

# Schedule

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MS ISO/IEC 17025

NO: SAMM 442

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**LABORATORY LOCATION:**  
(PERMANENT LABORATORY)



**METALLURGICAL CONSULTANCY  
AND SERVICES SDN. BHD**  
NO. 20, JALAN U5/17 (PS)  
SEKSYEN U5  
40150 SHAH ALAM, SELANGOR  
MALAYSIA

**FIELD OF TESTING: MECHANICAL**

This laboratory has demonstrated its technical competence to operate in accordance with MS ISO/IEC 17025:2005 (ISO/IEC 17025:2005).

This laboratory's fulfillment 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 and calibrations. 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 (see Joint ISO-ILAC-IAF Communiqué dated April 2017).

**SCOPE OF TESTING: MECHANICAL**

Materials/ Products Tested	Type of Test/ Properties Measured/ Range of Measurement	Standard Test Methods/ Equipment/Techniques
Metallic materials	Tensile test at ambient temperature Range: 0 kN to 1000 kN Properties measured: a. Yield stress b. 0.2% Proof Stress c. Tensile Strength d. Elongation % e. Reduction in Area % f. Young's Modulus	ASTM A370-2017 ASTM E8-2016 BS EN 10002- Part 1:2001 EN ISO 6892-1: 2016 JIS Z2241-2011 EN ISO895:1995  Equipment Used:- 1. Shimadzu UH-100A and T-Machine LT 3H 500 kN 2. T-Machine Extensometer
	Tensile test at elevated temperature (maximum 300 °C) Range: 0 kN to 500 kN Properties measured: a. Yield stress b. 0.2% Proof Stress c. Tensile Strength d. Elongation % e. Reduction in Area %	ISO 6892-2: 2011  Equipment Used:- 1. T-Machine LT 3H 500 kN 2. Book type oven equipped to the T-machine
	Through thickness tensile test	ASTM A770-03(R2012) API 2H-2006 S4 BS EN 10164:2004  Equipment Used:- T-Machine LT 3H 500 kN

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## SCOPE OF TESTING: MECHANICAL

Materials/ Products Tested	Type of Test/ Properties Measured/ Range of Measurement	Standard Test Methods/ Equipment/Techniques
Metallic materials (Continued)	Bend test & Slow Bend test	ASTM A370-2017 JIS Z2248:2006 ASTM E 190:2014 ASTM E 290:2014 ISO 7438:2016 AS 1085.20 : 2012 BS EN 14730-1 : 2017 EN 14587-1 : 2007  Equipment Used:- (i) Guided Bend Test Machine (ii) 300 Ton T- Machine
	Flattening test	ASTM A370-2017 EN ISO 8492:2013  Equipment Used:- Guided Bend Test Machine with hardened plunger and base plate.
	Flaring test	ASTM A370-2017 EN ISO 8493:2004  Equipment Used:- Shimadzu UH-100A
	Charpy impact test (V-notch and U-notch) Range: 0 J to 300J Sub-zero temperatures (-196°C) to elevated temperature (100°C)	ASTM E23-2016 ASTM A370-2017 ISO 148-1: 2016  Equipment Used:- Denison Mayes charpy machine Tinius Olsen charpy machine

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**SCOPE OF TESTING: MECHANICAL**

