


試験・校正成績書
(Calibration Report)

成績書番号

39711K

管理番号 (Control Number)	EMC-1 0006
品名	可変抵抗減衰器
Description	Variable resistance attenuator
製造者 (Manufacturer)	TOKYO KO-ON DENPA
型式 (Model Number)	STA-115
製造番号 (Serial Number)	11075
依頼者 (Customer)	株式会社 7コー
校正日 (Calibration Date)	2021年3月18日
温度 (Temperature)	23 °C
湿度 (Humidity)	50 %
校正者 (Calibrated by)	水澤 和弘
総合判定 (Judgement)	合格 / Pass
承認者 (Approved by)	
備考	

標準器 (Standard)		
管理番号 (Control Number)	型式 (Model Number)	名称 (Description)
ST-031	5700A	キャリブ レータ
EO-027	URE3	RMS/PEAK 電圧計

この成績書に記載する標準器は国家標準にトレーサブルである。
パナソニック F S エンジニアリング株式会社
1 / 2

発行日: 2021年3月18日

校正証明書

貴社名 株式会社 7コー

下記製品は、当社の作業規程に従って校正が行われていることを証明します。
この校正に使用した標準器は、パナソニック F S エンジニアリング株式会社、メーカー
JEMIC (日本電気計器後定所)、JQA (日本品質保証機構) などを通じて
国家標準、または NIST (National Institute of Standards and Technology)
などにトレーサビリティがとれています。

管理番号 EMC-1 0006
品名 可変抵抗減衰器
型式 STA-115
製造番号 11075
校正年月日 2021年3月18日
環境条件 温度 23°C 湿度 50%
発行番号 202101355

使用標準器

管理番号	型式	製造番号	名称	有効期限
ST-031	5700A	4635001	キャリブ レータ	2021/10
EO-027	URE3	101273	RMS/PEAK 電圧計	2021/3

〒561-0854 大阪府豊中市瑞津町3丁目1番1号
パナソニック F S エンジニアリング株式会社
CS統括部 校正サービス課
校正証明書発行責任者 佐藤 信治



発行日：2021年3月18日

校正証明書

貴社名 株式会社 フュー

下記製品は、当社の作業規程に従って校正が行われていることを証明します。
この校正に使用した標準器は、パナソニックFSエンジニアリング株式会社、メーカー
JEMC(日本電気計器検定所)、JQA(日本品質保証機構)などを通じて
国家標準、またはNIST(National Institute of Standards and Technology)
などにトレーサビリティがとれています。

管理番号 EMC-1 0005
製品名 周波数カウンタ
型式 VP-4545A
型番 700008E122
製造年月日 2021年3月18日
校正環境 温度 23℃ 湿度 50%
発行番号 202101454

使用標準器

管理番号	型式	製造番号	名称	有効期限
EO-030	FT-001S	1504010016	時間周波数遠隔校正装置	2021/6
EO-037	33250A	MY40005937	フロンクォンタエネレータ	2021/9

〒561-0854 大阪府豊中市稲津町3丁目1番1号
パナソニックFSエンジニアリング株式会社
CS統括部 校正サービス課
校正証明書発行責任者 佐藤 信治



試験・校正成績書

型式 STA-115 製造番号 11075 管理番号 EMC-1 0006

減衰精度/Attenuation accuracy 周波数/Frequency				ダイバ /Step	ダイバ /Div	下限 /Lower Limit	校正値 /Calibration Value	上限 /Upper Limit	判定 /Result
1 kHz	0.1 dB	0 dB	0.05 dB	0.1 dB	0 dB	0.05 dB	0.0 (REF.) dB	0.15 dB	PASS
1 kHz	0.1 dB	0.1 dB	0.15 dB	0.1 dB	0.1 dB	0.15 dB	0.10 dB	0.25 dB	PASS
1 kHz	0.1 dB	0.2 dB	0.25 dB	0.1 dB	0.2 dB	0.25 dB	0.20 dB	0.35 dB	PASS
1 kHz	0.1 dB	0.3 dB	0.35 dB	0.1 dB	0.3 dB	0.35 dB	0.30 dB	0.45 dB	PASS
1 kHz	0.1 dB	0.4 dB	0.45 dB	0.1 dB	0.4 dB	0.45 dB	0.40 dB	0.55 dB	PASS
1 kHz	0.1 dB	0.5 dB	0.55 dB	0.1 dB	0.5 dB	0.55 dB	0.50 dB	0.65 dB	PASS
1 kHz	0.1 dB	0.6 dB	0.65 dB	0.1 dB	0.6 dB	0.65 dB	0.60 dB	0.75 dB	PASS
1 kHz	0.1 dB	0.7 dB	0.75 dB	0.1 dB	0.7 dB	0.75 dB	0.70 dB	0.85 dB	PASS
1 kHz	0.1 dB	0.8 dB	0.85 dB	0.1 dB	0.8 dB	0.85 dB	0.80 dB	0.95 dB	PASS
1 kHz	0.1 dB	0.9 dB	0.95 dB	0.1 dB	0.9 dB	0.95 dB	0.90 dB	1.05 dB	PASS
1 kHz	0.1 dB	1.0 dB	1.00 dB	0.1 dB	1.0 dB	1.00 dB	1.00 dB	1.10 dB	PASS
1 kHz	1 dB	1 dB	1.90 dB	1 dB	1 dB	1.90 dB	2.00 dB	2.10 dB	PASS
1 kHz	1 dB	1 dB	2.90 dB	1 dB	1 dB	2.90 dB	3.01 dB	3.10 dB	PASS
1 kHz	1 dB	1 dB	3.90 dB	1 dB	1 dB	3.90 dB	4.01 dB	4.10 dB	PASS
1 kHz	1 dB	1 dB	4.90 dB	1 dB	1 dB	4.90 dB	5.01 dB	5.10 dB	PASS
1 kHz	1 dB	1 dB	5.90 dB	1 dB	1 dB	5.90 dB	6.01 dB	6.10 dB	PASS
1 kHz	1 dB	1 dB	6.90 dB	1 dB	1 dB	6.90 dB	7.01 dB	7.10 dB	PASS
1 kHz	1 dB	1 dB	7.90 dB	1 dB	1 dB	7.90 dB	8.01 dB	8.10 dB	PASS
1 kHz	1 dB	1 dB	8.90 dB	1 dB	1 dB	8.90 dB	9.01 dB	9.10 dB	PASS
1 kHz	1 dB	1 dB	9.90 dB	1 dB	1 dB	9.90 dB	10.00 dB	10.10 dB	PASS
1 kHz	10 dB	10 dB	9.70 dB	10 dB	10 dB	9.70 dB	10.02 dB	10.30 dB	PASS
1 kHz	10 dB	10 dB	19.70 dB	10 dB	10 dB	19.70 dB	19.99 dB	20.30 dB	PASS
1 kHz	10 dB	10 dB	29.70 dB	10 dB	10 dB	29.70 dB	29.97 dB	30.30 dB	PASS
1 kHz	10 dB	10 dB	39.70 dB	10 dB	10 dB	39.70 dB	40.04 dB	40.30 dB	PASS
1 kHz	10 dB	10 dB	49.70 dB	10 dB	10 dB	49.70 dB	50.08 dB	50.30 dB	PASS
1 kHz	20 dB	20 dB	19.70 dB	20 dB	20 dB	19.70 dB	20.02 dB	20.30 dB	PASS
1 kHz	20 dB	20 dB	39.70 dB	20 dB	20 dB	39.70 dB	40.07 dB	40.30 dB	PASS

パナソニックFSエンジニアリング株式会社
2 / 2

試験・校正成績書

入力感度試験/Sensitivity (kHz)

入力レベル /INPUT LEVEL		OK/NG	判定 /Result
INPUT A	50 mVrms	OK	PASS
INPUT A(7"リスケ)	25 mVrms	OK	PASS
INPUT B	50 mVrms	OK	PASS

