

ภาคผนวก ค : เอกสารสอบเทียบความถูกต้อง
ของเครื่องมือเก็บตัวอย่าง

CERTIFICATE OF ANALYSIS

EPA PROTOCOL GAS

Cylinder No. : EB0145030



Airgas Specialty Gases
Airgas USA, LLC
6141 Easton Road
Bldg 2
Plumsteadville, PA 18949
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E03NI99E15AC0U4
Cylinder Number: E80145030
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12021
Gas Code: CH4,PPN,BALN
Reference Number: 160-402242242-1
Cylinder Volume: 144.4 CF
Cylinder Pressure: 2015 PSIG
Valve Outlet: 350
Certification Date: Oct 15, 2021

Expiration Date: Oct 15, 2029

Certification performed in accordance with EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012) document EPA 600/R-12/001, using the assay procedures listed. Analytical Methodology does not require correction for analytical in-laboratory. This cylinder has a full analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a molar/mole basis unless otherwise noted.

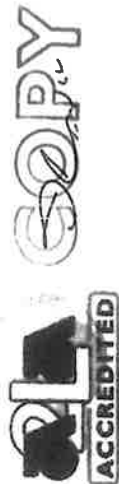
Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS				
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
METHANE	180.0 PPM	177.0 PPM	G1	+/- 1.0% NIST Traceable
PROPANE	185.0 PPM	187.0 PPM	G1	+/- 1.0% NIST Traceable
NITROGEN	Balance			
CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No	Concentration	Uncertainty
NITRM	08011503	K002564	246.7 PPM METHANE/AIR	+/- 0.6%
NITRM	200602-06	6162660Y	243.3 PPM PROPANE/AIR	+/- 0.5%
ANALYTICAL EQUIPMENT				
Instrument/Make/Model			Analytical Principle	Last Multipoint Calibration
Nicolet iS50 FTIR AUP2110295 CH4			FTIR	Oct 13, 2021
Nicolet iS50 FTIR AUP2110295 C3H8			FTIR	Oct 14, 2021

Triad Data Available Upon Request

NOTES:

Gross Weight: 28.0 Kg
Net Weight: 4.9 Kg
PO# 5221004861



Michael A. Harkins

Approved for Release

DRY GAS METER MC-572V

Serial No. : 0504003

Certificate Of Calibration

Method 5 Pre-Test Console Calibration - Cubic meter (m3)

Meter Console Information

Console Model : MC572V
 Console Serial : 0504003
 DGM Model # : SK25EX
 DGM Serial # : 0009854

Calibration Condition

Calibration Date: 3-Apr-23
 Issue Date: 3-Apr-23
 Cal. Report No.: WDS-SV680039
 Ambient Temp (°C): 25
 Pressure (mm Hg): 758
 Relative Humidity (%): 60

Factors/Conversion

Std. Temp (°K): 298
 Std. Pressure (mm Hg): 760
 K_f (K/mm Hg): 0.3857

Reference Equipment

WTM Model: W-NkoDa-5B WTM Cal. Due Date: Nov. 2022
 WTM Serial: 600245 Gamma: 1.0000

UUT Meter (DGM)

Run Time (minutes)	DGM Orifice (mm H ₂ O)	Volume		Outlet Temp		Volume		Outlet Temp	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final
	P _{static}	V _{in}	V _{out}	T _{in}	T _{out}	V _{in}	V _{out}	T _{in}	T _{out}
15.00	13.0	2.1249	2.2873	26	26	11.24924	11.40853	25	25
10.00	25.0	1.9384	2.0964	26	26	11.06645	11.22136	25	25
8.00	50.0	1.7294	1.9105	26	26	10.86093	11.03905	25	25
7.00	80.0	1.4887	1.6921	26	26	10.62322	10.82407	25	25
5.00	120.0	1.1950	1.3736	26	26	10.33100	10.50914	25	25

Reference Meter (WTM)

Standardized Data

Test Meter		Reference Meter		Correction Factor		Calibration Results		
Std. Volume	Std. Flow Rate	Std. Volume	Std. Flow Rate	"Gamma"	Variation	Flow Rate	ΔH@ (mm H ₂ O)	
V _{test} (m ³)	Q _{test} m ³ /min	V _{ref} (m ³)	Q _{ref} m ³ /min	(Y)	(ΔY)	Q _{calculated}	0.0212 SCMM	Variation
							ΔH _g	ΔΔH _g
0.159	0.011	0.156	0.010	0.983	-0.001	0.010	52.990	5.531
0.155	0.015	0.152	0.015	0.981	-0.002	0.015	47.999	0.540
0.178	0.022	0.175	0.022	0.982	-0.002	0.022	46.696	-0.763
0.200	0.029	0.197	0.028	0.983	-0.001	0.028	45.249	-2.210
0.177	0.035	0.175	0.035	0.989	0.006	0.035	44.361	-3.098
				0.984	= Y Avg		47.459	= ΔH@ Avg

Pass/Fail Result: **Pass**

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter. Acceptable tolerance of individual values from the average is ±0.02

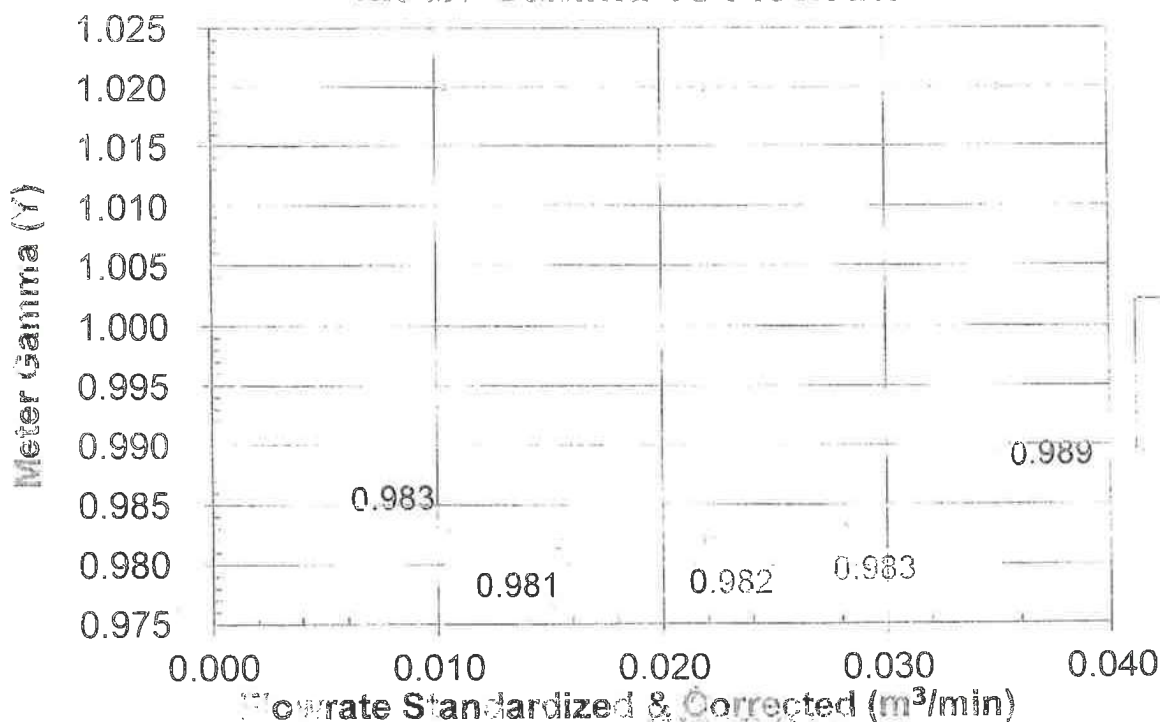
Note: For ΔH_g, orifice pressure differential that equates to 0.75cfm (0.0212m³/min) at standard temperature and pressure. Acceptable tolerance of individual values from the average is ±0.2 inches (5.1mm) H₂O

Approved By: _____

(Palpasu Chaisana)
 Service Manager

Date: 3-Apr-23

Meter Gamma vs Flowrate



Console Serial: 0504003

Console Model: MC572V

WDS

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Meter Console Information

Console Model: MC572V
 Console serial: 0504003
 Temp Indicator Model: 765-KF
 Temp Indicator Serial: JC17852

Calibration Conditions

Cal. Date: 3-Apr-23
 Issue Date: 3-Apr-23
 Cal. Report No.: WDS-SV660039
 Ambient Temp. (°C): 25
 Pressure (mm Hg): 758
 Humidity (%): 60

Reference Equipment

Temp. Simulator Model: FLUKE 714B
 Serial No: 80590035

Temperature Sensor Calibration

Reference Point	Ref. Temperature	Temp. Difference	Temp. Difference
#	°C	°C	°C
1	-18.0	-17.0	1.0
2	38.0	37.0	1.0
3	93.0	92.0	1.0
4	149.0	148.0	1.0
5	280.0	259.0	1.0
6	371.0	372.0	-1.0
7	482.0	482.0	0.0
8	593.0	594.0	-1.0
9	816.0	816.0	0.0
10	1038.0	1038.0	0.0
Maximum			1.0

Note

* For valid test results, the maximum difference between temperature readings should $\leq 1.0^{\circ}\text{C}$ (EPA Method 5, Section 6.1.1.8).
 Perform all TC Channel calibrations, Except meter (DGM) channel

DGM Out Temperature Sensor Calibration

Temperature Point	Ref. Temperature	Temp. Difference	Temp. Difference
#	°C	°C	°C
Ambient	26.5	26.0	0.5
Heat	100.5	102.0	-1.5

