

Schedule

Element Materials Technology Singapore Pte Ltd
West Point Bizhub
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Certificate No. : LA-2018-0689-G
Issue No. : 7
Date : 4 January 2024
Expiry Date : 09 September 2025
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FIELD OF TESTING : Mechanical Testing

MATERIALS / PRODUCTS TESTED	TESTS / PROPERTIES	STANDARD METHODS / TECHNIQUES / EQUIPMENT
<p>A Metals, Metal Products & Welds</p>	<p><u>Mechanical Tests</u></p> <p>1. Tension Test on Structural Steel Plate, Sheet Tubular Machine Capacity up to 1000 kN</p>	<ul style="list-style-type: none"> • ASTM A370-22 • ASTM B557-15 (2023) • ASTM B557M-15 (2023) • ASTM E8/E8M-22 • *ASTM A20/A20M-20 • *ASTM A36/A36M-19 • *ASTM A516/A516M-17 • *ASTM A615/A615M-22 • *ASTM A962/A962M-23A • API 5L: 2018 46th Ed Errata 1: 2018 • API 2H:2006(R2020), 9th Ed • *API 2W: 2019 6th Ed • API 1104:2021, 22nd Edition • AWS D1.1/D1.1M:2020 • AWS D1.2/D1.2M:2014 Errata 2014 • AWS D1.6/D1.6M:2017 • ASME BPVC IX-2023 • AS 1391:2020 • BS EN 10025-1:2004 • BS EN 10025-6:2019+A1:2022 • BS EN ISO 6892-1:2019 • BS EN ISO 4136:2022 • *BS EN 10225-1:2019 • *BS EN 10225-2:2019 • *BS EN 10225-3:2019 • *BS EN 10225-4:2019 • *BS 111:2019 • *BS EN ISO 15614-1:2017+A1:2019 • *DNVGL Rules for Classification of Ships July 2023 • *DNVGL-OS-B101 July 2020 • "Metallic Materials" • *DNVGL-ST-F101 2017 Appendix B, B300 • ISO 4136:2022 • ISO 5178:2019

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A Metals, Metal Products & Welds		<ul style="list-style-type: none"> • ISO 6892-1:2019 • *ISO 2566-1:2021 • *ABS Rules Part 2 2023 • *CAAS SAR Chapter 6.5 Appendix 1 [effective date 15 Dec. 2011 (issue 2)] • AS 2205.2.1:2003 • *AS/NZS 2885.2:2020
	2. Tension Test at Elevated Temperature (150°C)	<ul style="list-style-type: none"> • ASTM E21-20
	3. Tension and Proof Load Test on Fastener	<ul style="list-style-type: none"> • ASTM F606/F606M-21 • *ASTM A194/A194M-23 • *ASTM A193/A193M-23 • *ASTM A962/A962M-23A • ISO 898-1:2013 • ISO 898-2:2022
	4. Through-Thickness Tensile Test	<ul style="list-style-type: none"> • ISO 7778:2014 • *ASTM A770/A770M-03(2018) • *API 2W:2019 6th Ed • *API 2H:2006(R2020), 9th Ed • *BS EN 10164:2018
	5. All Weld Tensile Test	<ul style="list-style-type: none"> • AWS D1.1/D1.1M:2020 • AWS D1.2/D1.2M:2014 Errata 2014 • *BS EN ISO 15614-1:2017+A1:2019 • * DNVGL-ST-F101 2017
	6. Charpy V-notch Impact Test Temperature From Ambient Temperature Down to -196°C	<ul style="list-style-type: none"> • ASTM A370-22 • ASTM E23-23a • AWS D1.1/D1.1M:2020 • API 5L: 2018 46th Ed Errata 1:2018 • BS EN 10025-1:2004 • BS EN 10025-2:2019 • BS EN ISO 148-1:2016 • *BS EN ISO 15614-1:2017+A1:2019 • *BS EN ISO 11960:2021 • ISO 148-1:2016 • *ASTM A962/A962M-23A • *DNVGL-ST-F101 2017 Appendix B, B400 • AS 2205.7.1:2003 • *AS/NZS 2885.2:2020
	7. Flattening Test	<ul style="list-style-type: none"> • ASTM A370-22