基準時間精度試験/T imebase

E-レンジ 194 H		下限 /Lower Limit	測定値 /Measured Value	上限 /Upper Limit	判定 /Result
■ 標準	10 MHz	9.999 50 MHz	10.000 00 MHz	10.000 50 MHz	PASS
□ OPT 57	10 MHz	9.999 950 MHz		10.000 050 MHz	N/A
□ OPT 27	10 MHz	9.999 980 MHz		10.000 020 MHz	N/A

一般動作

	OK/NG	判定 /Result
DISPLAY	OK	PASS
ATT	OK	PASS
TEST	OK	PASS
Other measurement functions	OK	PASS

試験・校正成績書
(Calibration Report)

成績書番号 39712K

管理番号 (Control Number)	EMC-1 0005
品名 (Description)	周波数カウンタ Frequency Counter
製造者 (Manufacturer)	Panasonic
型式 (Model Number)	VP-4545A
製造番号 (Serial Number)	700008E122
依頼者 (Customer)	株式会社 7コー

校正日 (Calibration Date)	2021年3月18日
温度 (Temperature)	23 °C
湿度 (Humidity)	50 %

校正者 (Calibrated by)	水澤 和弘
総合判定 (Judgement)	合格/Pass

承認者 (Approved by)

備考



標準器 (Standard)

管理番号 (Control Number)	型式 (Model Number)	製造番号 (Serial Number)	名称 (Description)
E0-030	FT-001S	1504010016	時間周波数遠隔校正装置
E0-037	33250A	MY40005937	7アンパコン エレ-9

この成績書に記載する標準器は国家標準にトレーサブルである。



試験成績書

総数 3 枚中 1 枚
管理番号 : YD-210308

製品名 : オーディオアナライザ
型式名 : VP-7721A
製造番号 : 482531D125
製造者名 : 松下通信工業株式会社

試験年月日 : 2021 年 3 月 18 日
温度・湿度 : 23 °C 51 %RH
使用標準器 : 5700A,3458A,53132A,VP7722A
AC-12B,MG-443B

判定 : 合格

担当者 承認者



試験の結果は、下記であることを証明します。
この校正に關わる測定は、国家標準にトレーサビリティがとれています。

試験項目	規格	測定点	測定値	判定
発振部 周波数	± 3 %以内 (全範囲) ± 2 %以内 (0.16 kHz~15.99 kHz)	周波数	測定値	判定
		10 Hz	10.13 Hz	良
		20 Hz	20.25 Hz	良
		50 Hz	50.55 Hz	良
		400 Hz	404.17 Hz	良
		1 kHz	1.01 Hz	良
		20 kHz	20.031 kHz	良
出力振幅	± 0.5 dB (4 dB~-35.9 dB) ± 0.8 dB (-36 dB以下)	出力	測定値	判定
		4.0 dB	3.93 dB	良
		1.5 dB	1.43 dB	良
		-1.0 dB	-1.08 dB	良
		-3.5 dB	-3.58 dB	良
		-6.0 dB	-6.03 dB	良
		-16.0 dB	-16.03 dB	良
フラットネス	1 kHz 基準 ±0.3 dB (全範囲) ±0.1 dB (20 Hz~20 kHz)	周波数	測定値	判定
		10 Hz	-0.02 dB	良
		20 Hz	-0.02 dB	良
		50 Hz	-0.02 dB	良
		20 kHz	0.03 dB	良
		50 kHz	0.02 dB	良
		100 kHz	-0.03 dB	良

山脇電子工業株式会社

Yd2000-10a

校正証明書

証明書番号 : Y1557
発行年月日 : 2021 年 3 月 18 日

依頼者 : 株式会社アコー様

製品名 : オーディオアナライザ

型式名 : VP-7721A

製造番号 : 482531D125

校正実施日 : 2021 年 3 月 18 日

上記の計測器は当社の作業標準に従って校正・試験を行い、校正作業に於ける検査または試験の結果が仕様を満足していることを証明します。
この校正・試験に使用された標準器は、日本電気計器検定所(JEMIC)、及び日本品質保証機構(JQA)など日本の公的校正機関、または米国国立標準技術研究所(NIST)など国際度量衡委員会に加盟している諸外国の公的校正機関に対してトレーサビリティが保たれております。
また、一部の測定は自然物理定数もしくは合意標準にトレースしてあります。

We hereby certify that the above product has been calibrated in accordance with job standard of Yamawaki Electronics Industry Co., Ltd. and that the inspection and/or test results of the calibration satisfy the specification Measurement of the calibration is traceable such as JEMIC (JAPAN ELECTRIC METERS INSPECTION CORPORATION) or JQA (JAPAN QUALITY ASSURANCE ORGANIZATION), or to overseas public calibration organization participating international measurement committee such as NIST(NATIONAL INSTITUTE OF STANDARDS TECHNOLOGY).

使用標準器

型式名	製造番号	製品名	有効期限
5700A	5745305	マルチファンクション校正器	2021年05月
3458A	US28027886	テスターマルチメータ	2021年05月
53132A	MY40002181	インパルスカウンタ	2021年05月
VP-7722A	590019A122	オートイオアナライザ	2021年05月
AC-12B	M-61112004	歪率計校正器	2021年05月
MG-443B	M-46748	シンセサイザ・シミュレータ	2021年05月



山脇電子工業株式会社

Yamawaki Electronics Industry Co., Ltd.

〒151-0072 東京都渋谷区幡ヶ谷1-21-7 TEL : 03-3465-2421

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Yd2016-01a

試験項目	規格	測定点	測定値	判定
測定部				
ひずみ率	第2高調波偏差 ±1.5 dB (5 Hz~15.99 kHz) ±2.5 dB (16 kHz~50 kHz) +2.5 dB, -4 dB (50 kHz~159.9 kHz)	周波数	測定値	判定
		レンジ		
		400 Hz	- 10 dB	良
			- 40 dB	良
			- 60 dB	良
			- 10 dB	良
		1 kHz	-39.95 dB	良
			- 60 dB	良
			-59.55 dB	良
			-10.95 dB	良
残留雑音	基本波除去比 100 dB (5 Hz~15.99 kHz) 90 dB (16 kHz~50 kHz) 86 dB (50 kHz~159.9 kHz)	周波数	測定値	判定
		400 Hz	107.0 dB	良
		1 kHz	108.0 dB	良
		20 kHz	94.5 dB	良
		周波数	測定値	判定
		10 Hz	-96.8 dB	良
		20 Hz	-97.4 dB	良
		1 kHz	-99.5 dB	良
		15 kHz	-98.7 dB	良
		50 kHz	-93.8 dB	良
フィルター	検査仕様	100 kHz	-87.4 dB	良
		HPF	400 Hz	判定
		oct/-18 dB 1/3 octave特性		良
		LPF	30 kHz	判定
		oct/-18 dB 1/3 octave特性		良

試験項目	規格	測定点	測定値	判定	
発振部					
ひずみ率	≤0.3 % (全範囲) ≤0.005 % (30 Hz~49.9 kHz, 20 kHz~39.9 kHz) ≤0.002 % (50 Hz~19.99 kHz, 80 kHz BW)	周波数	測定値	判定	
		10 Hz	0.00147 %	良	
		20 Hz	0.00150 %	良	
		50 Hz	0.00108 %	良	
		400 Hz	0.00031 %	良	
		1 kHz	0.00029 %	良	
		20 kHz	0.00093 %	良	
		50 kHz	0.00153 %	良	
		100 kHz	0.00419 %	良	
測定部					
残留雑音	<10 μV (500 kHz BW)	UNBAL	測定値	判定	
ACIA* 測定	7kHz-1kHz ± 3 %	レンジ	入力電圧	測定値	判定
		100 V	100.0 V	100.1 V	良
		30 V	30.00 V	29.94 V	良
		10 V	10.00 V	10.05 V	良
		3 V	3.000 V	3.004 V	良
		1 V	1.000 V	1.001 V	良
		300 mV	300.0 mV	300.3 mV	良
		100 mV	100.0 mV	99.8 mV	良
		30 mV	30.00 mV	29.97 mV	良
		10 mV	10.00 mV	10.02 mV	良
		3 mV	3.000 mV	3.004 mV	良
		1 mV	1.000 mV	1.003 mV	良
		0.3 mV	0.300 mV	0.3005 mV	良
0.1 mV	0.100 mV	0.1004 mV	良		
フラットネス	1 kHz 基準 ±0.5 dB (20 Hz~100 kHz) ±3 dB (5 Hz~500 kHz)	周波数	測定値	判定	
	10 Hz	-0.21 dB	良		
	20 Hz	-0.04 dB	良		
	50 Hz	0.02 dB	良		
	10 kHz	-0.05 dB	良		
	20 kHz	-0.07 dB	良		
	50 kHz	-0.12 dB	良		
	100 kHz	-0.23 dB	良		
	200 kHz	-0.08 dB	良		

