



รายงานผลการทดสอบคุณภาพน้ำ

รายงานเลขที่ : 2022/06/130

ชื่อลูกค้า : บริษัท ดีบีเอส เอ (1991) จำกัด (มหาชน)

ที่อยู่ : 1 หมู่ 2 ต. ท่าตูม อ. ศรีมหาโพธิ์ จ. ปราจีนบุรี 25140

ตัวอย่างเลขที่ : 2022/06/130

วันที่เก็บตัวอย่าง : 08/06/2022

เวลาเก็บตัวอย่าง : 08.50 น.

วันที่รับตัวอย่าง : 08/06/2022

สถานที่เก็บตัวอย่าง : Monitoring Well 5

วันที่วิเคราะห์ : 8-15/06/2022

วิธีการเก็บตัวอย่าง : Grab

ชนิดตัวอย่าง : น้ำใต้ดิน

พารามิเตอร์ที่ทดสอบ	หน่วย	วิธีทดสอบ	ผลการทดสอบ	Standard*
Cadmium	mg/L	Digestion, Inductively Coupled Plasma Method	< 0.002	≤ 0.003
Copper	mg/L	Digestion, Inductively Coupled Plasma Method	< 0.006	≤ 1.0
Nickel	mg/L	Digestion, Inductively Coupled Plasma Method	0.025	≤ 0.02
Lead	mg/L	Digestion, Inductively Coupled Plasma Method	0.033	≤ 0.01
Zinc	mg/L	Digestion, Inductively Coupled Plasma Method	0.029	≤ 5.0
Manganese	mg/L	Digestion, Inductively Coupled Plasma Method	0.372	≤ 0.5
Arsenic	mg/L	Digestion, Inductively Coupled Plasma Method	< 0.006	≤ 0.01
Hexavalent Chromium	mg/L	Filtration, Colorimetric Method	< 0.025	≤ 0.05

ลักษณะตัวอย่าง : สีขาว ความขุ่นน้อย ตะกอนขนาดเล็ก แขนงลอย มีกลิ่น

หมายเหตุ : วิเคราะห์ตามมาตรฐาน Standard Methods for the Examination of Water and Wastewater ,

23rd Edition, 2017 ฉบับโดย APHA - AWWA - WEF.

* ประกาศคณะกรรมการสิ่งแวดล้อมแห่งชาติ ฉบับที่ 20 พ.ศ. 2543 มาตรฐานคุณภาพน้ำใต้ดิน

ผู้เก็บตัวอย่าง : นางสาวชนิกานต์ แสงสุฯ (ว-199-จ-8448)



ลงนามโดย :

(นางวีรภรณ์ มุสเจริญ)

ว-199-จ-8448

รายงานฉบับนี้รับพระราชทานสิทธิบัตรการลอกเลียนแบบ ห้ามมิให้คัดลอกหรือรายงานผลเพียงบางส่วน โดยไม่ได้รับอนุญาตจากบริษัท อินทิเกรตเต็ด รีเสิร์ช เซ็นเตอร์ จำกัด

122 หมู่ 2 ต.ท่าตูม อ.ศรีมหาโพธิ์ จ.ปราจีนบุรี 25140 โทร 02-6345230 ต่อ 3311

ฉบับที่ : 1 (แก้ไขครั้งที่ : 0)

หน้า 2 ของ 2

กากของเสีย

ตรวจวัดโดยบริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด

ANALYSIS REPORT

CUSTOMER NAME : DOUBLE A (1991) PUBLIC CO., LTD. (PULP1)
ADDRESS : 1 MOO 2, THATOOM, SRIMAHAPHOTE, PRACHINBURI THAILAND 25140.
CONTACT INFORMATION : TEL : 08 5835 1371 e-mail : kunnapat_p@doublea1991.com
SAMPLING SOURCE : SLUDGE ETP#1 (TTLC)
SAMPLE TYPE : SLUDGE **RECEIVED DATE** : JUNE 1, 2022
SAMPLING DATE : APRIL 26, 2022 **ANALYTICAL DATE** : JUNE 1-21, 2022
SAMPLING TIME : 12:00 HOUR **REPORT NO.** : 2022-U048253
SAMPLING METHOD : GRAB **WORK NO.** : 2021-009206
SAMPLING BY : CUSTOMER **ANALYSIS NO.** : T22AK425-0001
ANALYZED BY : SC