Difference Range

DGM Out Temp. Diff. $\pm 3^{\circ}\text{C}$

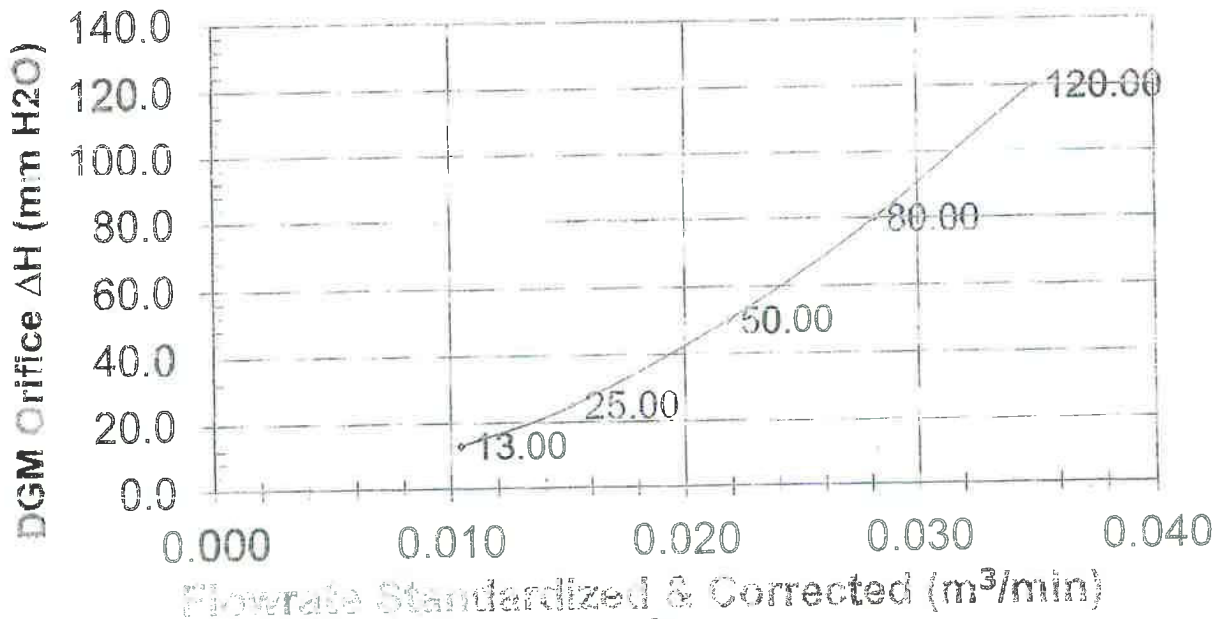
PASS

Approved By :

(Signature)

Service Manager

Meter Pressure vs Flowrate



Console Serial:

0504003

Console Model:

MC572V

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DRY GAS METER XC-572-OV

Serial No. : A2204323



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Certificate Of Calibration

Method: S-Pro-Test Console Calibration - Cubic meter (m)

Meter Console Information

Console Model : XC-572-OV
 Console serial : A2204323
 DGM Model #: SK25EX
 DGM Serial #: 00008294

Calibration Condition

Calibration Date: 2-May-2023
 Due Date: 1-May-2024
 Cal. Report No.: WDS-SV660066
 Ambient Temp (°C): 25
 Pressure (mm Hg): 758
 Relative Humidity (%): 55

Factors/Conversion

Std. Temp. (°K): 298
 Std. Pressure (mm Hg): 760
 K_f (K/mm Hg): 0.3857

Reference Equipment

WTM Model: W-NKoDa-5B
 WTM Serial: 600245
 WTM Cal. Date: 22-Nov-2022
 Gamma: 1.0000

		UUT Meter (DGM)				Reference Meter (WTM)			
Run Time (minutes)	DGM Orifice (mm H ₂ O)	Volume		Outlet Temp		Volume		Outlet Temp	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final
●	P _{m(t)}	V _{in}	V _{out}	t _{in}	t _{out}	V _{wt}	V _{wt}	t _{in}	t _{out}
15.00	13.0	18.0685	18.2252	25	26	17.55844	17.71673	25	25
10.00	25.0	18.2477	18.3984	25	26	17.73837	17.88948	25	25
8.00	50.0	18.4339	18.6056	25	26	17.92517	18.09730	25	25
7.00	80.0	18.6458	18.8344	25	27	18.13775	18.32707	25	26
5.00	120.0	18.8839	19.0510	25	27	18.37705	18.54528	25	25

Standardized Data				Calibration Results			
Test Meter		Reference Meter		Correction Factor		Flow Rate	
Std. Volume	Std. Flow Rate	Std. Volume	Std. Flow Rate	"Gamma"	Variation	Std & Corr	ΔH@ (mm H ₂ O)
V _{test} (m ³)	Q _{test} m ³ /min	V _{ref} (m ³)	Q _{ref} m ³ /min	(Y)	(ΔY)	Q _{m(corr)}	ΔH _g
0.154	0.010	0.154	0.010	1.004	0.003	0.010	54.437
0.148	0.015	0.148	0.015	1.002	0.001	0.015	50.528
0.169	0.021	0.169	0.021	0.999	-0.001	0.021	50.086
0.186	0.027	0.186	0.027	0.999	-0.001	0.027	50.928
0.165	0.033	0.165	0.033	0.999	-0.002	0.033	49.741
				1.001	Y Avg.		51.144
							ΔH _g Avg.

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance is ±0.02.

Note: For ΔH_g, orifice pressure differential that equates to 0.75cfm (0.0212m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2inches (5.1mm) H₂O.

Pass/Fail Result: PASS

Approved By:

(Palpasu Chaisana)
 Service Manager

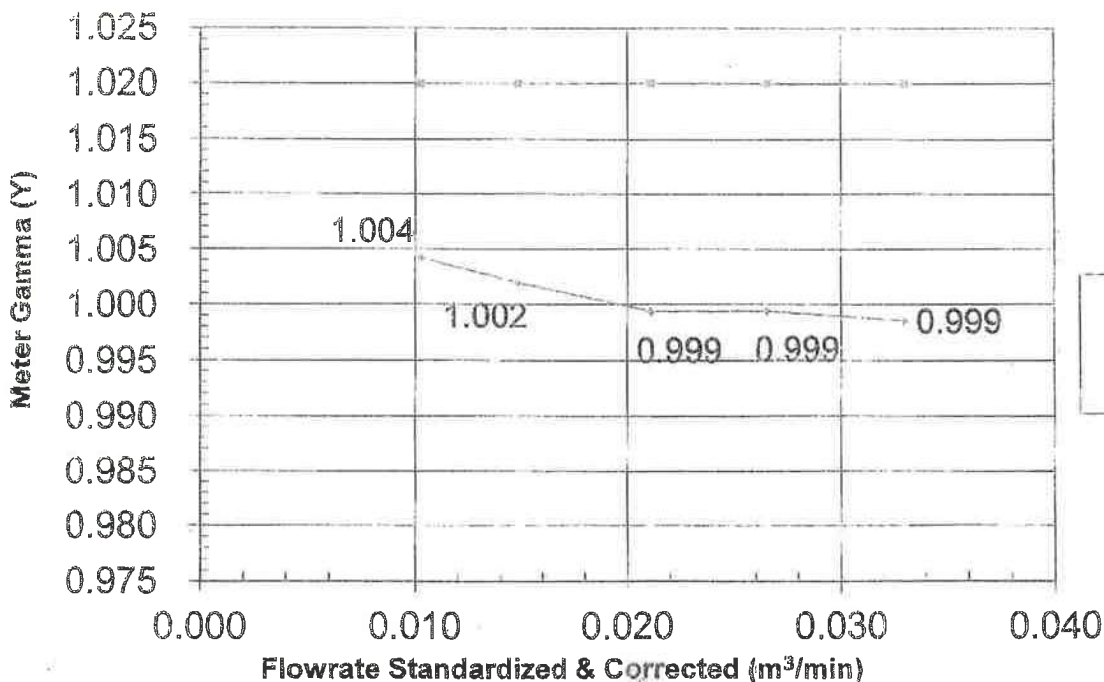
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Date

2-May-2023

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Meter Gamma vs Flowrate



Console Serial: A2204323

Console Model: XC-572-OV

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TEMPERATURE DISPLAY CALIBRATION

Meter Console Information

Console Model: XC-572-OV
Console Serial: A2204323
Temp. Indicator Model: 765-KF
Temp. Indicator Serial: JC19022

Calibration Conditions

Cal. Date: 2-May-2023
Due Date: 1-May-2024
Cal. Report No.: WDS-SV600068
Ambient Temp. (°C): 25
Pressure (mm Hg): 768
Humidity (%): 55

Reference Equipment

Temp. Simulator Model: FLUKE 714B
Serial No.: 60590035
Calibration Date: 14-Feb-2023

Temperature Sensor Calibration

Reference Point	Ref. Thermometer Temperature	Thermocouple Display Temperature	Temperature Difference
#	°C	°C	°C
1	-18.0	-17.0	1.0
2	25.0	25.0	0.0
3	90.0	90.0	0.0
4	120.0	120.0	0.0
5	250.0	249.0	1.0
6	380.0	380.0	0.0
7	500.0	500.0	0.0
8	620.0	620.0	0.0
9	740.0	739.0	1.0
10	860.0	860.0	0.0
Maximum:			1.0

Note

1 For valid test results, the maximum difference between temperature readings should $\leq 1.0^{\circ}\text{C}$ (EPA Method 5, Section 6.1.1.8).
Perform AUX, STACK, PROBE, OVEN, FILTER, EXIT. Except meter (DGM) channel