校正結果

音圧感度レベル

周波数 (Hz)	感度レベル (dB)	周波数 (Hz)	感度レベル (dB)
20	-27.03	2000	-26.96
30	-27.06	3000	-26.69
50	-27.08	4000	-26.38
100	-27.15	5000	-26.11
125	-27.17	6000	-26.03
150	-27.21	7000	-26.30
200	-27.23	8000	-27.07
250	-27.19	9000	-28.32
300	-27.15	10000	-30.06
500	-27.13	11000	-32.07
700	-27.19	12000	-33.88
1000	-27.11	12500	-34.61
1500	-27.05		

校正の不確かさ($k=2$):

周波数	不確かさ
20 Hz以上 8000 Hz以下	0.07 dB
8000 Hz超 10000 Hz以下	0.17 dB
10000 Hz超 12500 Hz以下	0.33 dB

校正の不確かさは、包含係数 $k=2$ とした拡張不確かさであり、約95%の信頼の水準を
 持つと推定される区間を与える。

校正条件

1. 校正値は、1 V/Pa を0 dBとした値である。
2. 校正に使用した標準器等：
標準マイクホン(可逆) Brüel & Kjær 4160 No.2652764
3. 偏極電圧：200 V
4. 校正結果は、下記校正室の環境条件における値である。
温度 23~24 °C 湿度 62~65 % 気圧 99.1~99.2 kPa

特記事項

校正品の受理後、修理及び調整を行わず校正を実施した。

以上

校正証明書

依頼者 株式会社 アコー
 住所 東京都世田谷区代沢2-6-10
 品名 標準マイクホン
 型式 4160
 製造番号 2973383
 製造者 Brüel & Kjær
 校正項目 音圧感度レベル
 校正方法 IEC 61094-2に準拠した相互校正法を用いた音圧絶対校正
 校正条件 別紙のとおり
 校正実施場所 東京都八王子市南大沢四丁目4番地4
 一般財団法人 日本品質保証機構 計量計測センター 計器検定課校正室
 校正年月日 2021年7月8日

校正結果は次頁以降のとおりであることを証明します。

2021年7月12日

東京都八王子市南大沢四丁目4番地4
 一般財団法人 日本品質保証機構
 計量計測センター



所長 佐野 弘明

この証明書は、計量法第14条第1項に基づいたものであり、特定標準器(国家標準)にトレーサブルな
 標準器により校正した結果を示すものです。
 書面による承認なしに、この証明書のカラーコピー及び一部分のみを複製して使用することを禁じます。
 当センターは、ISO/IEC 17025:2017に基づく校正機関として認定されています。



Southern Calibration Service Co., Ltd.

669/35 Kamjanavanit Rd., Banpru, Hayai, Songkhla 90250 Thailand

Tel: 081 599 0417 Fax: 074 805 133 Email: s.calibration@gmail.com www.scal-lab.com



CALIBRATION CERTIFICATE

Issued Date : 6-Sep-2021

Certificate No. : 21EB766

CSR No. : A049/2444

Page. : 1 of 3

Customer : ENVI GREEN SOUTHERN CO., LTD.

83/5 Moo.1 Khuan Ru, Rattaphum,

Songkhla 90180

Calibration Place : Customer Laboratory

Instrument Name : Electronic Balance

Manufacturer : OHAUS

Model : PA214C

Serial No. : B828108921

ID No. : AB-62-01

Resolution : 0.0001 g

Received Date : 3-Sep-2021

Calibrated Date : 3-Sep-2021

Ambient Temperature : (30 ±10) °C

Relative Humidity : (50 ±20) %

Calibration Method Used :

This instrument was calibrated using the Calibration In - house method : SCAL.WI.001 based on UKAS LAB 14 : 2015

The Southern Calibration Service Co.,Ltd.calibration control system complies with requirement of ISO/IEC 17025:2017

Traceability of measurement :

This Certificate is traceable to the International and /or national standards which realize the units of measurement according to the International System of Unit (SI) through :

- Tes : Thai Calibration Service Co.,Ltd.

Calibrated by : Imron Rattanaylum

The uncertainties are for a confidence

This certificate may not be reproduced other than in full, except with the prior written approval of Southern Calibration Service Co., Ltd.



69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 คู่มือสาย www.สอบเทียบเครื่องมือวัด.com

Certificate of Calibration

Certificate Number : SPR21070087-1 Page : 1 of 3

Customer : ENVI GREEN SOUTHERN CO.,LTD.
83/5 Moo.1 Kkuan ru ,Rattaphum ,Songkhla 90180

Equipment Name : Sound Calibrator

Manufacturer : Extech

Model : 407744

Serial Number : H.3977003

ID. Number : N/A

Environmental Conditions

Ambient Temperature : 23 °C ± 2 °C Received Date : 07 Jul 2021

Relative Humidity : 50 % ± 15 % Calibration Date : 09 Jul 2021

Location of Calibration : In-Lab Recommend Due Date : N/A

Calibration Procedure : In-House Method Date of Issue : 10 Jul 2021

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system

requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform

this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants,

consensus standards. The result reported herein apply only to the calibration of the item described above as

received.Our decision rule is to contact the customer if the item pass and fail calibration when the results

include the uncertainties and the customer must determine if the results meets their needs.

All calibrations are performed within manufacture's specifications.The calibration certificate shall not be

reproduced except in full,without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Munin Khumpum

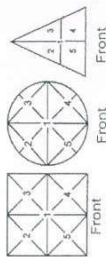
Calibration Officer

Result of Calibration :

3. Off-centre loading

A mass approximately 50g was placed on a pan and moved to various position .
The balance reading obtained are given in the table.

1	Position				Maximum Difference (g)
	2	3	4	5	
50.0000	50.0000	50.0001	50.0001	50.0000	0.0001



4. Departure from nominal value

Nominal Value (g)	Standard Value (g)	UUC Reading (g)	Correction (g)	Uncertainty (±g)	Coverage Factor (k)
0.1	0.1000	0.1000	0.0000	0.0000	2.0
0.5	0.5000	0.5000	0.0000	0.00008	2.0
1	1.0000	1.0000	0.0000	0.00008	2.0
2	2.0000	2.0000	0.0000	0.00008	2.0
5	5.0000	5.0000	0.0000	0.00009	2.0
10	10.0000	10.0000	0.0000	0.00009	2.0
20	20.0000	20.0000	0.0000	0.00009	2.0
40	40.0001	40.0000	0.0001	0.00013	2.0
60	60.0000	60.0000	0.0000	0.00013	2.0
80	80.0000	80.0000	0.0000	0.00017	2.0
100	100.0000	100.0002	-0.0002	0.00016	2.0
120	120.0000	120.0001	-0.0001	0.00024	2.0
140	140.0001	140.0001	0.0000	0.00024	2.0
160	160.0000	160.0000	0.0000	0.00026	2.0
180	180.0000	180.0001	-0.0001	0.00029	2.0
200	200.0000	200.0001	-0.0001	0.00030	2.0

- UUC = Unit Under Calibration

The report uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95%

...End...