COMPONENT ^{SC}	DETECTION LIMIT (mg/kg)	AMOUNT ^{1/} (mg/kg)	TEF ^{2/} (I-TEF)	TEQ (I-TEF) ^{3/} (mg/kg - I-TEQ)
PCDDs	2,3,7,8-TeCDD	0.000000500	< 0.000000500	< 0.000000500
	1,2,3,7,8-PeCDD	0.000000250	< 0.000000250	< 0.000000125
	1,2,3,4,7,8-HxCDD	0.000000250	< 0.000000250	< 0.000000250
	1,2,3,6,7,8-HxCDD	0.000000250	< 0.000000250	< 0.000000250
	1,2,3,7,8,9-HxCDD	0.000000250	< 0.000000250	< 0.000000250
	1,2,3,4,6,7,8-HpCDD	0.000000250	0.00000253	0.000000253
	OCDD	0.000000500	0.00000887	0.0000000887
PCDFs	2,3,7,8-TeCDF	0.000000500	< 0.000000500	< 0.000000500
	1,2,3,7,8-PeCDF	0.000000250	< 0.000000250	< 0.000000125
	2,3,4,7,8-PeCDF	0.000000250	< 0.000000250	< 0.000000125
	1,2,3,4,7,8-HxCDF	0.000000250	0.000000338	0.0000000338
	1,2,3,6,7,8-HxCDF	0.000000250	0.000000394	0.0000000394
	2,3,4,6,7,8-HxCDF	0.000000250	0.000000433	0.0000000433
	1,2,3,7,8,9-HxCDF	0.000000250	< 0.000000250	< 0.000000250
	1,2,3,4,6,7,8-HpCDF	0.000000250	0.000000424	0.0000000424
	1,2,3,4,7,8,9-HpCDF	0.000000250	< 0.000000250	< 0.0000000250
	OCDF	0.000000500	0.000000752	0.00000000752
TOTAL ^{4/}				0.000000156

COMPONENT ^{SC}	AMOUNT (mg/kg) ^{1/}
TeCDDs	0.0000116
PeCDDs	< 0.000000250
HxCDDs	< 0.000000250
HpCDDs	0.00000438
OCDD	0.00000887
TOTAL PCDDs	0.0000249
TeCDFs	0.00000140
PeCDFs	< 0.000000250
HxCDFs	0.00000165
HpCDFs	0.000000424
OCDF	0.000000752
TOTAL PCDFs	< 0.00000130
TOTAL	0.0000291

^{1/} AMOUNT OF COMPONENT PER SAMPLE.

^{2/} TEF (TOXIC EQUIVALENCY FACTOR). TEQ (TOXIC EQUIVALENCY) USE IS ACCORDING TO NATO/CCMS, 1988 (I-TEF).

^{3/} I-TEQ, TEQ FOR EACH COMPONENT OBTAINED BY MULTIPLYING THE CONCENTRATION WITH ITS CORRESPONDING TEF.

^{4/} DETECTION LIMIT OF TOTAL PCDDs AND PCDFs CALCULATED BY COMBINE ALL DETECTION LIMIT OF TOXIC PCDDs AND PCDFs

SC : THE TEST WAS SUBCONTRACTED TO THE ANOTHER LABORATORY

Piyapat S.
(MRS PIYAPAT SUTTAMANUTWONG)
LABORATORY SUPERVISOR
JUNE 22, 2022

ANALYSIS REPORT

CUSTOMER NAME : DOUBLE A (1991) PUBLIC CO., LTD. (PULP1)
ADDRESS : 1 MOO 2, THATOOM, SRIMAHAPHOTE, PRACHINBURI THAILAND 25140.
CONTACT INFORMATION : TEL : 08 5835 1371 e-mail : kunnapat_p@doublea1991.com
SAMPLING SOURCE : SLUDGE ETP#1 (STLC)
SAMPLE TYPE : SLUDGE **RECEIVED DATE** : JUNE 1, 2022
SAMPLING DATE : APRIL 26, 2022 **ANALYTICAL DATE** : JUNE 1-21, 2022
SAMPLING TIME : 12:00 HOUR **REPORT NO.** : 2022-U048254
SAMPLING METHOD : GRAB **WORK NO.** : 2021-009206
SAMPLING BY : CUSTOMER **ANALYSIS NO.** : T22AK425-0002
ANALYZED BY : SC

