009 (Reapproved 2014) ASTM E3047-2016
	(v) Titanium & Titanium Alloys Elements: Al, B, Cr, Co, Cu, Fe, Mn, Mo, Ni, Nb, Pd, Ru, Si, Sn, Ta, W, V, Y, Zr	ASTM E2371-2013
	(vi) Titanium & Titanium Alloys Elements: H	ASTM E1447-2009 (Reapproved 2016)
	(vii) Titanium & Titanium Alloys Elements: O, N	ASTM E1409-2013
	(viii) Aluminium & Aluminium Alloys Elements: Ag, As, B, Ba, Be, Bi, Ca, Cd, Co, Cr, Cu, Fe, Ga, Li, Mg, Mn, Mo, Na, Ni, P, Pb, Sb, Sc, Si, Sn, Sr, Ti, Tl, V, Zn, Zr	ASTM E1251-2017a ASTM E3061-2017

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	(ix) Aluminium & Aluminium Alloys Elements: H	ASTM E2792-2013
	(x) Refractory & Reactive Metals and their Alloys Elements: C	ASTM E1941-2010 (Reapproved 2016)
	(xi) Positive Material Identification	ASTM A751-2014a ASTM E1476-2004 (Reapproved 2014)
	(xii) Steels Elements: C, S N Mn Ni Cu Mo	 ISO 15350: 2000 ISO 15351: 1999 ISO 10278: 1995 ISO 13898-2: 1997 ISO 13898-3: 1997 ISO/TS 13899-1: 2004
	15. Portable Hardness Test	ASTM E110-2014 ASTM A956/A956M-2017a ASTM E10-2018
	16. Pitting Corrosion	ASTM G48-2011 (Reapproved 2015) Method A, Method B
	17. Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels	ASTM A262-2015 Practice A (ii) & E (i)
	18. Detecting susceptibility to Intergranular Attack in Wrought, Nickel-Rich, Chromium – Bearing Alloys	ASTM G28-2002 (Reapproved 2015)
	19. Determining Volume Fraction by Systematic Manual Point Count	ASTM E562-2011
	20. Fracture Mechanics Toughness Test, Crack Tip Opening Displacement (CTOD) Test a (SENB) Single Edge Notched Bend	BS 7448-1: 1991 BS 7448-2: 1997 ASTM A370-2018 BS EN ISO 15653: 2018 AS 2205.7.3: 2003 ISO 12135: 2016
	b (SENT) Single Edge Notched Tension	BS 8571: 2018 DNV RP F108: 2006 Section 2 DNVGL RP F108: 2017

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	21. Hydrogen Induced Cracking (HIC) Test	NACE Standard TM0284-2016 item no. 21215
	22. (SSCC) Test	ASTM G39-1999 (Reapproved 2016) ASTM A370-2018 BS EN ISO 7539-1: 2012 BS EN ISO 7539-2: 1995 NACE Standard TM0177-2016 item no.21212
	23. Salt Spray Test	ASTM B117-2018
	24. Fatigue Test	MS 146: 2014 BS 4449: 2005 + A3: 2016 SS 560: 2016 BS EN ISO 15630-1: 2010 AS 1085.20: 2012 MS ISO 15630-1: 2012
	25. Relaxation Test	JIS G 3137: 2008
	26. Detecting detrimental intermetallic phase in duplex austenitic/ferrite stainless steels	ASTM A923-2014 Method A (ii) & C (i)
	27. Determining average grain size	ASTM E112-2013
	28. Determination of Diffusible Hydrogen Content of Weld Metal, via Gas Chromatography, Produced by Arc Welding	AWS A4.3-1993 (R2006) BS EN ISO 3690: 2018
	29. Surface Geometry and Tolerances: Determination of the relative rib or indentation area	BS EN ISO 15630-1: 2010 MS ISO 15630-1: 2012 * MS 144: 2014 * MS 145: 2014 * MS 146: 2014
	30. Dimensions, Mass per Metre and Tolerances: Determination of deviation from Nominal mass per metre	BS EN ISO 15630-1: 2010 MS ISO 15630-1: 2012 * MS 144: 2014 * MS 145: 2014 * MS 146: 2014

Schedule

Certificate No. : LA-1995-0088-G Issue No. : 23

Date : 02 May 2019 Page : 8 of 9

MATERIALS/ PRODUCTS TESTED	TESTS/ PROPERTIES	STANDARD METHODS/ TECHNIQUES
B. STEEL WIRE MESH	1. Tension Test	
	(i) Tension on steel wires taken from wire fabric at ambient temperature in the range 0 kN to 600 kN with controlled strain rate & cross-head movement, including yield and proof stress.	*SS 32 Part 1: 1999 *SS 32 Part 2: 1986 *SS 18 Part 1: 1999 BS EN ISO 6892-1: 2016 SS 18 Part 2: 1970 (1981) SS 561: 2010 BS EN ISO 15630-2: 2010 MS ISO 15630-2: 2012 * MS 145: 2014
	(ii) Determination of percentage total elongation at maximum force	*SS 18 Part 1: 1999 *SS 32 Part 1: 1999
	2. Bend and Rebend Test	SS 427: 1998 SS 561: 2010 BS EN ISO 15630-2: 2010 MS ISO 15630-2: 2012 * MS 145: 2014
	3. Weld Shear Test	*SS 32 Part 1: 1999 *SS 32 Part 2: 1986 SS 561: 2010 BS EN ISO 15630-2: 2010 MS ISO 15630-2:2012 * MS 145: 2014

(*) : Specification

Schedule

Accredited Laboratory SAC-SINGLAS

Approved Signatories

1.	Mr Tee Chng Kin	-	all accredited tests
2.	Mr Seto Yuen Hee	-	item A1 – A13 & B1 – B3
3.	Mr Ong King Liong	-	item A14 (i), (ii), (iv), (xi), A15, A28
4.	Mr Johnson Lee Gao Shan	-	item A16 – A19, A21 – A22, A23 & A26 – A27
5.	Mr Kelvin Por Wei Han	-	item A20 – A25
6.	Mr Tang Tung Yieng	-	item A14 (i), (ii), (iv), (xi), A15
7.	Mr Luke Joon Shiong	-	item A14 (i), (ii), (iv), (xi), A15
8.	Mr Alsert Chua Chee Meng	-	item A14 – A15, A28
9.	Mr Gregory Chua Shyang Shyang	-	item A21 – A22, A28, A29, A30
10.	Mr Damien Looi Liang Wei	-	Item A1-A13, B1- B3, A20 (a)

Note :

This laboratory is accredited in accordance with the recognised International Standard ISO/IEC 17025:2005. A laboratory's fulfilment of the requirements of ISO/IEC 17025:2005 means the laboratory meets both the technical competence requirements and **management system requirements** that are necessary for it to consistently deliver technically valid test results. The **management system requirements** in ISO/IEC 17025:2005 (Section 4) are written in language relevant to laboratory operations and meet the principles of ISO 9001:2008 **Quality Management Systems — Requirements** and are aligned with its pertinent requirements.