Details of Calibration

1. Reference Standard Equipment Used:

Equipment	Model	Serial No.	Cert. no.	Due Date
Standard Weight Set	2mg-2kg	11119514/01	M2107051S	6-Jul-2022

2. The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the longterm stability of instrument.

3. This certificate is not certified any commercial transaction

4. Condition of Item : normal condition , no indication for any damage or malfunction

Result of Calibration :: (✓) Without Adjustment () After Adjustment

1. Repeatability

Nominal Value (g)	Standard Deviation (g)
200	0.00000

2. Effect of tare

Nominal Value (g)	Standard Value (g)	Balance Reading (g)	Correction (g)
20	20.0000	20.0000	0.0000
40	40.0001	40.0001	0.0000
60	60.0000	60.0002	-0.0002
80	80.0001	80.0001	-0.0001
100	100.0000	100.0002	-0.0002



Certificate of Calibration

Certificate Number : SPR22030350-2 Page : 1 of 3

Customer : ENVI GREEN SOUTHERN CO.,LTD.
83/5 Moo.1 Kuan ru ,RattaPhum ,Songkhla 90180

Equipment Name : Air Flow Meter
Manufacturer : MesaLabs
Model : Defender 520-H
Serial Number : 172157
ID. Number : No.1
Environmental Conditions
Ambient Temperature : 23 °C ± 2 °C Received Date : 21 Mar 2022
Relative Humidity : 50 % ± 15 % Calibration Date : 25 Mar 2022
Location of Calibration : In-Lab Recommend Due Date : 25 Mar 2023
Calibration Procedure : SP-CPM-04-13 Date of Issue : 26 Mar 2022

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration where the results include the uncertainties and the customer must determine if the results meets their needs.
All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr. Jirasak Pumbut
Calibration Officer



Calibration Report

Certificate Number : SPR22030350-2 Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Mass Flow Calibrator	AFC-COMLETE-10	12532	AD2107-244-0001	24 Jul 2022
Standard Air Flow Meter	520H	200353	454747	18 Aug 2022

Traceability

This certification is traceable to the International System of Unit maintained at :
MIT - Miracle International Technology Co.,Ltd.
MesaLabs - Mesa Laboratories, Inc. NVLAP Lab Code 200661-0 (ISO17025)



Calibration Report

Certificate Number : SPR21070087-1

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Measuring Receiver	8902A	2950A02471	EF-0001-21	08 Jan 2022
AUDIO Analyzer	8903B	3011A09975	EL04965/21	19 Feb 2022

Traceability

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

NIMT - The National Institute of Metrology, Thailand.

PCAL - Professional Calibration & Services Co.,Ltd



Result of Calibration

Certificate No. : SPR22030350-2

Page : 3 of 3

Range : 0 to 30 L/Min

Function : Air Flow Measurement

Unit : L/Min

Calibration Point	UUC Reading	Standard Reading	UUC Error	K Factor Value	Uncertainty (±)
5.0	5.0287	5.0155	0.0132	0.99738	0.050
10.0	10.008	10.005	0.003	0.99970	0.10
15.0	15.017	15.008	0.009	0.99940	0.20
20.0	20.028	20.012	0.016	0.99920	0.20
27.0	27.032	27.015	0.017	0.99937	0.30

Note:

The result of calibration was found accurate as show on date and place of calibration only.

This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2$, providing a level of confidence approximately 95 %

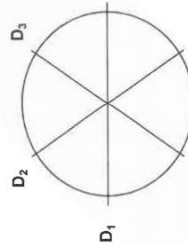
- End of Certificate -

NOZZLE CALIBRATION

Sampling System		Calibration Conditions		
Equipment Information		Date	Time	
Console Model Number	XC-572V	03-Feb-22	03-Feb-22	9:30 AM
Console Serial Number	A2011904	Calibration Reference No.	HC65APE0024	
DGM Model Number	SK25EX	Barometric Pressure	766	mm Hg
DGM Serial Number	00004870	Calibration	Vernier 0-150mm	0.01 mm increments
		Method Reference	US EPA Method	

Calibration Data					Results	
Nozzle ID	Nozzle Diameter				Different	$(D_1 + D_2 + D_3) / 3$
Sizes		D ₁	D ₂	D ₃	ΔD	Davg
	mm	mm	mm	mm	mm	mm
4	3.2	3.07	3.04	3.06	0.015	3.057
6	4.8	4.54	4.64	4.55	0.055	4.577
8	6.4	6.17	6.23	6.18	0.032	6.193
10	8.0	7.68	7.69	7.71	0.015	7.693
12	9.5	9.44	9.45	9.46	0.010	9.450
14	11.1	10.72	10.76	10.81	0.045	10.763
16	12.7	12.80	12.81	12.81	0.006	12.807

D₁, D₂, D₃ = There difference nozzle diameters at 60 degrees to each other,
each measured to the nearest 0.025 mm
ΔD = Maximum difference between any two diameters, must be ≤ 0.100 mm
Davg = (D₁ + D₂ + D₃) / 3



บริษัท สกทิพรแอสโซซิเอต จำกัด
SITHIPHORN ASSOCIATES COMPANY LIMITED

บริษัท สกทิพร แอสโซซิเอต จำกัด
Sithiphorn Associates Co., Ltd.
451 /51/1 ถนนสีลม แขวงบางปิ้ง เขตบางพลัด กรุงเทพฯ 10700 โทร. 0-2433-8331, 0-2435-8800, 0-2434-9191 แฟกซ์ : 0-2433-1679, 0-2434-9510
451-451/1 Sirinthorn Road, Bangbunru, Bangkok 10700 Thailand Tel. (662) 433-8331, 435-8800, 434-9191 Fax: (662) 433-1679, 434-9510
EMAIL:center@sithiphorn.com www.sithiphorn.com



Result of Calibration

Certificate No. : SPR21070087-1

Page : 3 of 3

Function : Acoustic Test

UUC Setting		Standard Reading		Error		(±) Uncertainty	
Hz	dB	Hz	dB	Hz	dB	Hz	dB
1000	94	999.3	93.9	0.7	0.1	0.073	0.32

Note:

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor k = 2, providing a level of confidence approximately 95%.
- End of Certificate -



Cert.No.: 22TW98
Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :
This certification is traceable to the International System of Unit through the reference standards laboratory of Industrial Calibration Center, Technology Promotion Association (Thailand-Japan).

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1) Burette	-	130BU10	21CG1389	25 Mar 2023
2) Balance	1126143764	140RC004	21MM430	21 Sep 2022

2. Standard Material :-

Material	Manufacturer	Lot.No.	Assay
Sodium Thiosulfate pentahydrate	Merck	AM1763316	100.2%

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 14J100195

Titration Method (Azide Modification Method)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.12	8.14	0.0084

This report was certified only for the instrument we tested it is allowable to use for study the system efficiency, The environmental impact control and present to organization it may concerned Intend to use for advertising and referral purpose is prohibited. This report may not be reproduced other in full, without written approval of the laboratory

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Wala

a 1105753



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000 FAX. 0-2719-9484

Cert.No.: 22TW98
Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : 5000-230V
Serial No. : 15B100751
ID No. : -
Received Date : 20 April 2022
Test Date : 21 April 2022
Reference : 2204-0429WC-1

Submitted by : S.P.S. Consulting Service Co., Ltd.
7 Phaholyothin 24, Phaholyothin Road.,
Jompol, Chatuchak, Bangkok 10900

Laboratory Condition : Temperature (25 ± 5) °C
Humidity (50 ± 20) %

Test Procedure : In - house method : CP-CH9
by Comparison Technique with Azide Modification Method

Tested by : Waialak Sirithean

Approved by :

(/) Malee Buikrua
() Saithip Meangmai
() Warakorn Lerngagrakul

Issue Date : 25 April 2022

B 0286555



QUALITY CALIBRATION CO.,LTD.

