PULL-OFF ADHESION TEST REPORT

CLIENT: EMAAR	REPORT NO: TPI 4629-01, Rev. 00
CONTRACTOR: IRON MAKERS STEEL INDUSTRIES LLC	INSPECTION DATE: 14-03-2026
SUB CONTRACTOR: TECHNIQA SURFACE ENGINEERING	PLACE OF INSPECTION: IMS DUBAI INDUSTRIAL CITY
PROJECT: MARINE SHORES (J-181)	SCOPE: ADHESION (PULL-OFF) TEST

1. PULL OFF TEST REPORT

Client Job/ Order No	:	Aries Job No	: TPI4629-01, Rev.00
JOB DETAILS		**TEST METHOD DETAILS**	
Project:	MARINE SHORES (J-181)	Test Date	: 14.03.2026
Client	: EMAAR	Size of Dolly	: 20 mm
Contractor	: IRON MAKERS STEEL INDUSTRIES LLC	Equipment Used	: Elcometer 510 Adhesion Gauge
Sub Contractor	: TECHNIQA SURFACE ENGINEERING	Serial Number	: RC13995
Doc. Ref. No.	: ISO 4624	Surface Cleaning Standard	: SSPC SP 2 / SP 3
Paint System	: 4 Coat System	Reference	: Client Specification
Date & Time (Fixing Dolly)	: 13.03.2026, 08:00 AM	Acceptance limit	: 5 MPa
Date & Time (Dolly pull off)	: 14.03.2026, 09:15 AM	Test Method	: Adhesion Test
Item Description	: Test Panels (2 Nos)	Adhesive Used	: Araldite 2 Pack Epoxy Adhesive
Job Location	: IMS DUBAI INDUSTRIAL CITY	Equipment Cal Due date	: 03.09.2026
Paint Manufacturer	: JOTUN	Coating Thickness/Actual (Average)	: 400µm (microns)

2. Weather Condition

Condition	Date & Time	Air Temperature(°C)	Steel Temperature(°C)	Dew Point Temperature(°C)	Relative Humidity (%)
Dolly Fixing	18.07.2025, 08:00 AM	25.5 °C	24.7 °C	5.2 °C	69.9 %
Dolly Pull-off	19.07.2025, 9:15 AM	25.0 °C	25.1 °C	7.4 °C	63.9 %

3. Paint System Details: 1st - Sample Plate

COAT NO.	COATING DESCRIPTION	REQUIRED DFT
1	THERMAL SPRAY ALUMINIUM	200 µm
2	PENGAURD TIECOAT	25 µm
3	JOTAMASTIC 85	115 µm
3	HARDTOP XP	60 µm

4. Paint System Details: 2nd - Sample Plate

COAT NO.	COATING DESCRIPTION	REQUIRED DFT
1	THERMAL SPRAY ALUMINIUM	200 µm
2	PENGAURD TIECOAT	25 µm
3	JOTAMASTIC 85	115 µm
3	HARDTOP XP	60 µm

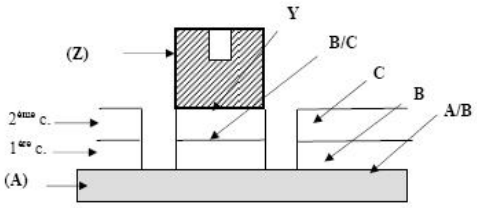
5. Inspection Details: 1st – Test panel

Item no	Test Number	DFT	Pull off Value	Mode of Failure	Remarks
Test Panel	Dolly No.1	455 µm	10.43 MPa	100% E	Value Achieved
Test Panel	Dolly No.2	453.75 µm	9.18 MPa	100% E	Value Achieved
Test Panel	Dolly No.3	477 µm	10.19 MPa	100% E	Value Achieved
Test Panel	Dolly No.4	477.25 µm	10.14 MPa	100% E	Value Achieved
Test Panel	Dolly No.5	416.5 µm	8.14 MPa	80% E, 20% Y/Z	Value Achieved
Test Panel	Dolly No.6	471.25 µm	10.35 MPa	100% E	Value Achieved
Test Panel Average Value Achieved – 9.73 MPa					