COMPONENT ^{SC}	DETECTION LIMIT (mg/L)	AMOUNT ^{1/} (mg/L)	TEF ^{2/} (I-TEF)	TEQ (I-TEF) ^{3/} (mg/L - I-TEQ)
PCDDs	2,3,7,8-TeCDD	0.0000000100	< 0.0000000100	< 0.0000000100
	1,2,3,7,8-PeCDD	0.0000000500	< 0.0000000500	< 0.0000000250
	1,2,3,4,7,8-HxCDD	0.0000000500	< 0.0000000500	< 0.0000000500
	1,2,3,6,7,8-HxCDD	0.0000000500	< 0.0000000500	< 0.0000000500
	1,2,3,7,8,9-HxCDD	0.0000000500	< 0.0000000500	< 0.0000000500
	1,2,3,4,6,7,8-HpCDD	0.0000000500	< 0.0000000500	< 0.0000000500
	OCDD	0.000000100	< 0.000000100	< 0.00000000100
PCDFs	2,3,7,8-TeCDF	0.0000000100	< 0.0000000100	< 0.00000000100
	1,2,3,7,8-PeCDF	0.0000000500	< 0.0000000500	< 0.0000000250
	2,3,4,7,8-PeCDF	0.0000000500	< 0.0000000500	< 0.0000000250
	1,2,3,4,7,8-HxCDF	0.0000000500	< 0.0000000500	< 0.0000000500
	1,2,3,6,7,8-HxCDF	0.0000000500	< 0.0000000500	< 0.0000000500
	2,3,4,6,7,8-HxCDF	0.0000000500	< 0.0000000500	< 0.0000000500
	1,2,3,7,8,9-HxCDF	0.0000000500	< 0.0000000500	< 0.0000000500
	1,2,3,4,6,7,8-HpCDF	0.0000000500	< 0.0000000500	< 0.0000000500
	1,2,3,4,7,8,9-HpCDF	0.0000000500	< 0.0000000500	< 0.0000000500
	OCDF	0.000000100	< 0.000000100	< 0.00000000100
TOTAL ^{4/}				< 0.000000100

COMPONENT ^{SC}	AMOUNT (mg/L) ^{1/}
TeCDDs	0.0153
PeCDDs	< 0.0000000500
HxCDDs	< 0.0000000500
HpCDDs	< 0.0000000500
OCDD	< 0.0000000100
TOTAL PCDDs	0.0153
TeCDFs	< 0.0000000100
PeCDFs	< 0.0000000500
HxCDFs	< 0.0000000500
HpCDFs	< 0.0000000500
OCDF	< 0.0000000100
TOTAL PCDFs	< 0.0000000260
TOTAL	0.0153

^{1/} AMOUNT OF COMPONENT PER SAMPLE.

^{2/} TEF (TOXIC EQUIVALENCY FACTOR), TEQ (TOXIC EQUIVALENCY)
USE IS ACCORDING TO NATO/CCMS, 1988 (I-TEF).

^{3/} I-TEQ, TEQ FOR EACH COMPONENT OBTAINED BY MULTIPLYING
THE CONCENTRATION WITH ITS CORRESPONDING TEF.

^{4/} DETECTION LIMIT OF TOTAL PCDDs AND PCDFs CALCULATED BY
COMBINE ALL DETECTION LIMIT OF TOXIC PCDDs AND PCDFs
SC : THE TEST WAS SUBCONTRACTED TO THE ANOTHER LABORATORY.

Piyapat S.
(MRS PIYAPAT SUTTAMANUTWONG)
LABORATORY SUPERVISOR
JUNE 22, 2022

ทรัพยากรนิเวศในน้ำ

ตรวจวัดโดยบริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด

ANALYSIS REPORT

CUSTOMER NAME : DOUBLE A (1991) PUBLIC CO.,LTD (PULP 1)
ADDRESS : 1 MOO 2 THA TUM SI MAHA PHOT PRACHIN BURI 25140
CONTACT INFORMATION : TEL : 08 5835 1371 e-mail : kunnapat_p@doublea1991.com
SAMPLING SOURCE : -
SAMPLE TYPE : SURFACE WATER **RECEIVED DATE** : MARCH 2, 2022
SAMPLING DATE : MARCH 1, 2022 **ANALYTICAL DATE** : MARCH 2-11, 2022
SAMPLING TIME : * **REPORT NO.** : 2022-U019162
SAMPLING METHOD^b : PLANKTON NET **WORK NO.** : 2021-009206
SAMPLING BY^b : MR KRIDSANAPONG NAMTHIP **ANALYSIS NO.** : T22AD851-0002 - T22AD851-0003
ANALYZED BY : MISS NAPAPORN PURATAKO