235 Petchkasem 63/2 Road, Laksong, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 22T0570

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : COD REACTOR
MANUFACTURER : HACH
ID NUMBER : DRB 06/59
RECEIVED DATE : 19-Jan-22
AMBIENT TEMPERATURE : 23°C ± 1°C
MODEL : DRB 200
SERIAL NUMBER : 15110C0498
CALIBRATION DATE : 21-Jan-22
RELATIVE HUMIDITY : 52 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT TEMPERATURE RECORDER WITH THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON 15 POINTS AND LOCATED ONE THERMOCOUPLE IN EACH OF THE FOUR CORNERS OF THE REACTOR AND PLACED THE EIGHTH THERMOCOUPLE AT THE CENTER OF THE REACTOR.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT MODEL SERIAL No CERTIFICATE No DUE DATE
1) DATA LOGGER WITH TC TYPE K HYDRA 2635A 8009008 21T6767 10-Jul-22
3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

BLOCK No.1 FRONT					BLOCK No.2 FRONT				
13	14	15	10	11	13	14	15	10	11
10	11	12	7	8	7	8	9	4	5
7	8	9	4	5	4	5	6	1	2
4	5	6	1	2	1	2	3		

TEMPERATURE MEASUREMENT ACCURACY TEST

Block No.	1	2
Controller temperature (°C)	145	145
Indicating Temperature	145	145
Measured Temperature (°C) at Spread	150.3	150.3
Locations	150.6	150.1
	149.7	149.7
	150.2	150.7
	149.9	149.9
	150.1	150.4
	150.1	150.4
	149.7	150.7
	150.6	150.7
	149.6	150.6
	149.9	150.6
	149.6	150.0
	149.7	150.1
	149.8	150.2
	149.6	150.2
Uncertainty of Measurement(± °C)	0.86	0.86

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.
NOTE 2 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k = 2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

F-G010 REV : 02



QUALITY CALIBRATION CO.,LTD.

235 Petchkasem 63/2 Road, Laksong, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qcalibration.com

CERTIFICATE No : 22T0570
REFERENCE No : 63773-2

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : COD REACTOR
MANUFACTURER : HACH
MODEL : DRB 200
SERIAL No : 15110C0498
ID No : DRB 06/59
SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : CHAICHARN CH.
CALIBRATION DATE : 21-Jan-22

APPROVED BY :
ISSUED DATE :
RECEIVED DATE :

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF
QUALITY CALIBRATION CO., LTD.

F-G010 REV : 02

Continuation of Calibration Certificate

Cert. No. : SP21012
Job No. : VC64SP0012
Pages : 2 of 3

Calibration Method :

This instrument was calibrated by using on-site calibration procedure In-house method : CP-SP-01
The calibration procedure to direct measurement wavelength accuracy by using wavelength standard solution, Photometric accuracy by using absorbance standard filter and absorbance standard solution
The calibration procedure used was based on ASTM E275-01,ASTM E925-02

Condition of this result of calibration :

1. Certified reference materials

Material	Ref. type	Cell serial No.	Cert. No.	Due Date
Holmium liquid	RM-HL	29706	87569	13/10/2022
Didymium liquid	RM-DL	28912	87588	15/10/2022
Neural density filter	RM-1N2N3N	13877	87600	15/10/2022
Potassium dichromate solutions	RM-0204060810	14204	87614	16/10/2022
Potassium Iodide solution	-	KI-0701-001	CI-0030-20	13/02/2022
2. This result of calibration was found accurate as shown on date and place of calibration only.
3. This certificate is traceable to the international system of unit maintained at :
 - 3.1 The UK National Physical Laboratory (NPL)
 - 3.2 The National Institute of Standards and Technology,NIST.

Result of calibration : Wavelength Accuracy

(Without adjustment)

Material	Certified Values of Reference Material (nm)	UUC* Reading (nm)	Error (nm)	Uncertainty ± (nm)	k Factor
RM-HL	278.13	278.2	0.07	0.16	2.00
	361.25	361.4	0.15	0.16	2.00
	467.82	468.1	0.28	0.16	2.00
	536.56	536.7	0.14	0.16	2.00
	640.50	640.7	0.20	0.16	2.00
RM-DL	740.09	739.2	-0.89	0.16	2.00
	864.94	863.8	-1.14	0.16	2.00

UUC* = Unit Under Calibration

451-451/1 Sirinthorn Rd ,Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : SP21012
Pages : 1 of 3

Calibration Certificate

Equipment : UV-VIS SPECTROPHOTOMETER
Manufacturer : PERKINELMER
Model : LAMBDA 365
Serial No.: 365K7060203
ID No.: SP04/60
Calibration Mode : WAVELENGTH ACCURACY
PHOTOMETRIC ACCURACY
Condition As Found : GOOD
Customer : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN ROAD,
CHOMPON, CHATUCHAK,
BANGKOK 10900, THAILAND.
Location : ORGANIC LABORATORY IV
Ambient Temperature : (24.5 ± 5) °C
Relative Humidity : (68.0 ± 25) %
Received Date : 30 AUGUST 2021
Calibration Date : 30 AUGUST 2021
Date of Issue : 31 AUGUST 2021

Calibrated by :

Approved by :

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG BANGKOK 10250

TEL. 0-2717-3000-27 FAX. 0-2719-9484



NSC-TISI-TIS1725
CALIBRATION 9008

Cert.No.: 21CH1216
Page.: 1 of 2

Certificate of Calibration

Equipment : pH Meter
Manufacturer : HANNA
Model : HI 3512
Serial No. : 08685754
ID No. : -

Condition As-Received:

Received Date : 14 September 2021
Calibration Date : 16 September 2021
Reference : 2109-0508WN-1

Submitted by :

S.P.S. Consulting Service Co.,Ltd.
7 Phanolyothin 24, Phanolyothin Road,
Jompol, Chatchak, Bangkok10900

Ambient Temperature : (25 ± 2.5) °C

Relative Humidity : (50 ± 15) %

Calibration Procedure :
In - house method :
- CP-CH5 by direct measurement with standard
voltage calibrator and direct measurement
with certified reference material (CRM)

Calibrated by :

Approved by :

(✓) Malee Butkruea
() Sathip Meangmal
() Warakorn Lerngagtrakul

Issue Date :

22 September 2021

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0032410

Continuation of Calibration Certificate

Cert. No. : SP21012
Job No. : VC64SP0012
Pages : 3 of 3

Result of calibration : Photometric Accuracy

(Without adjustment)

Material	Wavelength (nm)	Filter S/N	Nominal Absorbance (A)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor
Neutral Density glass filter	440.0	29360	1.0	1.0524	1.0507	-0.0017	0.0028	2.00
		29914	0.7	0.7454	0.7441	-0.0013	0.0030	2.00
		29381	0.5	0.5426	0.5414	-0.0012	0.0028	2.00
	546.1	29360	1.0	0.9822	0.9801	-0.0021	0.0028	2.00
		29914	0.7	0.6962	0.6947	-0.0015	0.0028	2.00
		29381	0.5	0.5076	0.5064	-0.0012	0.0028	2.00
	590.0	29360	1.0	1.0221	1.0199	-0.0022	0.0028	2.00
		29914	0.7	0.7238	0.7222	-0.0016	0.0029	2.00
		29381	0.5	0.5364	0.5342	-0.0022	0.0031	2.00
	635.0	29360	1.0	0.9751	0.9737	-0.0015	0.0028	2.00
		29914	0.7	0.6912	0.6899	-0.0013	0.0028	2.00
		29381	0.5	0.5214	0.5197	-0.0017	0.0032	2.00
Material	Wavelength (nm)	Solution	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor	
RM-0204060810	235.0	20	0.2436	0.2421	-0.0015	0.0101	2.00	
		40	0.4905	0.4865	-0.0040	0.0115	2.00	
		60	0.7453	0.7403	-0.0050	0.0067	2.00	
	80	0.9920	0.9919	-0.0001	0.0071	2.00		
	100	1.2487	1.2614	0.0127	0.0073	2.00		

Condition of this result of calibration : Spectrophotometer PERKINELMER Model LAMBDA 365 S/N 365K7060203

Resolution of Wavelength Mode 0.1 nm

Resolution of Photometric Mode 0.0001 A

Parameter Setting

Measurement Mode

Wavelength Scan

Scanning Speed

Data Pitch

Band width(Wavelength)

Band width(Vis)

Band width(Uv)

Wavelength, Absorbance

1100 nm-190 nm

600 nm/min

0.1 nm

1.0 nm

1.0 nm

1.0 nm

Stray Light** UUC* Reading at 220 nm

Transmittance T(%)

0.0002

Absorbance(A)

6.3546

**Specific Acceptance :

Transmittance ≥ 1.0 T(%)

Absorbance ≥ 2.0 A

**Stray light not TISI Accredited

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor k ,
providing a level of confidence of approximately 95%

End of Calibration Certificate



QUALITY CALIBRATION CO.,LTD.