DGM Out Temperature Sensor Calibration

Temperature point	Ref. Thermometer Temperature	Thermocouple Display Temperature	Temperature Difference
#	°C	°C	°C
Ambient	28.8	29.0	-0.2
Heat	100.0	101.3	-1.3

Difference Rang

DGM Out Temp. Diff: $\pm 3^{\circ}\text{C}$

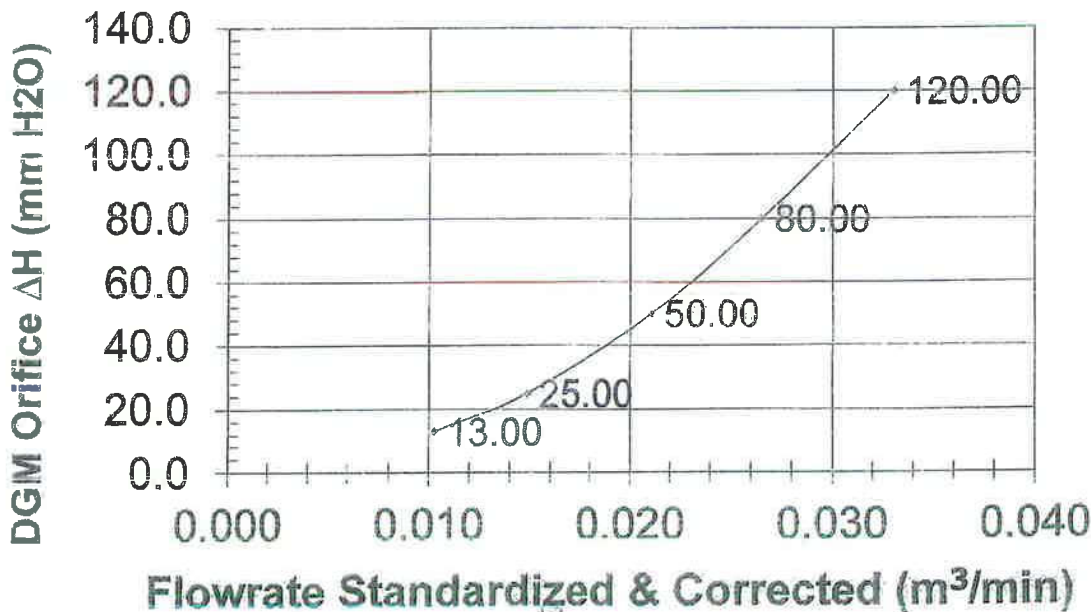
Approved By:

P. Jaisakulchai
Service Manager

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Meter Pressure vs Flowrate



Console Serial:

A2204323

Console Model:

XC-572-OV

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DRY GAS METER XC572V

Serial No. : 1110070

Certificate Of Calibration

Method 5 Pre-Test Console Calibration - Cubic meter (m3)

Meter Console Information

Console Model :	XC572V
Console serial :	1110070
DGM Model #:	SK25EX
DGM Serial #:	0005413

Calibration Condition

Calibration Date:	3-Jul-23
Due Date:	2-Jul-24
Cal. Report No.:	WDS-SV660107
Ambient Temp (°C):	25
Pressure (mm Hg):	758
Relative Humidity (%):	60

Factors/Conversion

Std. Temp. (*K):	298
Std. Pressure (mm Hg):	760
K _i (K/mm Hg):	0.3857

Reference Equipment

WTM Model: W-NKoDa-5B WTM Cal. Due Date: Nov. 2022
WTM Serial: 600245 Gamma: 1.0000

UUT Meter (DGM)

Run Time (minutes)	DGM Orifice (mm H ₂ O)	500 meter (DGM)				Reference meter (V _{ref})			
		Volume		Outlet Temp		Volume		Outlet Temp	
		Initial V _{int}	Final V _{ext}	Initial t _{int}	Final t _{ext}	Initial V _{ref}	Final V _{ref}	Initial t _{ref}	Final t _{ref}
15.00	13.0	599.3828	599.5462	27	27	20.05690	20.22163	28	27
10.00	25.0	599.5689	599.7246	27	26	20.24425	20.39999	27	27
8.00	50.0	599.7405	599.9176	26	26	20.41592	20.59344	27	27
7.00	80.0	599.9333	600.1337	26	26	20.60920	20.81034	27	27
5.00	120.0	600.1559	600.3319	26	26	20.83271	21.00950	27	27

Reference Meter (WTM)

Standardized Data

Standardized Data				Calibration Results				
Test Meter		Reference Meter		Correction Factor		Flow Rate	ΔH@ (mm H ₂ O)	
Std. Volume	Std. Flow Rate	Std. Volume	Std. Flow Rate	"Gamma"	Variation	Std & Corr	0.0212 SCMM	Variation
V _{test} (m ³)	Q _{test} m ³ /min	V _{ref} (m ³)	Q _{ref} m ³ /min	(Y)	(ΔY)	Q _{test/corr}	ΔH _e	ΔΔH _e
0.159	0.011	0.160	0.011	1.005	0.010	0.011	50.181	2.747
0.152	0.015	0.152	0.015	0.998	0.000	0.015	48.096	0.662
0.174	0.022	0.173	0.022	0.995	-0.001	0.022	47.605	0.171
0.197	0.028	0.196	0.028	0.993	-0.003	0.028	45.688	-1.747
0.174	0.035	0.172	0.034	0.990	-0.006	0.034	45.602	-1.832
				0.996	= Y Avg		47.434	= ΔH@ Avg

Pass/Fail Result:	Pass
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Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ± 0.02 .

Note: For ΔH_0 , orifice pressure differential that equates to 0.75cfm (0.021m³/min) at standard temperature and pressure, acceptable tolerance for individual values from the average is ± 0.2 inches (5.1mm) H₂O

Approved By:

(Patpasu Chaisana)
Service Manager

Date 3-Jul-23

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TEMPERATURE DISPLAY CALIBRATION

Calibration Conditions

Cal. Date	3-Jul-23
Due Date	2-Jul-24
Cal. Report No.	WDS-SV6601
Ambient Temp. (°C)	25
Pressure (mm Hg)	758
Humidity (%)	60

Reference Equipment

Tor Model: **FLUKE 714B**
 Serial No: **60590035**

Meter Console Information

Console Model :	XC572V
Console serial :	1110070
Temp Indicator Model :	765-KF
Temp. Indicator Serial :	JC17852

Temperature Sensor Calibration

Reference Point	Ref. Thermometer Temperature °C	Thermocouple Display Temperature °C	Temperature Difference °C
# 1	-18.0	-17.0	1.0
2	38.0	37.0	1.0
3	93.0	93.0	0.0
4	149.0	149.0	0.0
5	260.0	259.0	1.0
6	371.0	372.0	-1.0
7	482.0	482.0	0.0
8	593.0	594.0	-1.0
9	816.0	816.0	0.0
10	1038.0	1039.0	-1.0
		Maximum	1.0

PASS

Note

For valid test results, the maximum difference between temperature readings should $\leq 1.0^{\circ}\text{C}$ (EPA Method 5, Section 6.1.1.8). Perform all TC Channel calibrations. Except meter (DGM) channel

DGM Out Temperature Sensor Calibration

Temperature point	Ref Thermometer Temperature °C	Thermocouple Display Temperature °C	Temperature Difference °C
#			
Ambient	26.5	26.5	-0.5
Heat	100.5	102.5	-2.0

DGM Out Temp. Diff. $\pm 3^{\circ}\text{C}$

PASS

Approved By :

Patrice Chaisang
Service Manager

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Address 9/115 Lumpini Town Ville Ratchaphuek-Pinklao Village, No. 4, Bang Khanun, Bang Krui, Nonthaburi 11130 Thailand
Tel 090-680-1392 084-598-1944 084-704-1620



ELAPSED TIMER CALIBRATION

Meter Console Information

Model #: XC572V
Serial #: 1110070
Elapsed Timer Model #: C342-1464
Elapsed Timer Serial #:

Calibration Conditions

Cal. Date : 03-Jul-23
Due Date : 02-Jul-23
Cal. Report No. : WDS-SV656107
Ambient Temp. (°C) : 25
Pressure (mm Hg) : 758
Humidity (%) : 60

Reference Equipment

Calibration Standard: JS-307
Method Reference: Compare

Run Time Elapsed STD	Elapsed Time				Calibration Results				Average Time	Deviation
	Minute	Minute	Minute	Minute	Minute	Minute	Minute	Minute		
2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.000	0.000
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.000	0.000
5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.000	0.000
7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.000	0.000
9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.000	0.000

Approved By

(Patpasu Chaisana)
Service Engineer



WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED
Address 9/115 Lumpini Town Ville Ratchaphuek-Pinkao Village No.4, Bang Khanun, Bang Kruai, Nonthaburi 11130 Thailand
Tel. 090-660-1392, 084-598-1944, 084-704-1620

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Tel. 090-660-1392, 084-598-1944, 084-704-1620

Flue gas Analyzer

Testo 350 NEW

Serial No. 63455658/0722



Calibration Certificate

Certificate No.: G 660488
Date of issue : 17-Aug-23

Instrument description : Flue Gas Analyzer
Instrument model : Testo 350 New
Instrument serial no. : 63455658/0722
Control unit serial no. : 03601409/0722
ID no. or control no. :
Manufacturer : Testo SE & Co. KGaA
Probe description :
Probe model :
Probe serial :
Customer name : Eastern Thai Consulting 1992 Company Limited
Customer address : 683 Moo 11, Suktiapbarn 8 Road, Nongkham, Si Racha, Chon Buri 20280

Total pages of certificate : 2 Pages
Receiving no. : L-232624
Receiving date : 10-Aug-23
Parameter of calibration : Gas Calibration (Oxygen 2.498, 10.04, 21.02 %Vol, Carbon Monoxide 80.14, 302, 1003 ppm, Nitrogen Dioxide 80.96 ppm, Nitric Oxide 151.5 ppm, Sulphur Dioxide 100.8 ppm)
Used :
Condition of UUC : All of the Measurement were carried out the stabilized laboratory
Ambient condition : Temperature : 23 ± 5 °C
Humidity : 55 ± 15 %RH
Calibration place : 17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210
Calibration procedure no. : This instrument was calibrated by comparison with Standard gas mixture according to calibration work instruction no. WI-CL-28-C

The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.
This certificate is applied only to item under test Environmental condition.
This Calibration Certificate may not be reproduced other than in full except with the permission of the issuing laboratory.
Calibration certificates without signature and seal not valid and The results relate only to the items tested/calibrated.
This calibration certificate documents are traceability to national standards, which realize measurement according to the International System of Units (SI).