PHYTOPLANKTON (Natural Units/mL)	COUNTING UNIT	RESULT	
		STATION 1 13:30 HOUR * T22AD851-0002	STATION 2 14:30 HOUR * T22AD851-0003
Division Cyanophyta			
Class Cyanophyceae			
Family Chroococcaceae			
<i>Microcystis aeruginosa^b</i>	COLONY	36	94
Family Oscillatoriaceae			
<i>Oscillatoria</i> spp. ^b	FILAMENT	313	1,992
Division Chlorophyta			
Class Chlorophyceae			
Family Chlamydomonadaceae			
<i>Pandorina morum^b</i>	COLONY	208	1,016
Family Hydrodictyaceae			
<i>Pediastrum</i> spp. ^a	COLONY	288	84
Family Coelastraceae			
<i>Coelastrum</i> spp. ^b	COLONY	79	52
Family Oocystaceae			
<i>Ankistrodesmus</i> spp. ^b	COLONY	15	13
<i>Dictyosphaerium</i> spp. ^b	COLONY	36	40
<i>Kirchneriella</i> spp. ^b	COLONY	16	8
<i>Selenastrum</i> spp. ^b	COLONY	5	0
Family Scenedesmaceae			
<i>Actinastrum</i> spp. ^b	COLONY	7	40
<i>Microactinium</i> spp. ^b	COLONY	34	14
<i>Crucigenia</i> spp. ^b	COLONY	184	151
<i>Scenedesmus</i> spp. ^a	COLONY	9,198	4,153
Family Desmidiaceae			
<i>Closterium</i> spp. ^b	CELL	12	33
<i>Cosmarium</i> spp. ^b	CELL	10	0
<i>Staurastrum</i> spp. ^b	CELL	20,817	11,254



PHYTOPLANKTON (Natural Units/mL)	COUNTING UNIT	RESULT	
		STATION 1 13:30 HOUR * T22AD851-0002	STATION 2 14:30 HOUR * T22AD851-0003
Class Euglenophyceae			
Family Euglenaceae			
<i>Euglena</i> spp. ^b	CELL	77	90
<i>Phacus</i> spp. ^b	CELL	9	14
<i>Strombomonas</i> spp. ^b	CELL	0	51
<i>Trachelomonas hispida</i> ^b	CELL	9	90
<i>T. volvocina</i> ^b	CELL	46	63
Division Chromophyta			
Class Bacillariophyceae			
Family Thalassiosiraceae			
<i>Cyclotella</i> spp. ^b	CELL	12	11
Family Aulacoseiraceae			
<i>Aulacoseira granulata</i> ^b	FILAMENT	197	84
Family Fragilariaceae			
<i>Synedra rumpens</i> ^b	CELL	88	22
<i>S. ulna</i> ^b	CELL	12	20
Family Naviculaceae			
<i>Gyrosigma</i> spp. ^b	CELL	32	5
<i>Navicula</i> spp. ^b	CELL	38	13
Family Bacillariaceae			
<i>Nitzschia</i> spp. ^b	CELL	9	5
Family Surirellaceae			
<i>Surirella</i> spp. ^b	CELL	312	200
Class Chrysophyceae			
Family Pleurochloridaceae			
<i>Isthmochloron</i> spp. ^b	CELL	55	43
Class Dinophyceae			
Family Ceratiaceae			
<i>Ceratium</i> spp. ^b	CELL	69	20

PHYTOPLANKTON (Natural Units/mL)	COUNTING UNIT	RESULT	
		STATION 1 13:30 HOUR * T22AD851-0002	STATION 2 14:30 HOUR * T22AD851-0003
Family Peridiniaceae <i>Peridinium</i> spp. ^b	CELL	344	35
TOTAL ABUNDANCE		32,567	19,710
AMOUNT OF SPECIES		31	30
SAMPLE VOLUME (mL)		162	190
SAMPLE CONDITION WATER'S COLOUR/TURBID SEDIMENT		COLOURLESS/CLEAR GREEN	COLOURLESS/CLEAR GREEN

^a : ISO/IEC 17025 ACCREDITED BY DEPARTMENT OF SCIENCE SERVICE (DSS)

^b : VERIFIED BY OWN LABORATORY QUALITY SYSTEM, BUT STILL NOT ACCREDITED

REMARK : STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF 23rd EDITION, 2017

STATION 1 วัดวังบัวทอง (เหนือจุดปล่อยน้ำ)

STATION 2 วัดหลังถ้ำ (ใต้จุดปล่อยน้ำ)



(MISS CHAWEEVAN BOONLA)
LABORATORY SUPERVISOR

MARCH 18, 2022

ANALYSIS REPORT

CUSTOMER NAME : DOUBLE A (1991) PUBLIC CO.,LTD (PULP 1)
ADDRESS : 1 MOO 2 THA TUM SI MAHA PHOT PRACHIN BURI 25140
CONTACT INFORMATION : TEL : 08 5835 1371 e-mail : kunnapat_p@doublea1991.com
SAMPLING SOURCE : -
SAMPLE TYPE : SURFACE WATER
SAMPLING DATE : MARCH 1, 2022
SAMPLING TIME : *
SAMPLING METHOD : PLANKTON NET
SAMPLING BY : MR KRIDSANAPONG NAMTHIP
ANALYZED BY : MISS NAPAPORN PURATAKO