6. Inspection Details: 2nd - Sample Plate

Item no	Test Number	DFT	Pull off Value	Mode of Failure	Remarks
Test Panel	Dolly No.1	487.75 µm	10.16 MPa	100% E	Value Achieved
Test Panel	Dolly No.2	472.75 µm	7.11 MPa	90% E, 10% Y/Z	Value Achieved
Test Panel	Dolly No.3	446.25 µm	6.87 MPa	90% E, 10% Y/Z	Value Achieved
Test Panel	Dolly No.4	458 µm	9.04 MPa	90% E, 10% Y/Z	Value Achieved
Test Panel	Dolly No.5	436.75 µm	6.92 MPa	90% E, 10% Y/Z	Value Achieved
Test Panel	Dolly No.6	399.5 µm	9.82 MPa	100% E	Value Achieved
Test Panel Average Value Achieved – 8.32 MPa					

Failure Interpretation: *Codes (ISO 4624):*



A= is cohesive failure of substrate
A/B= is adhesive failure between substrate and first coat
B= is cohesive failure of first coat
B/C= is adhesive failure between first and second coats
C= is cohesive failure of second coat
D, E, F... = other coat for a multi coat system
-/Y= is adhesive failure between final coat and adhesive
Y= is cohesive failure of adhesive
Y/Z= is adhesive failure between adhesive and dolly

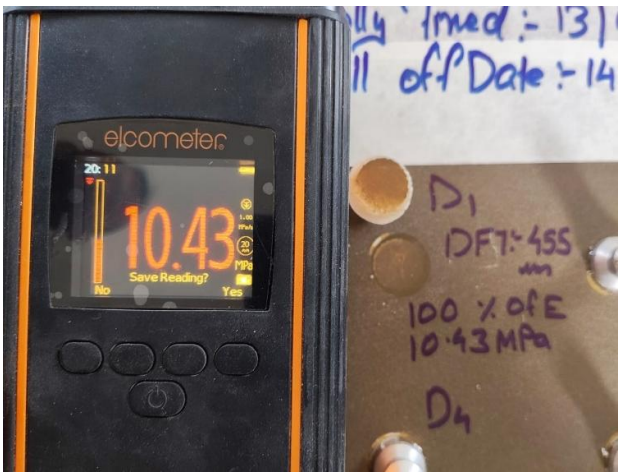
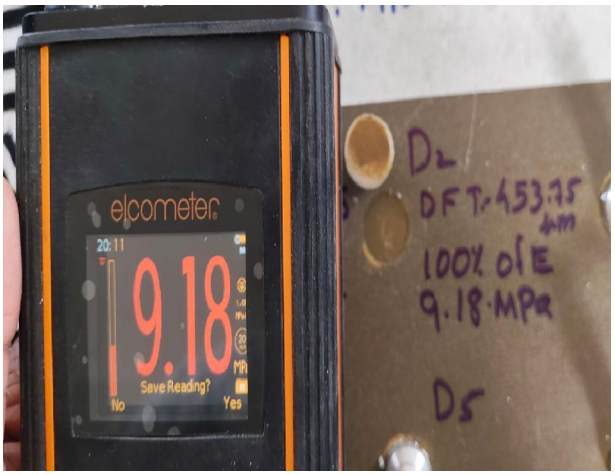
Breaking strength (MPa)= force / surface (cm²) *10

(1 bar=1daN/cm²=0.1 MPa)

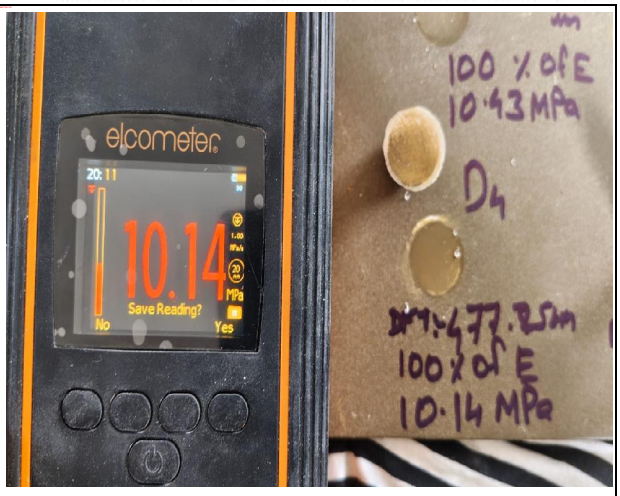
7. Inspection Photos:

For Test Panel 1

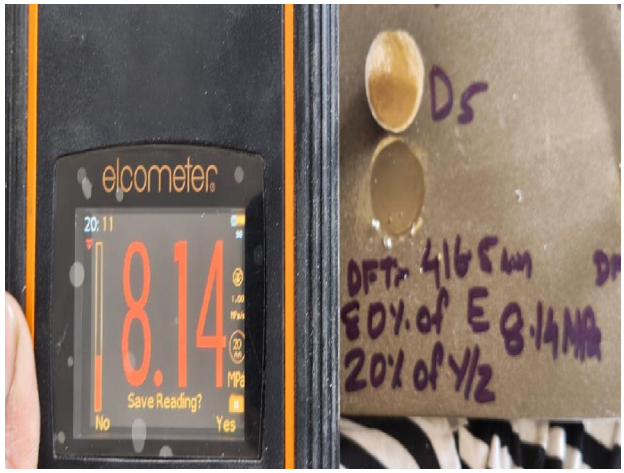
	
1. DFT Verifying D1	2. DFT Verifying D2

	
3. DFT Verifying D3	4. DFT Verifying D4
	
5. DFT Verifying D5	6. DFT Verifying D6
	
7. Pull of test value of Dolly D1	8. Pull of test value of Dolly D2

9. Pull of test value of Dolly D3

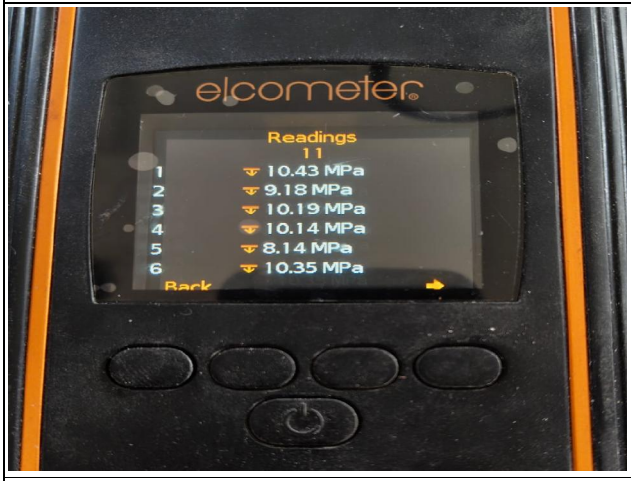


10. Pull of test value of Dolly D4

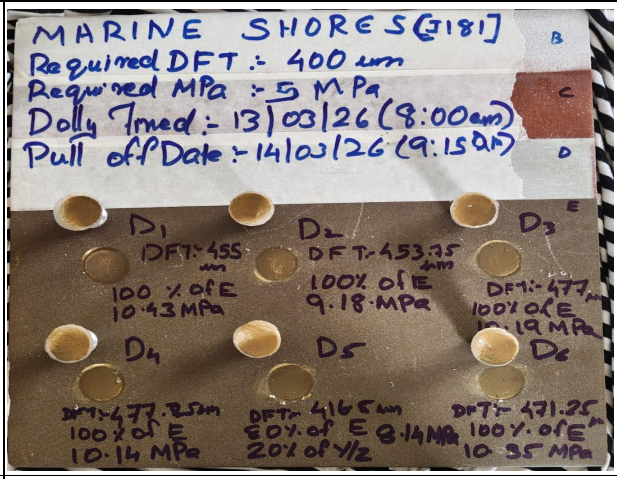


11. Pull of test value of Dolly D5

12. Pull of test value of Dolly D6

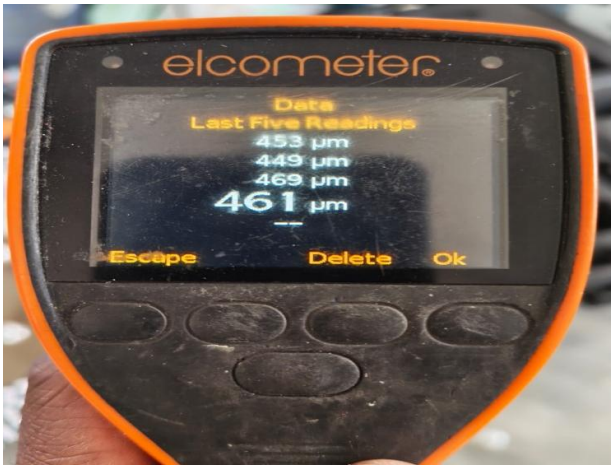


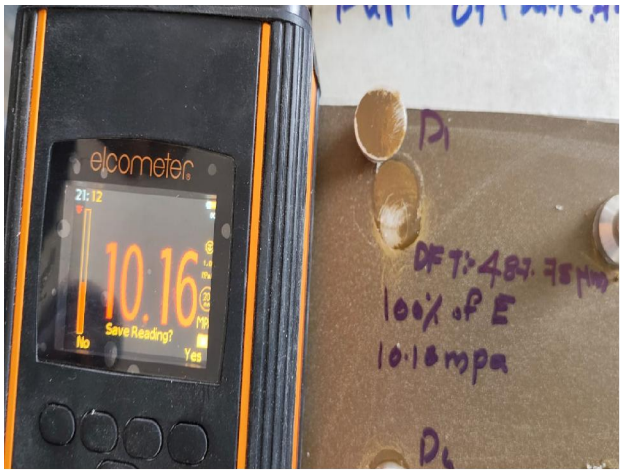
13. Review Pull of test value

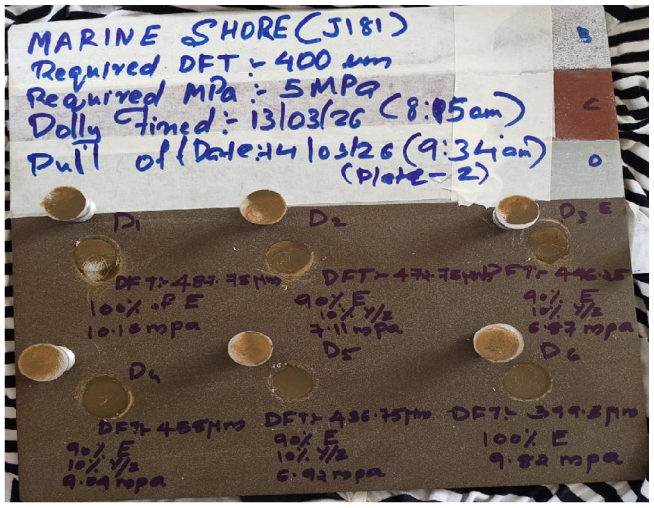


14. General View after Pull Off Test

For Test Panel-2

	
1. DFT Verifying D1	2. DFT Verifying D2
	
3. DFT Verifying D3	4. DFT Verifying D4
	
5. DFT Verifying D5	6. DFT Verifying D6

	
7. Pull of test value of Dolly D1	8. Pull of test value of Dolly D2
	
9. Pull of test value of Dolly D3	10. Pull of test value of Dolly D4
	
11. Pull of test value of Dolly D5	12. Pull of test value of Dolly D6

	
13. Review Pull of test value	14. General View after Pull Off Test