Date of calibration : 17-Aug-23

Kwanchai K.
Mr. Kwanchai Khamdang
Calibration Technician

Mrs. Nongluck Wongsettee
Technical Manager

FM-CL-09-C Rev.8

Page 1 of 2

Issued Date 26/02/16

Entech Industrial Solution Co., Ltd.

17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210 THAILAND Tel: 0-2779-8888 Calibration@entech.co.th
Tax ID : 0105536035591 www.entech.co.th



Calibration Certificate

Certificate No.: G 660488

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O ₂) 2.498 % Vol	4219/21	Linde	30-Sep-25
Oxygen (O ₂) 10.04 % Vol	CG-0153-21	Nimt	18-Nov-26
Oxygen (O ₂) 21.02 % Vol	CG-0041-22	Nimt	10-Feb-27
Carbon monoxide (CO) 80.14 ppm	CG-0040-22	Nimt	14-Feb-27
Carbon monoxide (CO) 302 ppm	1915/23	Linde	16-Jun-25
Carbon monoxide (CO) 1003 ppm	2583/22	Linde	09-Aug-24
Nitrogen Dioxide (NO ₂) 80.96 ppm	3240/21	Linde	26-Jun-24
Nitric Oxide (NO) 151.5 ppm	0161/23	Linde	22-Jan-25
Sulphur Dioxide (SO ₂) 100.8 ppm	3507/22	Linde	09-Nov-24

Measured room conditions

Temperature : 23.5 °C Humidity : 61.2 %RH Pressure : 1005.5 mbar

Calibration conditions

Gas Temperature : 24 °C Flow rate : 1,300 ml/min Gas pressure : 1016.4 mbar

Calibration Results (Without adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O ₂ (%Vol)	2.498	2.58	0.082	0.15
O ₂ (%Vol)	10.04	10.10	0.06	0.20
O ₂ (%Vol)	21.02	21.11	0.09	0.30
CO (ppm)	80.14	80	-0.14	3.0
CO (ppm)	302	301	-1	6.0
CO (ppm)	1003	997	-6	12
*NO ₂ (ppm)	80.96	80.3	-0.66	8.0
*NO (ppm)	151.5	153	1.5	8.0
*SO ₂ (ppm)	100.8	101	0.2	6.0

Remark : 1 cmol/mol = 1 %vol, 1 μmol/mol = 1 ppm.

* Calibrations marked Not TIS Accredited "In this Certificate have been included for completeness."

End of Report

FM-CL-09-C Rev.8

Page 2 of 2

Issued Date 26/02/16

Entech Industrial Solution Co., Ltd.

17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210 THAILAND Tel: 0-2779-8888 Calibration@entech.co.th
Tax ID : 0105536035591 www.entech.co.th

UV/VIS SPECTROPHOTOMETER

Model : UV - 1800

Serial No. : A11635101643 CD



Bara Scientific Co., Ltd.
988 U Chu Liang Building Floor 7 Rama4 Road
Silom Bangkok Thailand 10500
Tel : 02-6324300 Fax : 02-6375496-7
www.barascientific.com



Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No. BSCC-UV-152/23
Equipment UV/Vis Spectrophotometer
Model UV-1800
Manufacturer Shimadzu
Serial No. A11635101643 CD
ID No. N/A
Date of receipt 25 April 2023
Date of calibration 25 April 2023
Date of issue 27 April 2023

Customer name Eastern Thai Consulting 1992 Co.,Ltd

Address 683 Moo 11, Sukkaphibam 8 Rd., Nongkham, Sriracha, Chonburi 20230

Temperature (22.4-23.1) °C (On site)
Humidity (44.5-45.2) %RH (On site)

Equipment condition Good Operation

Calibration Location Analysis Department

Calibration Procedure In-house method WI-UV-702-01 based on ASTM E275-01

Traceability Wavelength Accuracy is traceable to certificate No. 94780 and 94775
Photometric Accuracy is traceable to certificate No. 94808 and 100147
Stray Light is traceable to certificate No. 94791
The above certificate are traceable to SI unit through Starna Scientific Ltd.
(UKAS accredited calibration laboratory NO. 0659)

Calibrated by Mr.Pannaphong Phannmekakul

Approved by

[Signature]

Mr.Kanchit Choothep
Technical Manager

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.
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Tel : 02-6324300 Fax : 02-6375496-7
www.barascientific.com



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Source of Success

Certificate of Calibration

Number of Page(s) 2 of 3

Certificate No. BSCC-UV-152/23

Calibration Results:

1.Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (±nm)
287.71	287.65	-0.06	0.18
445.82	445.80	-0.02	0.18
536.52	536.35	-0.17	0.18
741.02	740.99	-0.03	0.18
879.41	879.27	-0.14	0.18

2.Photometric Accuracy (UV)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
235	0.0000	0.0000	0.0000	0.0075
	0.7311	0.7313	0.0002	0.0075
257	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
313	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
350	0.0000	0.0000	0.0000	0.0075
	0.6306	0.6314	0.0008	0.0075

*CNR = Customer not request

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Certificate of Calibration

Certificate No. **BSCC-UV-152/23** Number of Page(s) **3 of 3**

Calibration Results:

3. Photometric Accuracy (Visible)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty ($\pm A$)
420.0	0.0000	0.0000	0.0000	0.0042
	0.5488	0.5508	0.0020	0.0042
	0.7527	0.7535	0.0008	0.0042
	1.0756	1.0758	0.0002	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5391	0.5406	0.0015	0.0042
	0.7355	0.7360	0.0005	0.0042
	1.0509	1.0501	-0.0008	0.0042
465.0	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
546.1	0.0000	0.0000	0.0000	0.0042
	0.5045	0.5044	-0.0001	0.0042
	0.6884	0.6885	0.0001	0.0042
	0.9816	0.9808	-0.0008	0.0042
590.0	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
635.0	0.0000	0.0000	0.0000	0.0042
	0.5183	0.5178	-0.0005	0.0042
	0.6864	0.6868	0.0004	0.0042
	0.9747	0.9738	-0.0008	0.0042

*CNR = Customer not request

4. Stray Light*

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC)	
	Wavelength (nm)	Absorbance (A)
200.75±0.11nm	200.72	2.0164

The Stray light transmission reference is less than 1.0%T and Stray light absorbance reference is greater than 2.00A
*Stray Light not NSC-ONSC Accredited.

The measurement uncertainty is base on a standard uncertainty multiplied by a coverage factor ($k=2$) providing a level of confidence of approximately 95%
End of Certificate

The above results are valid exclusively for the calibrated item(s) as mention in this report / Certificate
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ANALYTICAL BALANCE (DU)

Model. : XS205DU

Serial No. : 1126323724



Certificate No. : 23-006683
Sample Code : 23-02820-006

REPORT OF CALIBRATION

Equipment : ELECTRONIC BALANCE
Manufacturer : METTLER TOLEDO
Model : XS205DU
Capacity : Max 81 g / 220 g
Resolution : 0.01 mg / 0.1 mg
Serial No. : 1126323724
ID No. : LABE 05/1

Result of Calibration

1. Test weight and repeatability of reading

Repeatability is a measure of the ability of a balance to supply the same result in repetitive weighings with one and the same load under the same measurement condition. The measurement of the repeatability must include both the balance specifications and the ambient (vibration, fluctuating air current/temperature/humidity, etc.) Operator handling of the balance is also included in the standard deviation.

Unit : g	Range : 80	<input type="checkbox"/> Before adjustment	<input type="checkbox"/> After adjustment
<input checked="" type="checkbox"/> No adjustment	Nominal value	40	80
<input type="checkbox"/> Adjustment	Standard weight	40.000042	80.000045
	Average reading of indicator	40.00015	80.00019
	Standard deviation	0.000004	0.000007
Unit : g	Range : 200	<input type="checkbox"/> Before adjustment	<input type="checkbox"/> After adjustment
<input checked="" type="checkbox"/> No adjustment	Nominal value	100	200
<input type="checkbox"/> Adjustment	Standard weight	100.000022	200.000199
	Average reading of indicator	100.0001	200.0004
	Standard deviation	0.00004	0.00008

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Certificate No. : 23-006683
Sample Code : 23-02820-006

CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.
683 Moo 11, Sukhapiban 8 Rd., Nongkham,
Sriracha, Chonburi 20230
Location of Calibration : EASTERN THAI CONSULTING 1992 CO., LTD.
(Analytical Balance Room)

Equipment : ELECTRONIC BALANCE

Manufacturer : METTLER TOLEDO

Model : XS205DU

Serial No. : 1126323724

ID No. : LABE 05/1

Date of Receipt : 20 January 2023

Date of Calibration : 20 January 2023

Calibrated by : Mr. Thanadol Pholthep
Scientist

Issue date : 25 January 2023

The uncertainties are for a confidence probability of approximately 95%.