RECEIVED DATE : MARCH 2, 2022
ANALYTICAL DATE : MARCH 2-11, 2022
REPORT NO. : 2022-U019163
WORK NO. : 2021-009206
ANALYSIS NO. : T22AD851-0002 - T22AD851-0003

ZOOPLANKTON (UNITS/m ³)	COUNTING UNIT	RESULT	
		STATION 1 13:30 HOUR * T22AD851-0002	STATION 2 14:30 HOUR * T22AD851-0003
Phylum Protozoa			
Class Sarcodina			
Family Arcellidae			
<i>Arcella</i> sp.	CELL	11,057	66,545
Class Ciliata			
Family Vorticellidae			
<i>Vorticella</i> sp.	CELL	644	4,406
Phylum Rotifera			
Class Monogononta			
Family Brachionidae			
<i>Anuraeopsis</i> sp.	INDIVIDUAL	1,307	6,600
<i>Brachionus</i> sp.	INDIVIDUAL	5,207	28,595
<i>Keratella</i> sp.	INDIVIDUAL	9,107	68,195
Family Lecanidae			
<i>Lecane</i> sp.	INDIVIDUAL	3,900	7,706
Family Trichocercidae			
<i>Trichocerca</i> sp.	INDIVIDUAL	2,594	3,845
Family Synchaetidae			
<i>Polyarthra</i> sp.	INDIVIDUAL	3,257	16,500
Class Digononta			
Family Philodinidae			
<i>Rotaria</i> sp.	INDIVIDUAL	8,444	23,645
Phylum Arthropoda			
Class Crustacea			
Cyclopoid Copepod	INDIVIDUAL	0	2,756
Nauplius of Copepod	INDIVIDUAL	2,594	2,195
Family Moiniidae			
<i>Moina</i> sp.	INDIVIDUAL	0	2,756



ZOOPLANKTON (UNITS/m ³)	COUNTING UNIT	RESULT	
		STATION 1 13:30 HOUR * T22AD851-0002	STATION 2 14:30 HOUR * T22AD851-0003
Phylum Mollusca Class Bivalvia Bivalvia Larva	INDIVIDUAL	7,800	6,056
TOTAL ABUNDANCE		55,911	239,800
AMOUNT OF SPECIES		11	13
SAMPLE CONDITION WATER'S COLOUR/TURBID SEDIMENT		COLOURLESS/CLEAR GREEN	COLOURLESS/CLEAR GREEN

REMARK : STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF 23rd EDITION, 2017

STATION 1 วัดวังบัวทอง (เหนือจุดปล่อยน้ำ)

STATION 2 วัดหลังถ้ำ (ใต้จุดปล่อยน้ำ)



(MISS CHAWEEWAN BOONLA)
LABORATORY SUPERVISOR

MARCH 18, 2022

ANALYSIS REPORT

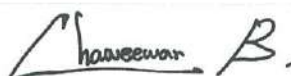
CUSTOMER NAME : DOUBLE A (1991) PUBLIC CO.,LTD (PULP 1)
ADDRESS : 1 MOO 2 THA TUM SI MAHA PHOT PRACHIN BURI 25140
CONTACT INFORMATION : TEL : 08 5835 1371 e-mail : kunnapat_p@doublea1991.com
SAMPLING SOURCE : -
SAMPLE TYPE : SEDIMENT
SAMPLING DATE : MARCH 1, 2022
SAMPLING TIME : *
SAMPLING METHOD : PETERSEN GRAB
SAMPLING BY : MR KRIDSANAPONG NAMTHIP
ANALYZED BY : MISS PATCHAREE KONGCHUMNAN

RECEIVED DATE : MARCH 2, 2022
ANALYTICAL DATE : MARCH 2-11, 2022
REPORT NO. : 2022-U019164
WORK NO. : 2021-009206
ANALYSIS NO. : T22AD851-0006 - T22AD851-0007

BENTHOS (INDIVIDUALS/m ²)	RESULT	
	STATION 1 13:30 HOUR * T22AD851-0006	STATION 2 14:30 HOUR * T22AD851-0007
Phylum Annelida		
Class Oligochaeta		
Family Tubificidae	7	28
Phylum Mollusca		
Class Bivalvia		
Family Corbiculidae		
<i>Corbicula</i> sp.	7	0
Phylum Arthropoda		
Class Insecta		
Family Chironomidae		
<i>Chironomus</i> sp.	21	7
Family Caenidae	7	0
TOTAL DENSITY	42	35
AMOUNT OF SPECIES	4	2
SAMPLE CONDITION	GRAVEL	HEAVY CLAY