8. Observation

Nil

9. Result:

Adhesion Pull-off Test has been carried out on Test Panel in accordance with ISO 4624 and the test result meets the client acceptance criteria of Adhesion 5 MPa.

INSPECTED & PREPARED BY	TECHNIQA SURFACE ENGINEERING	IRON MAKERS STEEL INDUSTRIES LLC	EMAAR
ARIES GROUP INSPECTION REPORT GOKUL GIRIKUMAR COATING INSPECTOR			
Date: 14-03-2026	Date:	Date:	

ARIES MARINE & ENG. SERVICES LLC
اريـــس للخدمات البحرية والهندسية ذ م م
ص.ب.: ٢٤٤٩٦، الشارقة، ا.ع.م.، تليفون: ٥٥٠٣٣٠٠ (٩٧١٦)، فاكس: ٥٥٠٣١٠٠ (٩٧١٦)
P.O. Box : 24496, Sharjah, UAE Tel: +971 6 5503300 Fax: +971 6 5503100
Email: ariesmar@eim.ae Website: www.ariesgroupglobal.com
Aries Management System is Certified by ABS with ISO 9001, 14001 & 45001

Attachment – CALIBRATION CERTIFICATE – (Adhesion Test)

AM.ADT.02

elcometer
approved service centre

Calibration Certificate • Certificat d'étalonnage • Kalibrierzertifikat

Aries Marine & Eng. Services

Our Reference: Notre Référence: Unser Zeichen: 6790

Customer Reference: Référence Client: Kundenreferenz:

ELCOMETER LLC
P O Box 33358
Dubai
United Arab Emirates

Certificate Number: Numéro de certificat: Zertifikat Nummer: 6786

Serial Number: Numéro de série: Seriennummer des Geräts: RC13995

Issue Date: ^ Date d'émission: Ausstellungsdatum: 04/09/2025

Part Number: Code Article d'instrument: Artikelnummer des Geräts: F510-20T

Calibration Date: Date d'étalonnage: Kalibrierdatum: 04/09/2025

Model: Modèle: Modell: Elcometer 510 Model T Automatic Adhesion Gauge; 20mm Kit
Elcometer 510 Jauge d'adhésion automatique modèle T; Kit 20mm
Elcometer 510 Modell T Automatisches Haftfestigkeitsprüfgerät; 20mm Set

Latest Recommended Due Date 03/09/2026

The instrument above has been calibrated using load cell Serial Number NL11604. This instrument bears traceability to National Standards via UKAS Certificate No. 571 issued by UKAS Calibration Laboratory No. 0157.

L'appareil ci-dessus a été étalonné à l'aide d'un capteur de force, numéro de série NL11604. Cet appareil est conforme à certaines normes nationales avec le certificat UKAS No. 571 delivré par le Laboratoire d'étalonnage UKAS No. 0157.

Das oben genannte Gerät wurde unter Verwendung eines Zugkraftgebers mit der Seriennummer NL11604 kalibriert. Dieses Gerät ist auf nationale Standards durch das UKAS Zertifikat Nr.: 571, welches vom UKAS Kalibrierlabor 0157 ausgestellt wurde, rückführbar.

Measurement Results * • Résultats de Mesure * • Messergebnisse *

Nominal Reference Pressure Pression de reference nominale Nominell vorgegebener Druck		Actual Reference Pressure Pression de reference actuelle Tatsächlich vorgegebener Druck		Acceptable Pressure Range[1] Gamme de Pression acceptable[1] Akzeptabler Bereich des Drucks[1]		Gauge Pressure Pression Jauge Druck des Messgerätes	
MPa	psi ‡	MPa	psi ‡	MPa	psi ‡	MPa	psi ‡
2.00	290.08	1.87	271.22	1.62 - 2.12	234.98 - 307.48	2.02	292.97
5.00	725.19	4.89	709.23	4.64 - 5.14	672.97 - 745.49	5.01	726.63
10.00	1450.38	9.97	1446.03	9.72 - 10.22	1409.77 - 1482.29	10.01	1451.82
15.00	2175.57	14.97	2171.21	14.72 - 15.22	2134.95 - 2207.47	15.02	2178.46
20.00	2900.75	20.02	2903.65	19.77 - 20.27	2867.40 – 2939.91	20.03	2905.10
25.00	3625.94	25.06	3634.64	24.81 - 25.31	3598.39 – 3670.90	25.01	3627.39

* 20mm Dolly, 1 MPa/s Pull Rate • Plot 20mm, échelle de traction 1MPa/s • 20mm Stempel, 1 MPa/s Zugkraft

[1] Gauge Accuracy: ±1% of full scale • Précision de la Jauge : ±1% de l'échelle complète • Genauigkeit des Messgerätes : ±1% des Skalenendwerts

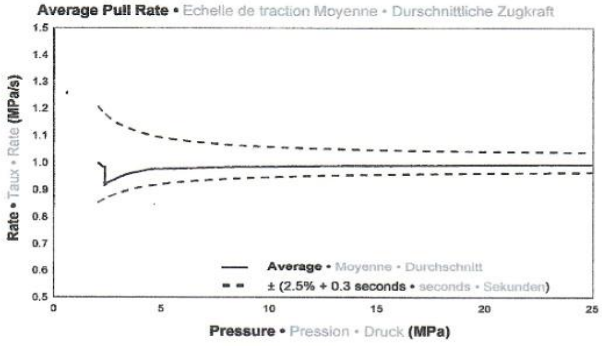
[2] Pull Rate Accuracy: ±(2.5% +0.3 seconds) • Précision échelle de traction: ±(2.5% +0.3 seconds) • Zugkraft-Genauigkeit: ±(2.5% +0.3 Sekunden)

‡ Calculated Value • Valeur calculée • Berechneter Wert

Pull Rate Results[2] • Résultats échelle de traction[2] • Zugkraft-Ergebnisse[2]

Range Gamme Bereich	Nominal Pull Rate Echelle de traction Nominale Nominale Zugkraft	Average Pull Rate Echelle de traction Moyenne Durschnittliche Zugkraft
2 - 15 MPa	0.30 MPa/s	0.30 MPa/s
2 - 25 MPa	1.00 MPa/s	0.99 MPa/s