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC)

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Certificate No. : 23-006683

Sample Code : 23-02820-006

Page 3 of 4

REPORT OF CALIBRATION

Result of Calibration

2. Sensitivity or value of a scale division

Change in the output variable of a measuring instrument divided by the associated change in the input variable.

Unit : g		Range : 80		Range : 200	
Test Point	Sensitivity, S	Test Point	Sensitivity, S	Test Point	Sensitivity, S
0	0.99800	0	0.9980	0	0.9980
40	0.99800	100	0.9980	100	0.9980
80	0.99800	200	0.9980	200	0.9980

3. Departure of indication from nominal value, Linearity

Unit : g		Range : 80		Range : 200	
Nominal Value	Standard Value	Average Reading of Indicator	Correction Value	Expanded Uncertainty	Coverage Factor (k)
Unload	0.000000	0.00000	0.00000	0.0000090	2.01
0.01	0.0100036	0.01000	0.00000	0.0000093	2.01
0.1	0.1000062	0.10000	0.00001	0.000012	2.00
1	1.0000036	1.00001	-0.00001	0.000014	2.00
5	5.0000044	5.00003	-0.00003	0.000020	2.00
10	10.0000000	10.00007	-0.00007	0.000032	2.00
20	20.0000016	20.00011	-0.00009	0.000036	2.00
50	50.0000029	50.00013	-0.00010	0.000067	2.00
100	100.0000022	100.00001	-0.00001	0.00016	2.00
150	150.0000051	150.00001	0.00000	0.00023	2.00
200	200.0000199	200.00003	-0.00001	0.00028	2.00

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003.



Certificate No. : 23-006683

Sample Code : 23-02820-006

REPORT OF CALIBRATION

Result of Calibration :

4. Eccentric or off-centre loading

Deviation of the measurement value through off - center (eccentric) loading. The corner load increases with the weight of the load and its removal from the center of the pan support.

Weighing pan		Test weight : 50 and 100	
Unit : g		Unit : g	
Range	Position	Reading of indicator	Reading of indicator
1	50.00014	100.0001	100.0001
2	50.00014	99.9998	99.9998
3	50.00006	100.0000	100.0000
4	50.00010	100.0001	100.0001
5	50.00017	100.0001	100.0001
6	50.00014	100.0001	100.0001
Maximum difference	0.00008	0.00008	0.00008

Condition of Calibration

1. Calibration Method : WI-CL-004 base on UKAS LAB 14: 2019

2. This result of calibration was found accurate as shown on date and place of calibration only.

3. Condition of Calibration item: Normal

4. This certification is traceable to the International System of Unit maintained at :

Through the reference standard laboratory of Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (Instrument number 1).

5. Reference standard instrument :

1) STANDARD WEIGHT 1 mg to 1 kg

Instrument : CLASS ID No. Certificate No. Due Date

E2 LB-WE-57 22-060839 27 June 2023

STANDARD WEIGHT 1 mg to 1 kg

CLASS ID No. Certificate No. Due Date

E2 LB-WE-57 22-060839 27 June 2023

STANDARD WEIGHT 1 mg to 1 kg

CLASS ID No. Certificate No. Due Date

E2 LB-WE-57 22-060839 27 June 2023

STANDARD WEIGHT 1 mg to 1 kg

CLASS ID No. Certificate No. Due Date

E2 LB-WE-57 22-060839 27 June 2023

STANDARD WEIGHT 1 mg to 1 kg

CLASS ID No. Certificate No. Due Date

E2 LB-WE-57 22-060839 27 June 2023

- End of Report -

DRY GAS METER MC-572V

Serial No. : 0504003

Certificate Of Calibration

Method 5 Pre-Test Console Calibration - Cubic meter (m3)

Meter Console Information

Console Model : MC572V
Console Serial : 0504003
DGM Model #: SK25EX
DGM Serial #: 0009854

Calibration Condition

Calibration Date: 3-Apr-23
Issue Date: 3-Apr-23
Cal. Report No.: WDS-SV660039
Ambient Temp (°C): 25
Pressure (mm Hg): 758
Relative Humidity (%): 60

Factors/Conversion

Std. Temp (°K): 298
Std. Pressure (mm Hg): 760
K₁ (K/mm Hg): 0.3857

Reference Equipment

WTM Model: W-NKoDa-5B WTM Cal. Due Date: Nov. 2022
WTM Serial: 600245 Gamma: 1.0000

UUT Meter (DGM)

Run Time (minutes)	DGM Orifice (mm H ₂ O)	Volume		Outlet Temp		Volume		Outlet Temp	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final
15.00	13.0	2.1249	2.2873	26	26	11.24924	11.40853	25	25
10.00	25.0	1.9384	2.0964	26	26	11.06845	11.22136	25	25
8.00	50.0	1.7294	1.9105	26	26	10.86093	11.03905	25	25
7.00	80.0	1.4887	1.6921	26	26	10.62322	10.82407	25	25
5.00	120.0	1.1950	1.3736	26	26	10.33100	10.50914	25	25

Reference Meter (WTM)

Standardized Data

Test Meter		Reference Meter		Correction Factor		Flow Rate		ΔH@ (mm H ₂ O)	
Std. Volume	Std. Flow Rate	Std. Volume	Std. Flow Rate	"Gamma"	Variation	Std & Corr	0.0212 SCMM	Variation	
V _{std} (m ³)	Q _{std} (m ³ /min)	V _{ref} (m ³)	Q _{ref} (m ³ /min)	(Y)	(ΔY)	Q _{ref} (m ³ /min)	ΔH ₀	ΔH _Δ	
0.159	0.011	0.156	0.010	0.983	-0.001	0.010	52.990	5.531	
0.155	0.015	0.152	0.015	0.981	-0.002	0.015	47.999	0.540	
0.178	0.022	0.175	0.022	0.982	-0.002	0.022	46.696	-0.763	
0.200	0.029	0.197	0.028	0.983	-0.001	0.028	45.249	-2.210	
0.177	0.035	0.175	0.035	0.989	0.006	0.035	44.361	-3.098	
				0.984	= Y Avg		47.459	= ΔH@ Avg	

Pass/Fail Result: Pass

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter. Acceptable tolerance of individual values from the average is ±0.02
Note: For ΔH₀, orifice pressure differential that equates to 0.75cfm (0.0212m³/min) at standard temperature and pressure. Acceptable tolerance of individual values from the average is ±0.2inches (5.1mm) H₂O

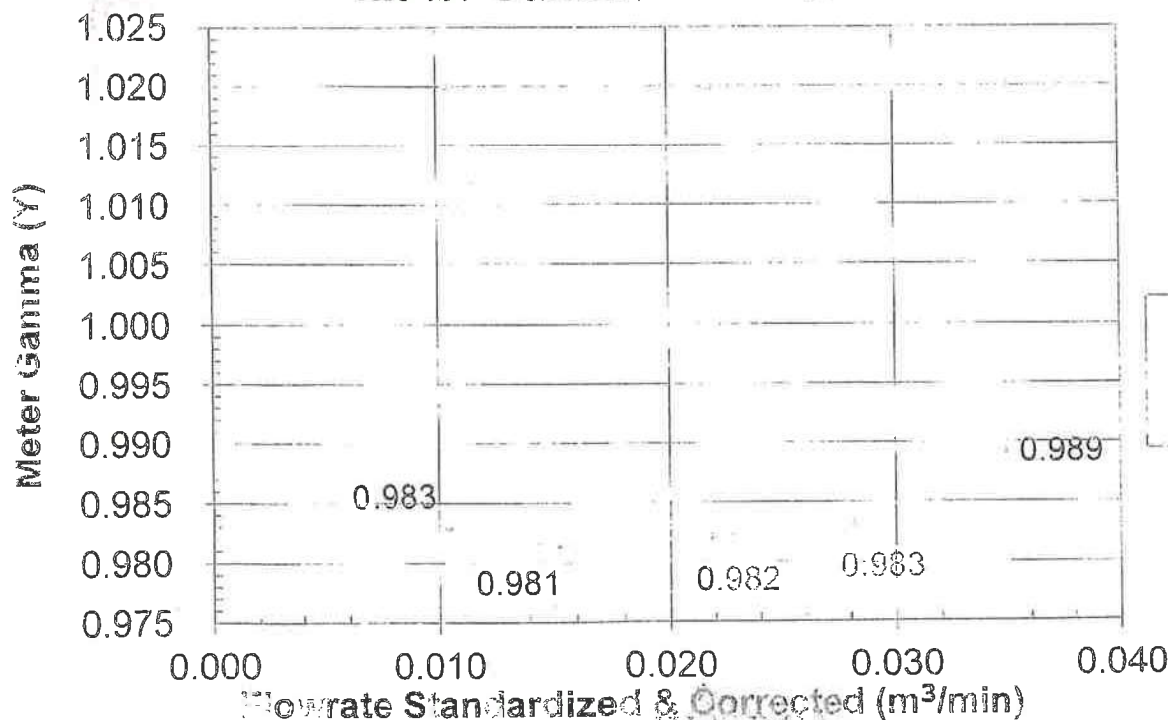
Approved By:

(Patpasu Chaisana)
Service Manager

WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

Date: 3-Apr-23

Meter Gamma vs Flowrate



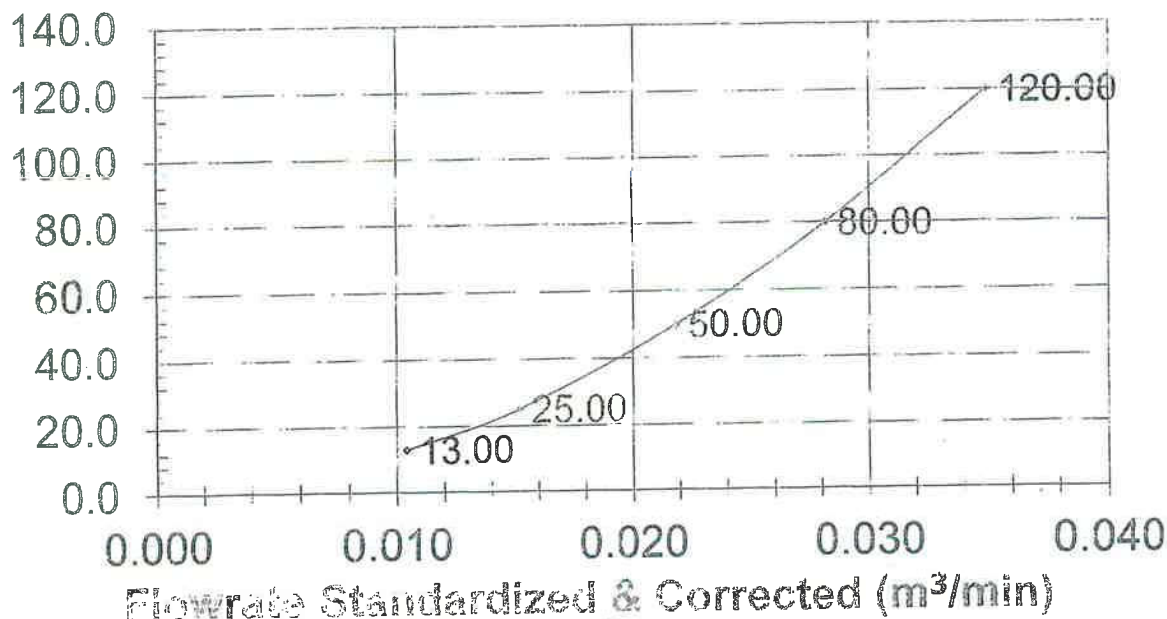
Console Serial 0504003

Console Model

MC572V

DGM Orifice ΔH (mm H2O)

Meter Pressure vs Flowrate



Console Serial:

0504003

Console Model:

MC572V

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WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

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TEMPERATURE DISPLAY CALIBRATION

Meter Console Information		Calibration Conditions		Reference Equipment	
Console Model :	MC572V	Cal. Date :	3-Apr-23	Temp. Simulator Model :	FLUKE 714B
Console Serial :	0504003	Issue Date :	3-Apr-23	Serial No	60590035
Temp Indicator Model :	765-KF	Cal. Report No. :	WDS-SV680039		
Temp. Indicator Serial :	JC17852	Ambient Temp. (°C)	25		
		Pressure (mm Hg) :	758		
		Humidity (%) :	60		

Temperature Sensor Calibration

Reference Point	Ref. Thermometer Temperature	Temperature	Temperature
#	°C	°C	°C
1	-18.0	-17.0	1.0
2	38.0	37.0	1.0
3	93.0	92.0	1.0
4	149.0	148.0	1.0
5	260.0	259.0	1.0
6	371.0	372.0	-1.0
7	482.0	482.0	0.0
8	593.0	594.0	-1.0
9	816.0	816.0	0.0
10	1038.0	1038.0	0.0
			Maximum
			1.0

PASS

Note

For valid test results, the maximum difference between temperature readings should $\leq 1.0^{\circ}\text{C}$ (EPA Method 5, Section 6.1.1.8).
Perform all TC Channel calibrations. Except meter (DGM) channel

DGM Out Temperature Sensor Calibration

Reference Point	Ref. Thermometer Temperature	Temperature	Temperature
#	°C	°C	°C
Ambient	26.5	26.0	0.5
Heat	100.5	102.0	-1.5

DGM Out Temp. Diff. $\pm 3^{\circ}\text{C}$

PASS

Approved By :

(Patrasai Chaisana)

Service Manager

WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED
Address 9/115 Lumpini Town Ville Rachapituek-Pinkao Village No. 4, Bang Khanun, Bang Kruai, Nonthaburi 11130 Thailand

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DRY GAS METER XC-572-OV

Serial No. : A2204323

Certificate Of Calibration

Method 5 Pre-Test Console Calibration - Cubic meter (m)

Meter Console Information

Console Model : XC-572-OV
Console serial : A2204323
DGM Model #: SK25EX
DGM Serial #: 00008294

Calibration Condition

Calibration Date: 2-May-2023
Due Date : 1-May-2024
Cal. Report No.: WDS-SV680066
Ambient Temp (°C): 25
Pressure (mm Hg): 758
Relative Humidity (%): 55

Factors/Conversion

Std. Temp. (°K): 298
Std. Pressure (mm Hg): 760
K₁ (K/mm Hg): 0.3857

Reference Equipment

WTM Model: W-NK0Da-5B WTM Cal. Date: 22-Nov-2022
WTM Serial: 600245 Gamma: 1.0000

UUT Meter (DGM)

Reference Meter (WTM)

Run Time (minutes)	DGM Orifice (mm H ₂ O)	Volume		Outlet Temp		Volume		Outlet Temp	
		Initial V _{mi}	Final V _{mf}	Initial t _{mi}	Final t _{mf}	Initial V _{ri}	Final V _{rf}	Initial t _{ri}	Final t _{rf}
15.00	13.0	18.0685	18.2252	25	26	17.55844	17.71573	25	25
10.00	25.0	18.2477	18.3984	25	26	17.73837	17.88948	25	25
8.00	50.0	18.4339	18.6056	25	26	17.92517	18.09730	25	25
7.00	80.0	18.6458	18.8344	25	27	18.13775	18.32707	25	25
5.00	120.0	18.8839	19.0510	25	27	18.37705	18.54528	25	25

Standardized Data

Calibration Results

Test Meter		Reference Meter		Correction Factor		Flow Rate		
Std. Volume V _{std} (m ³)	Std. Flow Rate Q _{std} m ³ /min	Std. Volume V _{std} (m ³)	Std. Flow Rate Q _{std} m ³ /min	"Gamma" (Y)	Variation (ΔY)	Std & Corr Q _m (std)(corr)	0.0212 SCMM ΔH _e	Variation ΔΔH _e
0.154	0.010	0.154	0.010	1.004	0.003	0.010	54.437	3.293
0.148	0.015	0.148	0.015	1.002	0.001	0.015	50.528	-0.616
0.169	0.021	0.169	0.021	0.999	-0.001	0.021	50.086	-1.058
0.186	0.027	0.186	0.027	0.999	-0.001	0.027	50.928	-0.216
0.165	0.033	0.165	0.033	0.999	-0.002	0.033	49.741	-1.403
				1.001	= Y Avg.		51.144	= ΔH _e Avg.

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ±0.02

Note: For ΔH_e, orifice pressure differential that equates to 0.75cfm (0.0212m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2inches (5.1mm) H₂O.

Pass/Fail Result: PASS

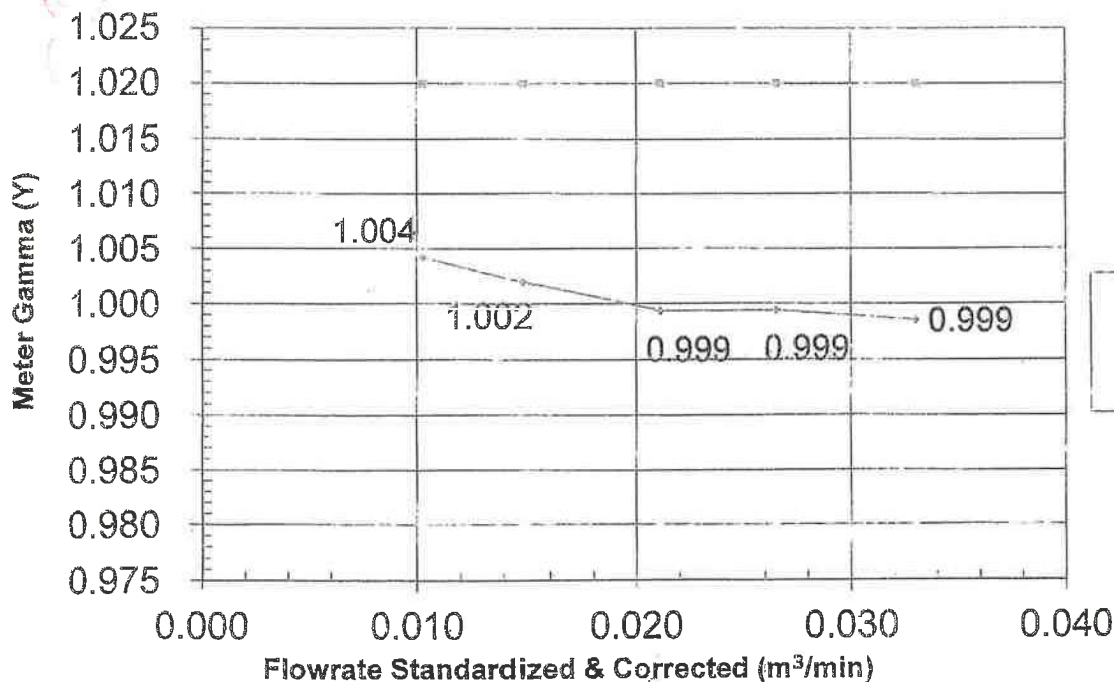
Approved By:

(Patpasu Chaisana)
Service Managerบริษัท วิสโดม ซายล์ แอนด์ เซอร์วิส กรุ๊ป จำกัด
WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

Date:

2-May-2023

Meter Gamma vs Flowrate



Console Serial: A2204323

Console Model: XC-572-OV



WISDOM SCIENCE

TEMPERATURE DISPLAY CALIBRATION

Meter Console Information

Console Model : XC-572-OV
Console Serial : A2204323
Temp. Indicator Model : 765-KF
Temp. Indicator Serial : JC19022

Calibration Conditions

Cal. Date : 2-May-2023
Due Date : 1-May-2024
Cal. Report No. : WDS-SV660066
Ambient Temp. (°C) : 25
Pressure (mm Hg) : 758
Humidity (%) : 55

Reference Equipment

Temp. Simulator Model : FLUKE 714B
Serial No. : 60590035
Calibration Date : 14-Feb-2023

Temperature Sensor Calibration

Reference Point	Ref. Thermometer Temperature	Thermocouple Display Temperature	Temperature Difference
#	°C	°C	°C
1	-18.0	-17.0	1.0
2	25.0	25.0	0.0
3	90.0	90.0	0.0
4	120.0	120.0	0.0
5	250.0	249.0	1.0
6	380.0	380.0	0.0
7	500.0	500.0	0.0
8	620.0	620.0	0.0
9	740.0	739.0	1.0
10	860.0	860.0	0.0
Maximum ¹			1.0

๑-25

Note

¹ For valid test results, the maximum difference between temperature readings should $\leq 1.0^{\circ}\text{C}$ (EPA Method 5, Section 6.1.1.8). Perform AUX, STACK, PROBE, OVEN, FILTER, EXIT. Except meter (DGM) channel

DGM Out Temperature Sensor Calibration

Temperature point	Ref. Thermometer Temperature	Thermocouple Display Temperature	Temperature Difference
#	°C	°C	°C
Ambient	28.8	29.0	-0.2
Heat	100.0	101.3	-1.3

Difference Rang

DGM Out Temp. Diff. $\pm 3^{\circ}\text{C}$

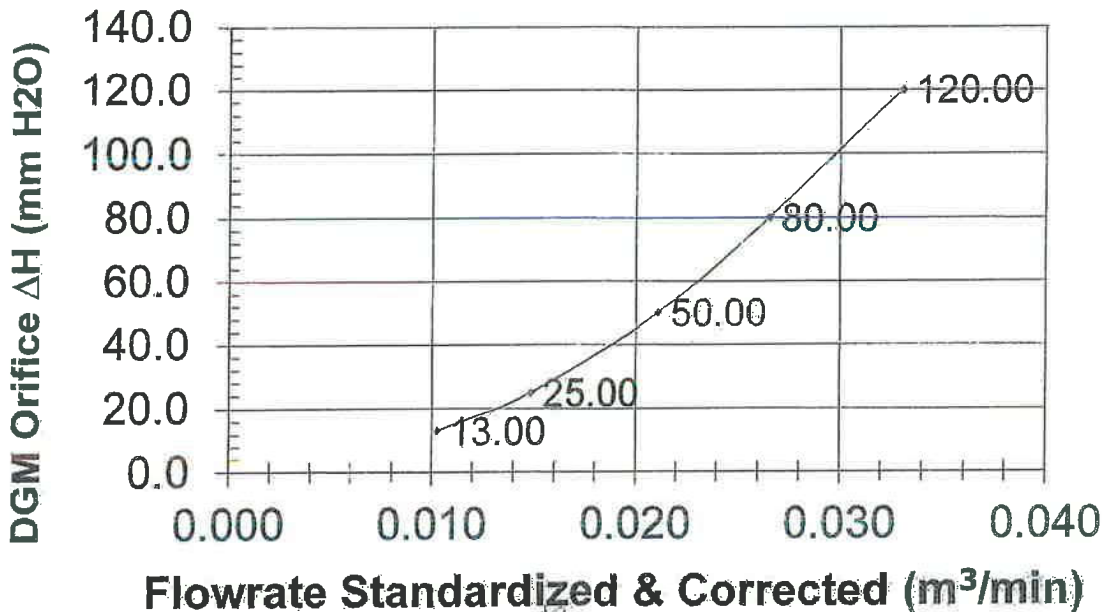
Approved By :

Pongsak Puthana
Service Manager

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WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

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Meter Pressure vs Flowrate



Console Serial:

A2204323

Console Model:

XC-572-OV

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DRY GAS METER XC572V

Serial No. : 1110070

Certificate Of Calibration

Method 5 Pre-Test Console Calibration - Cubic meter (m3)

Meter Console Information

Console Model : XC572V
 Console serial : 1110070
 DGM Model #: SK25EX
 DGM Serial #: 0005413

Calibration Condition

Calibration Date: 3-Jul-23
 Due Date: 2-Jul-24
 Cal. Report No.: WDS-SV660107
 Ambient Temp (°C): 25
 Pressure (mm Hg): 758
 Relative Humidity (%): 60

Factors/Conversion

Std. Temp. (°K): 298
 Std. Pressure (mm Hg): 760
 K₁ (K/mm Hg): 0.3857

Reference Equipment

WTM Model: W-NKoDa-5B WTM Cal. Due Date: Nov. 2022
 WTM Serial: 600245 Gamma: 1.0000

UUT Meter (DGM)				Reference Meter (WTM)			
Run Time (minutes)	DGM Orifice (mm H ₂ O)	Volume		Outlet Temp		Volume	
0	P _{max}	Initial	Final	Initial	Final	Initial	Final
15.00	13.0	599.3828	599.5462	27	27	20.05690	20.22163
10.00	25.0	599.5689	599.7246	27	26	20.24426	20.39999
8.00	50.0	599.7405	599.9176	26	26	20.41592	20.59344
7.00	80.0	599.9333	600.1337	26	26	20.60920	20.81034
5.00	120.0	600.1559	600.3319	26	26	20.83271	21.00950

Standardized Data				Calibration Results			
Test Meter		Reference Meter		Correction Factor		Flow Rate	
Std. Volume	Std. Flow Rate	Std. Volume	Std. Flow Rate	"Gamma"	Variation	Std & Corr	0.0212 SCMM
V _{std} (m ³)	Q _{std} m ³ /min	V _{ref} (m ³)	Q _{ref} m ³ /min	(Y)	(ΔY)	Q _{std} m ³ /min	ΔH ₀
0.159	0.011	0.160	0.011	1.005	0.010	0.011	50.181
0.152	0.015	0.152	0.015	0.996	0.000	0.015	48.096
0.174	0.022	0.173	0.022	0.995	-0.001	0.022	47.605
0.197	0.028	0.196	0.028	0.993	-0.003	0.028	45.688
0.174	0.035	0.172	0.034	0.990	-0.006	0.034	45.602
				0.996	Y Avg.		47.434
							ΔH@ Avg

Pass/Fail Result: **Pass**

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ±0.02

Note: For ΔH₀, orifice pressure differential that equates to 0.75cfm (0.0212m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2inches (5.1mm) H₂O

Approved By: _____

(Patpasu Chaisana)
 Service Manager

Date: _____

3-Jul-23

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TEMPERATURE DISPLAY CALIBRATION

Calibration Conditions

Cal. Date: 3-Jul-23 Temp. Simulator Model: FLUKE 714B
 Due Date: 2-Jul-24 Serial No.: 60590035
 Cal. Report No.: WDS-SV660107
 Ambient Temp. (°C): 25
 Pressure (mm Hg): 758
 Humidity (%): 60

Meter Console Information

Console Model: XC572V
 Console serial: 1110070
 Temp Indicator Model: 765-KF
 Temp. Indicator Serial: JC17852

Temperature Sensor Calibration

Reference Point	Ref. Thermometer Temperature °C	Thermocouple Display Temperature °C	Temperature Difference °C
#			
1	-18.0	-17.0	1.0
2	38.0	37.0	1.0
3	93.0	93.0	0.0
4	149.0	149.0	0.0
5	260.0	259.0	1.0
6	371.0	372.0	-1.0
7	482.0	482.0	0.0
8	593.0	594.0	-1.0
9	816.0	816.0	0.0
10	1038.0	1039.0	-1.0
		Maximum °	1.0

PASS

Note

* For valid test results, the maximum difference between temperature readings should be ≤1.0°C (EPA Method 5, Section 6.1.1.8)
 Perform all TC Channel calibrations. Except meter (DGM) channel

DGM Out Temperature Sensor Calibration

Temperature point	Ref. Thermometer Temperature °C	Thermocouple Display Temperature °C	Temperature Difference °C
#			
Ambient	26.5	27.0	-0.5
Heat	100.5	102.5	-2.0

PASS

Difference Range

DGM Out Temp. Diff. ±3 °C

Approved By: _____

Patpasu Chaisana
 Service Manager
 WISDOM SCIENCE

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WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

Address 9/115 Lumpini Town Ville Ratchaphruek-Pinklao Village No. 4, Bang Kham, Bang Kruai, Nonthaburi 11130 Thailand
 Tel. 080-660-1392, 084-598-1944, 084-704-1620