STATION 1 วัดวังบัวทอง (เหนือจุดปล่อยน้ำ)

STATION 2 วัดหลังถ้ำ (ใต้จุดปล่อยน้ำ)



(MISS CHAWEEWAN BOONLA)
LABORATORY SUPERVISOR

MARCH 18, 2022



คุณภาพอากาศในพื้นที่ทำงาน

ตรวจวัดโดยบริษัท อินทิเกรทเต็ด รีเสิร์ช เซ็นเตอร์ จำกัด

ระดับเสียงในพื้นที่ทำงาน

ตรวจวัดโดยบริษัท อินทิเกรทเต็ด รีเสิร์ช เซ็นเตอร์ จำกัด



Analysis Report

Job No. :

Issued Date : 24 May 2022

REPORT No. WS004/2022
CUSTOMER NAME บริษัท ดับเบิล เอ (1991) จำกัด (มหาชน) (โรงเยื่อ 1)
CONTACT NAME คุณกัญญ์ณภัท ปิณฑาประเสริฐ (085-835-1371)
MEASURED PARAMETER Equivalent Sound Level 8 hours (Leq 8 hrs)
MEASURED DATE 18 May 2022
MEASURED TIME 9.30 am - 5.30 pm
MEASURED INSTRUMENT Sound Level Meter Model Aco Type 6236 No.11 Serial No.192014

Location	Period	Sound Level [dB(A)]	
		Leq	Lmax
Debarking Drum Line 1	1 st hour	80.7	87.0
	2 nd hour	80.2	86.1
	3 rd hour	79.3	84.2
	4 th hour	79.0	86.9
	5 th hour	79.3	86.3
	6 th hour	73.4	85.8
	7 th hour	77.5	89.2
	8 th hour	80.1	86.6
	Leq 8 hrs	79	
	Standard ^{1/}	85	

Reference : ^{1/} Announcement of Department of Labour Protection and Welfare, B.E.2561 (Time Weighted Average-TWA)

Tested by : จักรี

Mr. Jakkree Inta
Environmental Scientist

Approved by : ทิฏา

Ms. Thittaya Nanmuen
Laboratory Manager

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• REPORTED ANALYSIS REFERS TO SUBMITTED SAMPLE ONLY

Page 1 of 6



Analysis Report

Job No. :

Issued Date : 23 May 2022

REPORT No. S2_003/2022
CUSTOMER NAME บริษัท ดับเบิล เอ (1991) จำกัด (มหาชน) (โรงเยื่อ 1)
CONTACT NAME คุณกัญญ์ณภัท ปัญญาประเสริฐ (085-835-1371)
MEASURED PARAMETER Equivalent Sound Level 12 hours (Leq 12 hrs)
MEASURED DATE 18 May 2022
MEASURED TIME 9.30 am - 9.30 pm
MEASURED INSTRUMENT Sound Level Meter Model Aco Type 6236 No.11 Serial No.192014

Location	Period	Sound Level [dB(A)]	
		Leq	Lmax
Debarking Drum Line 1	1 st hour	80.7	87.0
	2 nd hour	80.2	86.1
	3 rd hour	79.3	84.2
	4 th hour	79.0	86.9
	5 th hour	79.3	86.3
	6 th hour	73.4	85.8
	7 th hour	77.5	89.2
	8 th hour	80.1	86.6
	9 th hour	80.1	90.2
	10 th hour	80.0	85.9
	11 th hour	79.9	84.8
	12 th hour	79.8	84.6
	Leq 12 hrs	79	
	Standard ^{1/}	83	

Reference : ^{1/} Announcement of Department of Labour Protection and Welfare, B.E.2561 (Time Weighted Average-TWA)

Tested by : จกักรีย์
Mr. Jakkree Inta
Environmental Scientist

Approved by : กัญญา
Ms. Thittaya Nanmuen
Laboratory Manager

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Analysis Report

Job No. :

Issued Date : 24 May 2022

REPORT No. WS004/2022
CUSTOMER NAME บริษัท ดีบีเอส เอ (1991) จำกัด (มหาชน) (โรงเยื่อ 1)
CONTACT NAME คุณกัญญ์ณภัส ปัญญาประเสริฐ (085-835-1371)
MEASURED PARAMETER Equivalent Sound Level 8 hours (Leq 8 hrs)
MEASURED DATE 18 May 2022
MEASURED TIME 9.35 am - 5.35 pm
MEASURED INSTRUMENT Sound Level Meter Model Aco Type 6236 No.13 Serial No.192016