Average Pull Rate • Echelle de traction Moyenne • Durschnittliche Zugkraft



DUBAI - U.A.E.
ELCOMETER L.L.C

Name: Nom: Name: Harish Gowda

www.elcometer.com

^ This Certificate is valid from the Issue Date • Ce certificat est valable à partir de la date d'émission • Das Zertifikat ist gültig ab Erstellungsdatum

Attachment – CALIBRATION CERTIFICATE (DFT Gauge)

AM-CTG-01

METRIC القياس لمعايرة الأوزان والفحوصات
CALIBRATION & TESTING LABORATORY
THE COMPLETE SOLUTION
+971 6 546 5550 +971 56 473 0912 info@metriccal.ae www.metriccal.ae PO.Box: 3504, Warehouse#12, ind. Area15, Sharjah - U.A.E.

CERTIFICATE OF CALIBRATION

Job Number	MCL-JN-25-5589-TR	**Calibration Date**	Friday, November 21, 2025
Certificate Number	MCL-JN-25-5589-TR-D-1	**Recommended Commended Due**	Friday, November 20, 2026
Location	In-Lab	**Issues Date**	Friday, November 21, 2025

CUSTOMER DETAILS

Name	**Aries Marine & Engg. Services LLC**
Address	P.O.Box: 24496 ,Sharjah, United Arab Emirates

DUC DETAILS

Description	**Coating Thickness Gauge**	**Serial Number**	**LG07024**
Manufacturer	Elcometer	**Capacity**	0 to 1600 µm
Model	456B	**Resolution**	0.1 / 1µm
Aries Id	**AM-CTG-01**	**Material**	Ferrous

ENVIRONMENTAL CONDITIONS DURING CALIBRATION

Avg. Ambient Temperature	20.6°C Uncertainty± 0.6°C	Avg. Relative Humidity	48.5%RH Uncertainty± 4%RH

CALIBRATION METHOD

The above equipment has been calibrated in accordance with
---MCL-QSD-CP-DIM-CTG-001 , Deviation of indication were measured against reference standard master of compatible class.

TRACEABILITY

The Standards ISO/IEC 17025:2017 of the Compliant Calibration Laboratory are traceable to the International System of Units (SI) through the National Institute of Standards and Technology or similar , and are part of a comprehensive measurement assurance program for ensuring continued accuracy and measurement traceability within the level of uncertainty reported by this laboratory. The unique laboratory calibration number identified above shall be used in referencing metrological traceability for artifacts identified only in this certificate.

CERTIFIED REFERENCE INSTRUMENTS DETAILS

Description	Make	Model	Certificate No	Due Date	Traceable
Coating Thickness Foil	N/A	N/A	MCL-JN-25-5259-EN-D-1	4-Nov-26	MCL-ENAS

CALIBRATION RESULT

Sr.no	Nominal Value	Mean Measured Value	Error	Error %	Uncertainty in µm±
	in µm	in µm	in µm		
1	50	50.2	0.2	0.4	7.4
2	101	102	1	1.0	7.4
3	248	250	2	0.8	7.4
4	497	500	3	0.6	7.4
5	1015	1019	4	0.4	7.5

UNCERTAINTY STATEMENT

The combined standard uncertainty includes the standard uncertainty reported for the standard, the standard uncertainty for the measurement process, a component of uncertainty to account for any observed deviations from MCL values that are less than surveillance limits. The combined standard uncertainty is multiplied by a coverage factor (k) of 2 to provide an expanded uncertainty, which defines a level of confidence of approximately 95 percent (95 %). The expanded uncertainty presented in this report is consistent with the ISO/IEC Guide to the Expression of Uncertainty in Measurement (2008). The expanded uncertainty is not to be confused with a tolerance limit for the user during application.This certificate did not contain any statement of conformity for the measured values.

Form no- MCL-QSD-F-022 , Revision no : 00 , Revision date : 00 , Issue Date : 01-06-2022

Calibrated by
Saktivel
P.Saktivel

CERTIFIED
METRIC CALIBRATION & TESTING LABORATORY
-End of Certificate-
Tel: 065465550, P.O.Box: 3504, Sharjah- U.A.E.

Authorized by
Jagadeesh

SISTEMA ISO 45001:2018 SISTEMA ISO 9001:2015 SISTEMA ISO 14001:2015