ELAPSED TIMER CALIBRATION

Meter Console Information

Model #: XC572V
Serial #: 1110070
Elapsed Timer Model #: C342-146A
Elapsed Timer Serial #: -

Calibration Conditions

Cal. Date : 03-Jul-23
Due Date : 02-Jul-24
Cal. Report No. : WDS-SV660107
Ambient Temp. (°C) : 25
Pressure (mm Hg) : 758
Humidity (%) : 60

Reference Equipment

Calibration Standard: JS-307
Method Reference: Compare

Run Time Elapsed STD	Calibration Results				Average Time	Deviation
	Elapsed Timer		Average Time			
Minute	Minute	Minute	Minute	Minute	Minute	Minute
2.00	2.00	2.00	2.00	2.000	0.000	
3.00	3.00	3.00	3.00	3.000	0.000	
5.00	5.00	5.00	5.00	5.000	0.000	
7.00	7.00	7.00	7.00	7.000	0.000	
9.00	9.00	9.00	9.00	9.000	0.000	

Approved By



(Peipasu Chaisama)
Service Engineer



WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED
Address 9/115 Lumpini Town Ville Ratchaphruek-Pinkiao Village No. 4, Bang Kharun, Bang Kruai, Nonthaburi 11130 Thailand
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Tel. 090-660-1392, 084-598-1944, 084-704-1620

Flue gas Analyzer

Testo 350 NEW

Serial No. 60378478



Calibration Certificate

Certificate No: G 660353
Date of issue : 20-Jun-23

ENTECH

Where
Bang

Instrument description : Flue Gas Analyzer
Instrument model : Testo 350 NEW
Instrument serial no. : 60378478
ID no. or control no. :
Manufacturer : Testo SE & Co. KGaA
Probe description :
Probe model :
Probe serial :
Customer name : Eastern Thai Consulting 1992 Company Limited
Customer address : 683 Moo 11, Sukhapibarn 8 Road, Nongkham, Si Racha, Chon Buri 20280

Total pages of certificate : 2 Pages
Receiving no. : L-231787
Receiving date. : 16-Jun-23
Parameter of calibration : Gas Calibration(Oxygen 2.498,10.04,21.02 %vol, Carbon Monoxide 80.14,309.9,1003 ppm Nitrogen Dioxide 80.96 ppm, Nitric Oxide 151.5 ppm, Sulphur Dioxide 100.8 ppm)

Condition of UUC. : Used
Ambient condition : All of the Measurement were carried out the stabilized laboratory

Temperature : 23 ±5 °C
Humidity : 55 ± 15 %RH

Calibration place : 17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210

Calibration procedure no. : This instrument was calibrated by comparison with Standard gas mixture according to calibration work instruction no. WI-CL-28-C

The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.
This certificate is applied only to item under test Environmental condition.
This Calibration Certificate may not be reproduced other than in full except with the permission of the issuing laboratory.
Calibration certificates without signature and seal not valid and The results relate only to the items tested/calibrated.
This calibration certificate documents are traceability to national standards, which realize measurement according to the International System of Units (SI).

Date of calibration : 20-Jun-23

Kwanochai K.
Mr. Kwanchai Khamdoun

Calibration Technician

D. Wuttit
Mrs. Nongluck Wongsettee

Technical Manager

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Issued Date 26/02/16

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FM-CL-09-C Rev.8



Calibration Certificate

Certificate No.: G 660353

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Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O2) 2.498 % Vol	4219/21	Linde	30-Sep-25
Oxygen (O2) 10.04 % Vol	CG-0153-21	Nimit	18-Nov-26
Oxygen (O2) 21.02 % Vol	CG-0041-22	Nimit	10-Feb-27
Carbon monoxide (CO) 80.14 ppm	CG-0040-22	Nimit	14-Feb-27
Carbon monoxide (CO) 309.9 ppm	2803/21	Linde	22-Jun-23
Carbon monoxide (CO) 1003 ppm	2583/22	Linde	09-Aug-24
Nitrogen Dioxide (NO2) 80.96 ppm	3240/21	Linde	26-Jun-24
Nitric Oxide (NO) 151.5 ppm	0161/23	Linde	22-Jan-25
Sulphur Dioxide (SO2) 100.8 ppm	3507/22	Linde	09-Nov-24

Measured room conditions

Temperature : 22.9 °C Humidity : 65.2 %RH Pressure : 1008.2 mbar
Calibration conditions
Gas Temperature : 23 °C Flow rate : 1,200 ml/min Gas pressure : 1019.4 mbar

Calibration Results (before adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O2 (%Vol)	2.498	2.53	0.032	0.15
O2 (%Vol)	10.04	10.08	0.04	0.20
O2 (%Vol)	21.02	21.09	0.07	0.30
CO (ppm)	80.14	81	0.86	3.0
CO (ppm)	309.9	311	1.1	6.0
CO (ppm)	1003	1005	2	12
*NO2 (ppm)	80.96	72.1	-8.86	8.0
*NO (ppm)	151.5	142	-9.5	8.0
*SO2 (ppm)	100.8	102	1.2	6.0

Calibration Results (after adjustment) (Table 3)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O2 (%Vol)	2.498	2.53	0.032	0.15
O2 (%Vol)	10.04	10.08	0.04	0.20
O2 (%Vol)	21.02	21.09	0.07	0.30
CO (ppm)	80.14	81	0.86	3.0
CO (ppm)	309.9	311	1.1	6.0
CO (ppm)	1003	1005	2	12
*NO2 (ppm)	80.96	81.2	0.24	8.0
*NO (ppm)	151.5	152	0.5	8.0
*SO2 (ppm)	100.8	102	1.2	6.0

Remark : 1 cmol/mol = 1 %vol., 1 µmol/mol = 1 ppm.

* Calibrations marked Not TISI Accredited "in this Certificate have been included for completeness."

End of Report

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FM-CL-09-C Rev.8

Issued Date 26/02/16

Hot Air Oven

Model : UFE 500

Serial No. : G511.0182

CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.
683 Moo 11, Sukhaphiban 8 Rd., Nongkham,
Siracha, Chonburi 20230

Location of Calibration : EASTERN THAI CONSULTING 1992 CO., LTD.
(Hot Lab)

Equipment : Temperature controlled enclosures (Hot air oven)
Manufacturer : Memmert
Model : LFE 500
Serial No. : G511-0182
ID No. : LAFB 17/4
Date of Receipt : 20 January 2023
Date of Calibration : 20 January 2023

Condition of Calibration

1. Environment	1.1 Ambient temperature	Maximum : 27.9 °C	Minimum : 25.3 °C
1.2 Relative humidity	Maximum : 50.9 %	Minimum : 38.5 %	
1.3 Line voltage supplied	Maximum : 221.9 VAC	Minimum : 218.5 VAC	

2. Calibration method
TLAS-G-20: Guidelines for calibration and checks of temperature controlled enclosures.

3. Reference standard instrument

Instrument	ID No.	Certificate No.	Due Date
Data Acquisition With Sensor (RTD-PH00)	LB-DA-11 (RTD-138 to RTD-146)	22-040309	21 April 2023

4. This certificate is traceable to the international system of unit (SI Unit).
The measurement is traceable to Asia Medical and Agricultural Laboratory and Research Center Public Company Limited.

5. This result of calibration was found accurate as shown on date and place of calibration only.

6. Condition of calibration item : Normal

Calibrated by : Mr. Sarawoot Thammo
Approved by : (Mr. Somchai Neampunt)
SIGNED FOR DIRECTOR

Issue date : 24 January 2023

The uncertainties are for a confidence probability of approximately 95%.
The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the consistent capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC)

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Phlabphla, Wang Thonglang, Bangkok 10310

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TEL 02-516-2422
FAX 02-516-6949
Effective date 15/10/2

REPORT OF CALIBRATION

Results of Calibration

Resolution : 0.5 °C

1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C) reading (°C)	UUC*	Measured temperature at each positions (°C)										Uncertainty ± (°C)	Coverage factor k
			# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	# 10		
104	103.5	103.5	104.10	104.08	103.87	103.99	104.08	104.08	103.96	104.01	103.84	104.01	0.47	2.00

2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
104.0	0.08	0.32	0.39

Notes

* UUC* = Unit Under Calibration

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REPORT OF CALIBRATION

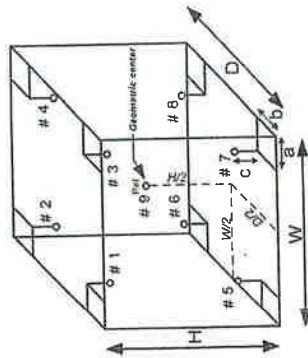
Certificate No. : 23-006679

Sample Code : 23-02820-002

Results of Calibration

Notes

- Sensor installation locations
 - All sensors at any corners or walls should be positioned 5 cm (a x b x c) from the wall.
 - The reference sensor is preferably located of the geometric center of the chamber.
- Interior dimensions approx of chamber :
W = 56 cm ; D = 40 cm ; H = 48 cm
- Air valve or fresh air level : Off
- Fan level : Open
- The quoted uncertainty includes "Stability of chamber and loading effect in chamber at 20% of uniformity".
- Uniformity - the maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.
- Stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.
- Overall variation - the difference of the maximum and the minimum measured temperatures throughout observation time.
- UUC* reading - the average reading of indicating device that forms the integral part of the enclosure.
- Calibration results without adjustment.

Figure: Example of sensor
installation Positions

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003

- End of Report -

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