235 Petchkasem 63/2 Road, Laksong, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

www.qcalibration.com



CERTIFICATE No : 22M2568
REFERENCE No : 64386-2

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : SARTORIUS
MODEL : BSA224S-CW
SERIAL No : 36591842
ID No : BA 08/61
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY

TETNITHI W.

CALIBRATION DATE

11-Mar-22

APPROVED BY

ISSUED DATE

RECEIVED DATE

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF
QUALITY CALIBRATION CO., LTD.

F-G010 REV 02



Cert. No.: 21CH1216
Page.: 2 of 2

Condition of this calibration result

1. Reference Standard Instrument : -

Instrument Serial No. ID No. Cert. No. Due Date
1) Document Process Calibrator 46530031 130RC098 20E3666 14 Oct 2021
This certification is traceable to the International System of Unit maintained at:-
- Traceable to National Institute of Metrology (Thailand), NIMT

2. Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd.,
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	754028	28 June 2023
pH 6.985	CPA chem	725927	12 Jan 2022
pH 10.015	CPA chem	761018	02 Aug 2022

3. This certificate is valid only to the item calibrated on date and place of calibration.

Calibration Results

Function : mV Measurement
Performing standard curve by Fluke at pH (4,7,10)

Unit Under Calibration	Nominal Value	Standard Voltage		Actual Reading		Uncertainty of Measurement (\pm mV)	Coverage factor k
		pH	mV	mV	pH		
pH Meter S/N.: 08685754	4.000	177.48	177.9	4.000	0.058	2.00	2.00
	7.000	0.00	0.4	7.000	0.058	2.00	2.00
	10.000	-177.48	-177.2	10.000	0.058	2.00	2.00

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4,7,10)

Unit Under Calibration	Standard Buffer Solution	Actual pH Reading		Actual mV Reading		Uncertainty of pH measurement (\pm)	Coverage factor k
		4.008	6.985	169.2	-4.4		
pH Electrode S/N.: 061416CM	4.008	4.008	10.013	169.2	-178.9	0.0046	2.00
	6.985	6.985	10.013	-4.4	0.0075	0.0075	2.00
	10.015	10.015	10.013	-178.9	0.013	0.013	2.05

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

-o0o-

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CERTIFICATE No : 22M2568

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE : MODEL : BS224S-CW
MANUFACTURER : SARTORIUS : S/N : 36591842
ID No : BA 08/61 : RECEIVED DATE : 11-Mar-22
AIR PRESSURE : 1008mbar \pm 1mbar : CALIBRATION DATE : 11-Mar-22
AMBIENT TEMPERATURE : 22°C \pm 1°C : RELATIVE HUMIDITY : 51 %RH \pm 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY ACCORDING TO UKAS LAB 14 EDITION 6:2019 BY USING KNOWN WEIGHT STANDARD WEIGHT. THE BALANCE WAS ADJUSTED USING WEIGHT OF QUALITY CALIBRATION TO ADJUST. THE BALANCE HAS NO ZERO TRACKING FUNCTION. REPEATABILITY WAS MEASURED BY USING 10 REPEATED MEASUREMENTS. LINEARITY WAS MEASURED COVERING 10 POINTS, EVENLY SPREAD OVER THE RANGE. THE INSTRUMENT WAS SET ZERO BEFORE PERFORMING THE LINEARITY TEST. OFF-CENTER LOADING WAS MEASURED BY USING STANDARD WEIGHTS PLACED ON THE PAN AND MOVED TO VARIOUS POSITIONS ON THE PAN.

2. REFERENCE STANDARD INSTRUMENTS :-

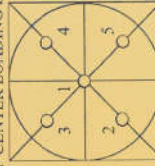
INSTRUMENT : MODEL : SERIAL No : CERTIFICATE No : DUE DATE :
E2 QK-1-151 C02210415 09-Feb-23
1) STANDARD WEIGHT SET
3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL
2. TARE FUNCTION : NORMAL
3. REPEATABILITY OF READING AT 200 g WAS 0.000048 g
4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.00	0.0000	0.0000	0.000078
0.10	0.1000	0.0000	0.000078
0.20	0.2000	0.0000	0.000078
0.50	0.5000	0.0000	0.000079
1.00	1.0000	0.0000	0.000079
2.00	2.0000	0.0000	0.000080
5.00	5.0000	0.0000	0.000081
10.00	10.0000	0.0000	0.000084
20.00	20.0000	0.0000	0.000089
50.00	50.0000	0.0000	0.00011
100.00	100.0000	0.0000	0.00019
200.00	199.9999	0.0001	0.00032

5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	99.9999
2	100.0000
3	99.9999
4	100.0000
5	100.0000
OFF-CENTER LOADING	0.0001

NOTE: THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT PRODUCTION AREA
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR $k=2$, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD

214 Bangwaek Rd. Bangpai Bangkok 10160
Tel.: 0-2865-4647-8 Fax: 0-2865-4649 http://www.mit.in.th

CALIBRATION CERTIFICATE

Certificate No. : AD2108-008-0001

Date Issued : 16-Aug-21

Customer : S.P.S. CONSULTING SERVICE CO., LTD.

7 Soi Phaholyothin 24 Phaholyothin Road., Jompol, Chatuchak,
Bangkok 10900

Equipment : Block Digestion (Gerhardt, TR)

Manufacturer : Gerhardt

Model : -

Serial No. : 4061832

ID No./Tag No. : KJ 01/43

Date Received : 06-Aug-21

Date Calibrated : 15-Aug-21

Calibrated by : Mr. Auttapol Kunaumpol

Calibration Method or Calibration Procedure Used

In-house method : CP-49 base on TLAS G-20 by comparing against Standard Thermometer.

This certificate is traceable to national standards, which realize the units of measurement according to the International System of Units (SI).

Result of Calibration

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor $k = 2$, providing a level confidence approximately 95 percent.

This certificate may not be reproduced other than in full except with the prior written approval of the Technical Manager, Miracle International Technology Company Limited.



Page 1 of 2



MAINTENANCE AND TEST CERTIFICATE MODEL OPTIMA 5300DV

Customer : S.P.S.Consulting Service Co.,Ltd		Date Tested: January 12, 2022	
Address : 7 Soi Phaholyothin 24		Recommendation Recertification	
Paholyothin Road		Period	6 Months
Jompol Chatachak, Bangkok 1090		Recertification Due:	July 12, 2022
User Name: K.Phenpha Viphasathawat		Date Last Certified:	July 14, 2021
Phone: 083-9269252		Visit Number:	2 of 2
Fax: 02-513-4221		PerkinElmer Phone:	02-719-6420 ext 206
		PerkinElmer Fax:	02-318-5597

CONFIGURATION TESTED		ACCESSORIES/COMPONENT NOT INCLUDED	
MODEL	OPTIMA 5300DV	SERIAL NUMBER	077C7042401
TESTED EQUIPMENT	IPV Methods	CALIBRATION NUMBER	
TEST STANDARD USED	Multielement Standard	EXPIRATION DATE	August 30, 2022
	Wavecal Solution		January 30, 2022
	VIS Wavecal solution		June 30, 2022
	Instrument Cal. STD4		August 30, 2022
CUSTOMER SUPPLIED	2 % HNO3	CUSTOMER INITIALS	
	10 % HNO3		

Certificate No. : AD2108-008-0001

Environment : Ambient Temperature : (25 ± 2)°C
Relative Humidity : (50 ± 15)%RH

Calibration Temperature (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Stability ¹ (°C)	Measured Uniformity ² (°C)	Overall Variation ³ (°C)
380	380	380	1.03	1.51	2.60