<b>Materials/ Products Tested</b>	<b>Type of Test/ Properties Measured/ Range of Measurement</b>	<b>Standard Test Methods/ Equipment/Techniques</b>
Metallic materials (Continued)	<p>Hardness test</p> <p>a. Vickers (HvN) Range: 1 kgf to 50 kgf</p> <p>b. Brinell (HbN)</p> <p>c. Rockwell (HrB &amp; HrC)</p>	<p>ASTM E384-2017 ASTM A370-2017 ISO 6507-1:2018 JIS Z2244:2009 ASTM E92:2017 AS 1085.20 : 2012 EN 14587-1 : 2007 (Clause 6.4.8)</p> <p>Equipment Used:- Vickers Hardness Tester/FV-800</p> <p>ASTM E10-2017 ASTM A370-2017 JIS 2243:2008 ISO 6506-1:2014 AS 1085.20 : 2012 BS EN 14730-1 : 2017 (Clause 7.2)</p> <p>Equipment Used:- Brinell Hardness Tester / CV-3000LDB</p> <p>ASTM E18-2017 ASTM A370-2017 ISO 6508-1:2016</p>
Reinforcement bar	<p>a. Tensile testing Range of: 0 kN to 1000 kN</p> <p>b. Bend test</p> <p>c. Re-bend test</p> <p>d. Fatigue Testing</p>	<p>BS 4449:2005+A3:2016 MS 146:2014 MS 144:2014 MS 145:2014 MS ISO 15630-1:2012 BS 4449:2005 A2 : 2016 MS 146 : 2014 BS EN ISO 15630-1 : 2010 BS EN ISO 15630-2 : 2010 BS EN ISO 15630-3 : 2010 MS EN ISO 15630-1 : 2012 MS EN ISO 15630-2 : 2012 MS EN ISO 15630-3 : 2012</p> <p>Equipment Used:- (i) Shimadzu UH-100 A and T- Machine LT 3H 500 kN (ii) Guided bend test machine (iii) BISS 30 Ton Dynamic Testing Machine (iv) BISS 100 Ton Dynamic Testing Machine (v) T- Machine Dynamic 50 Tons</p>

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**SCOPE OF TESTING: MECHANICAL**

<b>Materials/ Products Tested</b>	<b>Type of Test/ Properties Measured/ Range of Measurement</b>	<b>Standard Test Methods/ Equipment/Techniques</b>
Rail	Fatigue Testing	EN 14587-1 : 2007 AS 1085.20 : 2012 BS EN 14730-1 : 2017

**Signatories:**

1. **Dr. Lim Ching Liang**
2. **Lim Chin Hui, Aaron**
3. **Lim Chin Ruenn, Benjamin**
4. **Ameer Khan b. Ibram Khan**
5. **Shalini Devi A/P Ramaiya**

**SCOPE OF TESTING: MECHANICAL**

Materials/ Products Tested	Type of Test/ Properties Measured/ Range of Measurement	Standard Test Methods/ Equipment/Techniques
Metallic Bolts, Screw and Studs	Tensile test Range: 0 kN to 1000 kN	ISO 898 Part 1:2013 ASTM A370-2017  Equipment Used:- Shimadzu UH-100A and T-Machine LT 3H 500 kN
	Proof load test Range: 0 kN to 1000 kN	ISO 898 Part 1: 2013 ASTM A370-2017  Equipment Used:- Shimadzu UH-100A and T- Machine LT 3H 500 kN
	Shear test of bolt Range: 0 kN to 1000 kN	In house developed procedure (QP/WI/01-i)  Equipment Used:- Shimadzu UH-100A and appropriate jig
Metallic Nut- coarse threads	Proof load test of nut Range: 0 kN to 1000 kN	ISO 898-2:2012 ASTM A370-2017  Equipment Used:- Shimadzu UH-100A and appropriate jig
Metallic clad or weld overlay	Shear test of clad material or weld overlay	ASTM A263:2012  Equipment Used:- T- Machine LT 3H 500 kN
Metallic materials including welded structures/plate/pipe	Heat Treatment:  a. Post weld heat treatment b. Normalizing	ASME VIII UCS (56) In house developed procedure (QP/WI/12a & b)  Equipment Used:- (i) Box Type Electric Furnace (ii) Temperature-recorder (iii) K-type thermocouple

**SCOPE OF TESTING: MECHANICAL**

Materials/ Products Tested	Type of Test/ Properties Measured/ Range of Measurement	Standard Test Methods/ Equipment/Techniques
Welded Structure/ Plates/ pipes	Test required for the qualification of Welding Procedure (WPS), Welder (WQT) and Production Control Test Plate (mock-up test).  (i) Transverse tensile test Range: 0 kN to 1000 kN  (ii) Bend test  (iii) Charpy impact test (V-notch and U-notch) Range: sub-zero temperatures (minus 196 °C) to elevated temperature (100 °C) Range: 0 J to 300 J.  (iv) Macro examination of welds  (v) Hardness test of welds  (vi) Fracture test  (vii) Nick break test	API 1104:2013 ASME IX:2017 AWS D1.1:2015 AWS D1.2:2014 AWS D1.3: 2018 AWS D1.6:2017 BS EN ISO 9606-1:2017 BS EN ISO 15614-1:2017 BS 1113:1999 BS 2790:1992 AS1210:2010 AS1554-1: 2011 BS EN 12952-6:2011 BS EN 12953-5:2002 BS EN ISO 15614-2017 BS EN ISO 15614-8:2016 ISO 10042:2005 JIS Z 2242:2005 EN 287-1:2011 AS 1085.20 : 2012 (Appendix 4) EN 14587-1 : 2007 (Clause 6.4.6) BS EN 14730-1 : 2017 (Clause 7.4.2)