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A Metals, Metal Products & Welds	8. Flaring / Flanging Test	<ul style="list-style-type: none"> • *ASTM A106/106M-19a • *ASTM A530/A530M-18 • *ASTM A1016/A1016M-18a • ASTM A370-22 • *ASTM A1016/A1016M-18a
	9. 3-Point Bend Test	<ul style="list-style-type: none"> • ASTM A370-22 • *ASTM A615/A615M-22 • *ASTM A962/A962M-23A • ASTM E855/E855M-21 • ASTM E190-21 • ASTM E290-22 • AWS D1.1/D1.1M:2020 • ASME BPVC IX-2023 • ISO 5173:2023 • BS EN ISO 5173:2023 • BS EN ISO 7438:2020 • *BS EN ISO 15614-1:2017+A1:2019 • *BS EN ISO 11960:2021 • AWS D1.6/D1.6M:2017 • AWS D1.2/D1.2M:2014 Errata 2014 • API 5CT:2018, 10th Ed + Addendum 1 (2021) • *DNVGL-ST-F101 2017 Appendix B500 • API 1104:2021, 22nd Edition • *ABS Rules Part 2 2023 • *CAAS SAR Chapter 6.5 Appendix 1 [effective date 15 Dec. 2011 (issue 2)] • AS/NZS 2205.3.1:2020 • *AS/NZS 2885.2:2020
	10. Fracture Test	<ul style="list-style-type: none"> • AWS D1.1/D1.1M:2020 • AWS D1.2/D1.2M:2014 Errata 2014 • AWS D1.6/D1.6M:2017 • ASME BPVC IX-2023 • BS EN ISO 9017:2018 • *ABS Rules Part 2 2023
	11. Fracture Toughness: Single Edge Notch Bend (SENB)	<ul style="list-style-type: none"> • BS 7448-1:1991 • BS 7448-2:1997 • BS EN ISO 15653:2018 • API RP 2Z: 2005 4th Ed Reapproved 2020 • API 1104:2021, 22nd Edition • * DNVGL-ST-F101 2017 Appendix B, B800

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A Metals, Metal Products & Welds		<ul style="list-style-type: none">• ISO 12135:2021• ASTM E1820-23b• *AS/NZS 2885.2:2020
	12. Fracture Toughness: Single Edge Notch Tension (SENT)	<ul style="list-style-type: none">• DNVGL RP-F108-2019
	13. Nick-Break Test	<ul style="list-style-type: none">• API 1104:2021, 22nd Edition
	14. Fatigue Testing of Reinforcing Bar	<ul style="list-style-type: none">• BS 4449:2005+A3:2016
	15. Shear Strength	<ul style="list-style-type: none">• ASTM A264-12(2019)• ASTM A265-12(2019)
	<u>Metallography</u>	
	16. Vickers Hardness Test	<ul style="list-style-type: none">• ASTM A370-22• *ASTM A962/A962M-23A• ASTM E92-23• BS EN ISO 6507-1:2018• * DNVGL-ST-F101 2017 Appendix B, B1003• * DNVGL-ST-F101 2017 Appendix B, B1011• AS 2205.6.1:2003• *AS/NZS 2885.2:2020
	17. Rockwell Hardness Test	<ul style="list-style-type: none">• BS EN ISO 6508-1:2016• ASTM E18-22• ASTM A370-22• * DNVGL-ST-F101 2017 Appendix B, B1011• *ASTM A962/A962M-23A
	18. Brinell Hardness Test	<ul style="list-style-type: none">• BS EN ISO 6506-1:2014• ASTM E10-23• ASTM A370-22• * DNVGL-ST-F101 2017 Appendix B, B1011• *ASTM A962/A962M-23A
	19. Microindentation Hardness Test	<ul style="list-style-type: none">• ASTM E384-22
	20. Macroetching of Metals & Alloys	<ul style="list-style-type: none">• ASTM E340-15

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A Metals, Metal Products & Welds	21. Macroscopic Examination	<ul style="list-style-type: none"> • ASME BPVC IX-2023 • AWS D1.1/D1.1M:2020 • * DNVGL-ST-F101 2017 Appendix B, B1001 • ASTM E381-22 • ASTM A604/A604M-07(2022)
	22. Microetching of Metals & Alloys	<ul style="list-style-type: none"> • ASME BPVC IX-2023 • AWS D1.1/D1.1M:2020 • AWS D1.2/D1.2M:2014 Errata 2014 • AWS D1.6/D1.6M:2017 • * DNVGL-ST-F101 2017 Appendix B, B1001 • BS EN ISO 17639:2022 • ISO 5817:2023 • *ASME BPVC IX 2023 • AS/NZS 2205.5.1:2019 • *AS/NZS 2885.2:2020
	23. Microscopic Examination	<ul style="list-style-type: none"> • ASTM E407-07(2015)e1 • * DNVGL-ST-F101 2017 Appendix B, B1002
	24. Sample Preparation	<ul style="list-style-type: none"> • ASTM E562-19e1 • ASTM E45-18a • BS EN 1321:1997 • BS EN ISO 17639:2022 • * DNVGL-ST-F101 2017 Appendix B, B1002 • *CAAS SAR Chapter 6.5 Appendix 1 [effective date 15 Dec. 2011 (issue2)]
	25. Determination of Average Grain Size	<ul style="list-style-type: none"> • ASTM E3-11(2017)
	26. Microstructure and Graphite in Iron Castings	<ul style="list-style-type: none"> • ASTM E112-13(2021)
	27. Visual examination of Welded Structure/ Plates/ Pipes	<ul style="list-style-type: none"> • ASTM A247-19 • *CAAS SAR Chapter 6.5 Appendix 1 [effective date 15 Dec. 2011 (issue 2)]