Calibration Temperature (°C)	Standard Reading (°C), Probe No. 8 is Reference Probe					Uncertainty ⁴ (±°C)
380	No. 1	No. 2	No. 3	No. 4	No. 5	1.9
	380.46	380.79	380.65	380.83	380.53	
	No. 6	No. 7	No. 8	No. 9	No. 10	
	380.57	379.82	380.26	379.62	380.52	
	No. 11	No. 12	No. 13	No. 14	No. 15	
	380.36	380.53	380.47	380.73	380.35	
	No. 16	No. 17	No. 18	No. 19	No. 20	
	380.23	379.61	379.71	380.50	380.77	

Without adjustment

No. 1	No. 6	No. 11	No. 16
No. 2	No. 7	No. 12	No. 17
No. 3	No. 8	No. 13	No. 18
No. 4	No. 9	No. 14	No. 19
No. 5	No. 10	No. 15	No. 20

Top view position

Measurement Standards Used & Traceability :

The International System of Units (SI) through
MIT Certificate No. AD2108-085-0002 for Digital Thermometer with Probe (Agilent) Module 2 (172) Type K Serial No. US37011204, Due 02-Feb-22

- Notes :
1. The temperature stability is the one-half of greatest maximum difference of measured temperatures at any one probe.
 2. The temperature uniformity is the maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time.
 3. Overall variation is the difference of maximum and minimum measured temperatures throughout observation time.
 4. The uncertainty of measurement is included temperature stability.

End of Certificate

Page 2 of 2



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER : 077C7042401		DATE TESTED : January 12, 2022	
PARAMETER	SPECIFICATION	FINAL VALUE	
Spectral Resolution : UV	As 193.696 nm	≤ 0.007	0.00554
	Ni 231.604 nm	≤ 0.008	0.00725
	Ni 341.476 nm	≤ 0.012	0.00752
Spectral Resolution : VIS	La 408.672 nm	≤ 0.020	0.01616
	Ba 455.403 nm	≤ 0.025	0.02416
Precision	As 193.696 nm	% RSD < 1.0	0.34 %
	Zn 213.856 nm	% RSD < 1.0	0.27 %
	Mn 257.610 nm	% RSD < 1.0	0.41 %
	La 379.478 nm	% RSD < 1.0	0.57 %
	Ba 455.403 nm	% RSD < 1.0	0.33 %
	Ba 493.408 nm	% RSD < 1.0	0.26 %
Detection Limits : Axial	Tl 190.080 nm	3(scd)	5.51 ppb
	As 193.696 nm	3(scd)	8.59 ppb
	Pb 220.353 nm	3(scd)	0.50 ppb
Detection Limits : Radial	As 193.696 nm	3(scd)	21.00 ppb
	Zn 213.856 nm	3(scd)	0.32 ppb
	Mn 257.610 nm	3(scd)	0.18 ppb
	La 379.478 nm	3(scd)	0.44 ppb
	Ba 455.403 nm	3(scd)	0.17 ppb
	Ba 493.408 nm	3(scd)	0.12 ppb
BEC : Axial (IB X 500)/(IS-IB)	Cd 226.502 nm	≤ 150 ppb	12.46
BEC : Radial (IB X 1000)/(IS-IB)	Mn 257.610 nm	≤ 45 ppb	30.82



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C7042401		DATE TESTED January 12, 2022	
1. MECHANICAL CHECKS			
A. Inspect and clean all fans and filters.		<div>OK</div>	
B. Inspect and replace as necessary, all torch components including the RF coil.		<div>OK</div>	
C. Inspect all tubing for sign of dacking or leaking.		<div>OK</div>	
D. Adjust water and gas pressure regulator settings.		<div>OK</div>	
E. Inspect and leak check pneumatics drawers.		<div>OK</div>	
F. Clean the exterior of the instrument.		<div>OK</div>	
2. OPTICAL CHECKS			
A. Inspect and clean all optical components.		<div>OK</div>	
B. As required, check and replace all purgefilters.		<div>OK</div>	
C. Recheck optical alignment.		<div>OK</div>	
3. COOLING SYSTEM CHECKS			
A. Perform preventive maintenance on chiller.		<div>OK</div>	
B. Flush out the chiller every year.		<div>N/A</div>	
4. PERFORMANCE CHECKS			
A. Torch View Alignment.		<div>OK</div>	
B. Wavelength Calibration.		<div>OK</div>	



Result of Calibration

Certificate No. : SPR21110197-2

Page : 3 of 3

Range : 94 to 114 dB Function : @1kHz

Select A	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	113.7	113.8	-0.3	-0.2	0.15

Select C	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	113.7	113.8	-0.3	-0.2	0.15

Select Z	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	113.7	113.8	-0.3	-0.2	0.15

Note:

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2$, providing a level of confidence approximately 95%.
- End of Certificate -



Calibration Report

Certificate Number : SPR21110197-2

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	SC-942	B014059	EEL.BP.13/1063	15 Oct 2022

Traceability

This certification is traceable to the International System of Unit maintained at :
TISTR - Thailand Institute of Scientific and Technological Research



PinAAcle 900T Preventive Maintenance Report

Company Name: S.P.S. CONSULTING SERVICE CO.,LTD

Instrument Location: 7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN 24, PHAHOLYOTHIN 24

JOMPOL, CHATUCHAK, BANGKOK, 10900

Instrument Serial No.: PTC514111103

Date: 07-Jan-2022

Pin A Acle 900T Preventive Maintenance (PM)				
Company Name:	S.P.S. CONSULTING SERVICE CO.,LTD			
Address (Instrument Location):	7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN ROAD, JOMPOL, CHATUCHAK, B ⁺			
Serial Number:	PTCS14111103	PM Number:	1/2	
Customer Name (if applicable):	K. PHENPHIA	Telephone Number:	083-936-9252	
Customer Support Engineer Name:	K DUANG	Service Order Number:	WO-01543557	
Date PM Performed: (DD-MM/YY)	07-Jan-2022	Next PM Due Date: (DD-MM/YY)	07-Jul-2022	
Standard Labor Hours to Complete PM :			5 hours	

Part Number	Release	Publication Date
09370143 Rev.9	A	January 2018



Scope

The purpose of this PM is to ensure the continued functionality of the PinAacle 900T by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer.

The customer should save their method before the PM begins.

General Instructions:

The customer must provide the engineer operational data to demonstrate recent instrument performance prior to starting the PM. Always check with the customer before making any changes that may affect the customer's analysis or calibration, including a current back-up of system software and/or data files. The completed document should be signed by an authorized PerkinElmer and customer representative and left with the customer. Update the PM sticker and instrument logbook as required.

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Additional Tools Required for PM			
Part Number (if applicable)	Description	Quantity	Serial #
N1013000	0.2A Neutral density filter	1	MG0-252
N1013002	1.0A Neutral density filter	1	MG2-358
B3100652 Or N9307029	Electronic Flow Meter	1	NA
B0505495	Test Jig	1	NA
03030997	System 2 EDL Driver	1	03030997
N3050605	As System 2 EDL	1	16148
N3050121	Cu Lumina HCL	1	092216-010130
N3050109	Ba Lumina HCL	1	102416-040160
N3050139	K Lumina HCL	1	110716-010060
N3050152	Ni Lumina HCL	1	100516-030190
N3050119	Cr Lumina HCL	1	091911-020150

Component List

Component / Specific Model	Serial #	Configuration Notes
AS900	AS9S14B1002	WINLAB32

Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
B0501696	Fan Filters	2
B3002013	THGA Contact Cylinders	1
B3141064	Glycerol for THGA Cooling	N/A
N3160156	O-Ring Kits for Sampling Introduction (Stainless Steels Nebulizer)	N/A
N3160157	O-Ring Kits for Sampling Introduction (Plastic Nebulizer)	2
N9301714	Replacement Acetylene Filter Cartridge	1
TH001022	Replacement Air Filter Cartridge	2

Additional Reagents and Standards Required for PM			
Part Number (if applicable)	Description	Quantity	Expired Date (MM/YY)
N9300183	1000 mg/L Copper Standard	AR	30-Jan-2022
N9300244	GFAAS Mixed Standard	AR	28-Feb-2022