Location	Period	Sound Level [dB(A)]	
		Leq	Lmax
Chipper Line 1	1 st hour	94.1	98.5
	2 nd hour	94.0	98.6
	3 rd hour	94.5	99.1
	4 th hour	93.8	97.8
	5 th hour	93.9	97.7
	6 th hour	90.3	97.5
	7 th hour	92.8	97.6
	8 th hour	94.5	99.2
	Leq 8 hrs	93	
	Standard ^{1/}	85	

Reference : ^{1/}Announcement of Department of Labour Protection and Welfare, B.E.2561 (Time Weighted Average-TWA)

Tested by : จกรี่
Mr. Jakkree Inta
Environmental Scientist

Approved by : กัท
Ms. Thittaya Nanmuen
Laboratory Manager

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Analysis Report

Job No. :

Issued Date : 23 May 2022

REPORT No. S2_003/2022
CUSTOMER NAME บริษัท ดีบีเอส เอ (1991) จำกัด (มหาชน) (โรงเยื่อ 1)
CONTACT NAME คุณกัญญ์ณภัท ปัญญาประเสริฐ (085-835-1371)
MEASURED PARAMETER Equivalent Sound Level 12 hours (Leq 12 hrs)
MEASURED DATE 18 May 2022
MEASURED TIME 9.35 am - 9.35 pm
MEASURED INSTRUMENT Sound Level Meter Model Aco Type 6236 No.13 Serial No.192016

Location	Period	Sound Level [dB(A)]	
		Leq	Lmax
Chipper Line 1	1 st hour	94.1	98.5
	2 nd hour	94.0	98.6
	3 rd hour	94.5	99.1
	4 th hour	93.8	97.8
	5 th hour	93.9	97.7
	6 th hour	90.3	97.5
	7 th hour	92.8	97.6
	8 th hour	94.5	99.2
	9 th hour	95.2	99.6
	10 th hour	94.8	98.9
	11 th hour	92.2	98.2
	12 th hour	92.0	98.1
	Leq 12 hrs	93	
	Standard ^{1/}	83	

Reference : ^{1/} Announcement of Department of Labour Protection and Welfare, B.E.2561 (Time Weighted Average-TWA)

Tested by : จกฐ์
Mr. Jakkree Inta
Environmental Scientist

Approved by : ทิตก
Ms. Thittaya Nanmuen
Laboratory Manager

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ระดับความร้อนในพื้นที่ทำงาน

ตรวจวัดโดยบริษัท อินทิเกรทเต็ด รีเสิร์ช เซ็นเตอร์ จำกัด



Analysis Report

Job No. :

Issued Date : 8 June 2022

REPORT No. WH001/2022
CUSTOMER NAME บริษัท ดีบีเอส เอ (1991) จำกัด (มหาชน) (โรงเยื่อ 1)
CONTACT NAME คุณกัญญ์ณภัท ปัญญาประเสริฐ (085-835-1371)
MEASURED PARAMETER Wet Bulb Globe Temperature
MEASURED DATE 18 May, 7 June 2022
MEASURED TIME 10.00 am - 12.00 am
MEASURED INSTRUMENT Heat Stress Monitor Model Delta Ohm ; HD 32.2

Item	Location	Type of Work	Temperature (°C)				
			WB	GT	DB	WBGT	Standard ^{1/}
1	Digester Pulp 1	งานเบา	27.6	35.3	34.6	30	34
2	Recovery Boiler at Burner Floor at NPP5	งานเบา	27.6	37.2	36.2	30	34

Reference : ^{1/} Ministerial Regulation on Standard of Safety Administration and Management, Occupational Health and Environmental Condition concerning Heat, Light and Noise, B.E. 2559 (Section 1 : Heat)

Tested by : จักษ์
Mr. Jakkree Inta
Environmental Scientist

Approved by : ทิตา
Ms. Thittaya Nanmuen
Laboratory Manager

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Analysis Report

Job No. :

Issued Date : 17 June 2022

REPORT No. WC004/2022
CUSTOMER NAME บริษัท ดับเบิล เอ (1991) จำกัด (มหาชน) (โรงเยื่อ 1)
CONTACT NAME คุณกัญญ์ณภัส ปัญญาประเสริฐ (085-835-1371)
SAMPLING PARAMETER Chemical Fume
SAMPLING DATE 18 May 2022
ANALYTICAL DATE 23 May - 15 June 2022
SAMPLING INSTRUMENT Personal Air Sampling Model SKC 224-PCXR8 and Filter, Sorbent Tube , Sampling Bag