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MATERIALS / PRODUCTS TESTED	TESTS / PROPERTIES	STANDARD METHODS / TECHNIQUES / EQUIPMENT
A Metals, Metal Products & Welds	28. <u>Corrosion Tests</u> Corrosion Testing	<ul style="list-style-type: none"> • ASTM G48-11(2020)e1, Practice A • ASTM G48-11(2020)e1, Practice C • ASTM G48-11(2020)e1, Practice E • ASTM A923-23 Method C
	29. Pitting Corrosion	<ul style="list-style-type: none"> • * DNVGL-ST-F101 2017 Appendix B, C200
	30. Intergranular Corrosion	<ul style="list-style-type: none"> • ASTM A262-15(2021), Practice A • ASTM A262-15(2021), Practice B • ASTM A262-15(2021), Practice C • ASTM A262-15(2021), Practice E • ASTM A262-15(2021), Practice F
	31. Hydrogen Induced Cracking (HIC)	<ul style="list-style-type: none"> • NACE TM0284-2016 • * DNVGL-ST-F101 2017 Appendix B, C300
	32. Sulphide Stress Cracking (SSC)	<ul style="list-style-type: none"> • NACE TM0177-2016 • NACE TM0316-2016 • ASTM G39-99(2021) • EFC No 16 3rd Edition • * DNVGL-ST-F101 2017 Appendix B, C400
	33. Detecting Susceptibility to Intergranular Corrosion (Ferric Sulphate – Sulphuric Acid Test)	<ul style="list-style-type: none"> • ASTM G28-22 Method A
	34. <u>Coatings</u> Cathodic Disbondment	<ul style="list-style-type: none"> • AFNOR NF A49-711 (1992), Annex K • AFNOR NF EN 10329 (A49-716) Annex E (2006) • NACE SP0394-2023, Appendix F • CSA Z245.20-14 Section 12.8 Update No. 3, May 2016 • ISO 21809-1:2018, Annex H • ISO 21809-3:2016 Amd.1:2020, Annex G • ASTM G8-96(2019) • ASTM G42-11(2019)e1
	35. Hot-Water Soak	<ul style="list-style-type: none"> • NACE SP0394-2023, Appendix J • ISO 21809-3:2016 Amd.1:2020, Annex I • ISO 21809-1:2018 Annex L • ISO 21809-2:2014 Annex A.16

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MATERIALS / PRODUCTS TESTED	TESTS / PROPERTIES	STANDARD METHODS / TECHNIQUES / EQUIPMENT
A Metals, Metal Products & Welds	36. Non-destructive Measurement of Film Thickness of Pipeline Coatings on Steel	<ul style="list-style-type: none"> • ASTM D7091-21 • ISO 21809-1:2018, Annex A • ISO 21809-3:2016 Amd.1:2020, Annex B
	37. Penetration Resistance of Pipeline Coatings (Blunt Rod)	<ul style="list-style-type: none"> • ISO 21809-3:2016 Amd.1:2020, Annex E (excluding pressure of 0.10 N/mm²)
	38. Holiday Detection	<ul style="list-style-type: none"> • ASTM G62-22 • ISO 21809-1:2018, Annex B • ISO 21809-3:2016 Amd.1:2020, Annex C
	39. Pull-off Test for Adhesion	<ul style="list-style-type: none"> • ISO 4624:2023 • BS EN ISO 4624:2023 • ASTM D4541-22
	40. Adhesion or Cohesion Strength of Thermal Spray Coatings	<ul style="list-style-type: none"> • CSA Z245.20-14 Section 12.14 Update No. 3, May 2016
	41. Peel Strength Test	<ul style="list-style-type: none"> • ISO 21809-1:2018, Annex C • ISO 21809-3:2016 Amd.1:2020, Annex H
	42. Impact Test	<ul style="list-style-type: none"> • ISO 21809-3:2016 Amd.1:2020, Annex D • NACE SP0394-2023 Appendix I
	43. Measurement of Metal and Oxide Coating Thickness by Microscopic Examination	<ul style="list-style-type: none"> • ASTM B487-20
	44. Porosity of the coating	<ul style="list-style-type: none"> • ISO 21809-2:2014 Annex A.12
	45. Cross-Section & Interface Porosity	<ul style="list-style-type: none"> • NACE SP0394-2023 Appendix G
46. Flexibility	<ul style="list-style-type: none"> • NACE SP0394-2023 Appendix H 	

* Product Specification

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Approved Signatories

S/N	Name	Scope
1.	Mr Aldrin C. Quijada	- For all accredited tests
2.	Mr Rory L. Dapitan	- For all accredited tests
3.	Mr Ramesh Sellapan	- For all accredited tests excluding item 20 to 26, and item 34 to 46
4.	Ms Khin Ohnmar Aung	- For accredited tests 34 to 46 only (i.e. coating tests).
5.	Dr Basab Bhattacharya	- For all accredited tests
6.	Mr Kingsley Leong	- Item 1, 3-10, 13, 16-22, 24-25.
7.	Mr Lim Bing Cong	- For accredited tests item 16 to 27 and item 43
8.	Mr Andrew Teo Cheng Kiat	- For accredited tests item 1 to 9 & 16 to 18

Note :

This laboratory is accredited in accordance with the recognised International Standard ISO/IEC 17025. A laboratory's fulfilment of the requirements of ISO/IEC 17025 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 are written in language relevant to laboratory operations and operate generally in accordance with the principles of ISO 9001.