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**SCOPE OF TESTING: MECHANICAL (METALLURGY)**

<b>Materials/ Products Tested</b>	<b>Type of Test/ Properties Measured/ Range of Measurement</b>	<b>Standard Test Methods/ Equipment/Techniques</b>
Metallic materials	Metallography (a) Surface Preparation (b) Grain size determination	ASTM E112-13
	Microstructure Identification (a) Ferrite, Pearlite or colonies of Pearlite (b) Austenite, (c) Martensite and Tempered Martensite, (d) Carbide (e) Sigma Phase (f) Delta Phase (g) High Temperature Creep	In house developed procedure (QP/WI/13) AS 1085.20 : 2012 (Appendix I) EN 14587-1 : 2007 (Clause 6.4.7) BS EN 14730-1 : 2017 (Clause 7.4.3 & 7.4.4)
Metallic materials including ferritic, austenitic, martensitic and duplex stainless steel	Ferrite Count (i) Point counting	ASTM E562-11  Equipment Used: Rotating polisher/grinder (Struers & Metkon model) and digital camera, high power microscope and appropriate size grid
	(ii) Instrumentation technique (feritscope)	In house developed procedure (QP/WI/15-b)  Equipment Used: Fischer Feritscope  In house developed procedure (QP/WI/15-a)
	(iii) Chemical composition Technique (by Schaeffler's Diagram)	Equipment Used: Shimadzu Emission Spectrometer GVM-514S and the diagram  Emission Spectrometer Q4 Tasman calibrated using relevant CRM

**SCOPE OF TESTING: MECHANICAL (METALLURGY)**

<b>Materials/ Products Tested</b>	<b>Type of Test/ Properties Measured/ Range of Measurement</b>	<b>Standard Test Methods/ Equipment/Techniques</b>
Welding Filler metal	Determining the hydrogen content in arc weld metal  Thermal Conductivity Detector Method (TCD Method)	ISO/DIS 3690:2012  Equipment Used: Hot air extraction/gas chromatography chamber
All type of ferrous and non-ferrous metallic materials (including Copper based, Nickel based, Aluminum based and Titanium based materials.	Positive Material Identification (Spectrometric Analysis-Instrumentation Technique)	In house developed procedure (QP/WI/11-b2)  Equipment Used: PMI master plus and PMI master pro calibrated using relevant CRM
	Positive Material Identification (X-ray Fluorescent technique)	In house developed procedure (QP/WI/11-c1)  Equipment Used: Oxford X-Met 3000TX+ analyzer calibrated using relevant CRM
Austenitic Stainless Steel	Corrosion test- Detecting susceptibility to inter-granular attack in austenitic stainless steel	ASTM A262-15 Practice A ASTM A262-15 Practice B ASTM A262-15 Practice C ASTM A262-15 Practice E ASTM A262-15 Practice F
Wrought, Nickel Rich, Chromium Bearing Alloys	Corrosion test- Detecting susceptibility to inter-granular corrosion in Wrought, Nickel Rich, Chromium Bearing Alloys	ASTM G28-2015 Method A ASTM G28-2015 Method B