Additional Reagents and Standards Required for PM (Customer Support Solution)			
Part Number (if applicable)	Description	Quantity	Expiration Date (MM/YY)
N/A	DI Water	250 ml.	AR
N/A	0.5% HNO ₃	250 ml.	AR

- ☒ Perform Cooling System maintenance if needed per SDB# COSY005.STN.
- ☒ Check auto sampler operation.
- ☒ Perform an auto sampler check valve test as described in the Service Manual.
- ☒ Lubricate the spindles of the auto sampler pumps and all moving parts of the tray mechanics as described in the Service Manual.
- ☒ Inspect the auto sampler sampling capillary as described in the Service Manual. Replace if necessary.
- 4. Electrical:**
- ☒ Inspect PC boards. Clean if necessary.
- ☒ Carefully check all internal and external cable connections.
- ☒ Check instrument firmware revisions upgrade to current levels (if necessary)
- ☒ Run Diagnostics Test within the Advanced function of the Spectrometer page. Check the results in the service log folder in the Spectrometer BM Log Viewer.
- 5. Optics:**
- ☒ Inspect and clean the sample compartment windows, if needed.
- ☒ Inspect and clean the furnace windows, if needed.
- ☒ Inspect and clean the GFTV camera lens, if needed.
- ☒ Inspect optics. Clean or replace if necessary,

6. Gasses:

- ☒ Verify that the Gasses supplied to the instrument are within the pressure and purity specifications found in the PinAAcle 900 Series Pre-Installation Checklist SDB.
- ☒ Verify that the air filter element is dry. Replace if necessary.

7. Flame Interlock Check:

Description: Check to ensure that all safety interlocks are closed.

Parameter	Specification	Test Results	Pass/Fail
Flame Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Drain Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Nebulizer Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
C ₂ H ₂ Pressure Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Air Pressure Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Burner Head Sensor	Choosing Nitrous Oxide as the oxidant should trigger an interlock shuts down	Active	Passed

Procedure Checklist

Use (✓) to check off those steps in the checklist that have been completed.

1. General:

- ☒ Review the instrument performance with the customer and document any recent problems.
- ☒ Inspect the customer log book and make any appropriate PM entries.
- ☒ Perform general inspection of system for cleanliness.

2. PC Instrument Software:

- ☒ Instrument Software user files/databases archived, packed, and/or deleted as needed.

3. Mechanical:

- ☒ Inspect and clean all fans and filters. Replace filters if necessary
- ☒ Inspect all gas and water lines for leaks and/or wear. Replace if needed. Thoroughly inspect all quick connects. Replace the Y connector. P/N 09921079, if needed.
- ☒ Clean exterior of the instrument.

3.1 Flame Technique

- ☒ Inspect the burner head, burner chamber, and nebulizer. Clean if needed as stated in the Hardware Guide.
- ☒ Check burner head dimensions with the feeler gauge as stated in the Hardware Guide in the Maintenance chapter section on cleaning the burner head and checking sloth width. Replace if out of specification
- ☒ Check the condition of the end cap, burner head, and nebulizer O-rings. Replace if necessary.
- ☒ Check the drain system for signs of wear. Replace worn or damaged parts.
- ☒ Visually check for proper flame conditions when igniting the Air-C₂H₂ and N₂O-C₂H₂ flames (if applicable).

3.2 THGA Technique

- ☒ Inspect the pole pieces and clean where the pole pieces contact the furnace. Replace the pole piece p-rings as needed. P/N's B0501018 & B0501250. Grease the O-rings as needed with Apiezon L grease. P/N 09905148
- ☒ Inspect the four insulation pads on the front contact housing of the THGA in furnace. If the pads are missing replace the THGA furnace or replace the insulator pads on the furnace.
- ☒ Inspect the graphite tube and clean the contact cylinders. Replace if necessary.
- ☒ Check internal and external gas flows with the Electronic Gas Flow Meter and the Gas Flow Test Probe as described in the Service Manual. Correct if necessary.
- ☒ Check furnace open/close function.
- ☒ Verify the operation of the GFTV Camera for proper operation and viewing alignment in the furnace camera Tube View window. Align if needed.
- ☒ Check the operation of the Halogen Light ASSY for the GFTV Camera. Replace if needed.
- ☒ Check the water level/quality in the recirculation (if applicable). Add distilled water if necessary.
- ☒ Check the cooling system fluid flow rate with the FCS In-Line Flow Meter for proper levels if needed. Refer to SDB# COSY008.STN

8.6 AA-BG Baseline Noise with Arsenic

Description: Ensures that background correction does not produce excessive noise at a low wavelength.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0036	Passed

8.7 Flame Sensitivity

Description: Instrument Sensitivity checked against Copper standard.

Standard Copper Sensitivity			
Parameter	Specification	Results (Abs.)	Pass/Fail
5 mg/L Sensitivity SS Neb (if applicable)	> 0.250 Abs.	NA	Not Applicable
2 mg/L Sensitivity HS Neb (if applicable)	> 0.250 Abs.	0.3290	Passed

9. After PM Performance tests [THGA]:

9.1 Furnace Gas Flows

Description: Ensures the flow rates are within specification.

Parameter	Specification	Test Results	Pass/Fail
Internal Flow Rate	250 mL/min ± 25 mL/min	255	Passed
External Flow Rate	100 mL/min ± 10 mL/min	105	Passed

9.2 Chromium Baseline Noise

Description: Signal to noise check.

Parameter	Specification	Results	Pass/Fail
Baseline Noise	≤ 0.005 Abs.	0.0015	Passed
Standard Deviation	≤ 0.005	0.0008	Passed

9.3 Chromium Characteristic Mass and Precision

Description: Calculate the characteristic mass using the characteristic mass tool and precision from the integrated absorbance values.

Parameter	Specification	Results	Pass/Fail
Cr m ₀ Results	≤ 7.0 pg/0.0044 A-s	5.8	Passed
Precision	≤ 2.0 %	1.09	Passed

8. After PM Performance tests [Flame]:

8.1 Detector Linearity with Barium

Description: Ensures that the detector is linear in the Visible Range.

Parameter	Specification	Certificate Value at 553.6 nm (Abs.)	Test Results	Pass/Fail
1.0 A ND Filter	± 5% from Cert.	0.9798	0.9930	Passed
0.2 A ND Filter	± 5% from Cert.	0.2042	0.1974	Passed

8.2 Baseline Noise at 1.0 Absorbance with Barium

Description: Ensures that a high absorbance will not produce excessive noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0013	Passed

8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.001	0.0001	Passed

8.4 D₂ Background Compensation with Copper

Description: Verifies the instruments ability to compensate for Background absorption.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0019	Passed

8.5 AA-BG Baseline Noise with Copper

Description: Ensures that background correction does not produce excessive noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0004	Passed

Additional Comments

Additional Comments Regarding the PM

Zeeman Ratio = $\frac{\text{Atomic Signal (Peak area)}}{\text{Atomic Signal (Peak area)} + \text{Background Signal (Peak area)}}$

= $\frac{0.1665}{0.1665+0.1416}$

= 0.54

REPLACE PM KIT FOR PINAAACLE900T

Review

The preventive maintenance checks and if applicable performance tests for PinAAcle 900T have been completed.

This PinAAcle 900T Passes ☒ Fails ☐ the preventive maintenance.

Review of Preventive Maintenance:

Authorized PerkinElmer Representative:

Authorized Customer Representative:

9.4 Copper Characteristic Mass and Zeeman Ratio

Description: Calculate the characteristic mass using the characteristic mass tool and check the Zeeman Ratio.

Parameter	Specification	Results	Pass/Fail
Cu m ₀ Result	≤ 16.5 pg/0.0044 A-s	13.5	Passed
Zeeman Ratio	0.52 ± 0.04	0.54	Passed

10. Review:

- ☒ Review with the customer PM work performed.
- ☒ Review with the customer routine maintenance procedures.
- ☒ Discuss recommended customer supplied materials to have on hand.
- ☒ Attach PM sticker.