**SCOPE OF TESTING: MECHANICAL (METALLURGY)**

Materials/ Products Tested	Type of Test/ Properties Measured/ Range of Measurement	Standard Test Methods/ Equipment/Techniques
Stainless steel and related alloys	Corrosion test- Pitting corrosion resistance of stainless steel and related alloys by use of ferric chloride solutions	ASTM G48-2015
Duplex Stainless Steel	Corrosion Test-Ferric Chloride Corrosion Test for Classification of Structures of Duplex Stainless Steels	ASTM A 923 Practice C-2014
Galvanized and corrosion resisting coated metallic products	Salt spray (Fog) test	ASTM B117-2016 ISO9227:2017 ASTM G 85:2011
Metallic materials (Pipeline and pressure vessel steel)	Hydrogen Induced Cracking (HIC)  - Crack length ratio (CLR) - Crack thickness ratio (CTR) - Crack sensitivity ratio (CSR)	NACE TM 0284:2016  Equipment used: - Air tight test vessel for gas flow rate up to 5000 ml/min. - Metkon rotating polisher and high resolution microscope
	Sulphide Stress Cracking (SSC)  - Resistance of metal to SSC in H <sub>2</sub> S environment	NACE TM 0177:2016  Equipment used: - Air tight test vessel for gas flow rate up to 5000 ml/min. - Metkon rotating polisher and high resolution microscope. - Appropriate test jigs to constantly stress the specimen.

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**SCOPE OF TESTING: MECHANICAL (METALLURGY)**

Materials/ Products Tested	Type of Test/ Properties Measured/ Range of Measurement	Standard Test Methods/ Equipment/Techniques
Iron based- ferrous metallic materials	Positive Material Identification (Spectrometric Analysis- Instrumentation Technique)  (i) Carbon and alloy steel Elements: C, Mn, Si, S, P, Cr, Mo, Ni, V, Nb, Al, Ti, Cu  (ii) Stainless steel Elements: C, Mn, Si, S, P, Cr, Mo, Ni, V, Nb, Al, Ti, Cu	ASTM E415-2017 BS EN 14730-1 : 2017 (Clause 5.4.3) AS 1085.20 : 2012 (Appendix J) ASTM E1086-14  Equipment Used:  Bruker Elemental Optical Emission Spectrometer Q4  Tasman calibrated using the calibrated using relevant CRM

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**SCOPE OF TESTING: MECHANICAL (METALLURGY)**

Materials/ Products Tested	Type of Test/ Properties Measured/ Range of Measurement	Standard Test Methods/ Equipment/Techniques
Metallic Materials	In Situ Boroscopy	In house developed procedure (QP/WI/20-b)  Equipment Used: Vizaar Revolver 80
	In Situ Metallography	In house developed procedure (QP/WI/20-d)  Equipment Used: Polishing Equipment and Media, Portable Microscope, Acetate Films and Laptop
Fe-based materials	In Situ Ferrite Content Measurement	In house developed procedure (QP/WI/20-e)  Equipment Used: Fischer Feritscope

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**SCOPE OF TESTING: MECHANICAL (METALLURGY)****SITE: CATEGORY 1**

<b>Materials/ Products Tested</b>	<b>Type of Test/ Properties Measured/ Range of Measurement</b>	<b>Standard Test Methods/ Equipment/Techniques</b>
All type of ferrous and non-ferrous metallic materials (including Copper based, Nickel based, Aluminum based and Titanium based materials.	In Situ PMI (Spectrometric Analysis- Instrumentation Technique)	In house developed procedure (QP/WI/20-c)  Equipment Used WAS-LAB PMI Master Oxford Xmet 3000TX Bruker Q4 Mobile Plus
All type of ferrous and non-ferrous metallic materials (including Copper based, Nickel based, Aluminum based materials	Positive Material Identification (Spectrometric Analysis- Instrumentation Technique)  Elements : C, Mn, Si, S, P, Cr, Mo, Ni, V, Nb, Al, Cu, B, MN	JIS G1253:2012  In House Procedure for BS Standards (QP/WI/11-d1)  ASTM E 634:2012 ASTM E 1251:2017 ASTM E 3047:2016  Equipment Used :  Bruker Elemental Optical Emission Spectrometer Q4 Tasman calibrated using the relevant CRM

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SCOPE OF TESTING: MECHANICAL

SITE: CATEGORY 1

Materials/ Products Tested	Type of Test/ Properties Measured/ Range of Measurement	Standard Test Methods/ Equipment/Techniques
Metallic Material	In situ Hardness	In house developed procedure (QP/WI/20-f)  Equipment Used Equotip Hardness Tester
	In situ Thickness Gauging	In house developed procedure (QP/WI/20-a)  Equipment Used Elcometer 456
	In situ Surface Roughness	In house developed procedure (QP/WI/20-g)  Equipment Used Mitutoyo Surface Tester
	Magnetic Particle Inspection	EN ISO 17638:2016

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