Item	Location	Parameter ^{3/}	Unit	Result	Standard ^{1/}	LOD	Analytical Method
1	Chemical Plant	NaOH	mg/m ³	0.02	2	0.001	OSHA ID 121
		ClO ₂	mg/m ³	0.04	0.3	0.001	OSHA ID 101
		SO ₂	ppm	0.017	5	0.001	UV Fluorescence
2	ClO ₂ Plant	NaOH	mg/m ³	0.02	2	0.001	OSHA ID 121
		ClO ₂	mg/m ³	0.03	0.3	0.001	OSHA ID 101
		SO ₂	ppm	0.014	5	0.001	UV Fluorescence
3	Fiberline	H ₂ S ^{4/}	ppm	0.124	20	0.001	UV Fluorescence
		CH ₃ SH ^{5/}	ppm	0.04	10	0.01	NIOSH 2542
		CH ₃ SCH ₃	ppm	0.09	10 ^{2/}	0.01	OSHA IMIS D650

Reference : ^{1/} Announcement of Department of Labour Protection and Welfare, B.E. 2560 (Chemical Threshold Limit)

^{2/} American Conference of Governmental Industrial Hygienists 2013 (ACGIH)

^{3/} Tested by Emex Association Co., Ltd. Registration No. 7-244.

^{4/} Tested by Integrated Research Center Co.,Ltd. Registration No. 7-199.

ND = Not Detected, LOD of CH₃SH = 0.025 ppm, CH₃SCH₃ = 0.08 ppm

Sampling by : จกั ยู่
Mr. Jakkree Inta
Environmental Scientist

Approved by : ทิตตา
Ms.Thittaya Nanmuen
Laboratory Manager

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Analysis Report

Job No. :

Issued Date : 4 July 2022

REPORT No. WC004/2022
 CUSTOMER NAME บริษัท ดับเบิล เอ (1991) จำกัด (มหาชน) (โรงเยื่อ 1)
 CONTACT NAME คุณกัญญณัฐ ปัญญาประเสริฐ (085-835-1371)
 SAMPLING PARAMETER Chemical Fume
 SAMPLING DATE 7 June 2022
 ANALYTICAL DATE 9 June - 4 July 2022
 SAMPLING INSTRUMENT Personal Air Sampling Model SKC 224-PCXR8 and Sorbent Tube , Sampling Bag

Item	Location	Parameter ^{3/}	Unit	Result	Standard ^{1/}	LOD	Analytical Method
1	Pulp Mill at Evaporation Plant	H ₂ S ^{4/}	ppm	0.102	20	0.001	UV Fluorescence
		CH ₃ SH	ppm	0.36	10	0.025	NIOSH 2542
		CH ₃ SCH ₃	ppm	1.25	10 ^{2/}	0.01	OSHA IMIS D650
2	Recovery Boiler at Burner Floor	H ₂ S ^{4/}	ppm	0.059	20	0.001	UV Fluorescence
		CH ₃ SH	ppm	0.05	10	0.025	NIOSH 2542
		CH ₃ SCH ₃	ppm	0.22	10 ^{2/}	0.01	OSHA IMIS D650

Reference : ^{1/} Announcement of Department of Labour Protection and Welfare, B.E. 2560 (Chemical Threshold Limit)

^{2/} American Conference of Governmental Industrial Hygienists 2013 (ACGIH)

^{3/} Tested by Emex Association Co., Ltd. Registration No. ๖-244.

^{4/} Tested by Integrated Research Center Co.,Ltd. Registration No. ๖-199.

Sampling by : จกฤษฎี
 Mr. Jakkree Inta
 Environmental Scientist

Approved by : นันทนา
 Ms.Thittaya Nanmuen
 Laboratory Manager

ภาคผนวก จ
ใบรับรองการสอบเทียบเครื่องมือ

บริษัท อินทิเกรทเต็ด รีเสิร์ช เซ็นเตอร์ จำกัด



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No.: 21H2650
Page: 1 of 2

Equipment: Heat Stress Monitor

Manufacturer: Delta Ohm

Model: HD 32.2

Serial No.: 10027486

ID No.:

Condition As-Received: Used Item

Received Date: 24 December 2021

Calibration Date: 28 December 2021

Reference: 2112-0696WC

Submitted by: Integrated Research Center Co., Ltd.

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

122 Moo 2, T.Thaloom, A.Srimahaphote, Prachinburi 25140

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.

Procedure used: Calibration were conducted using in-house calibration procedure CP-H03 according to comparison with
standard temperature probe for temperature measurement function into humidity / temperature chamber.

Condition of this result of calibration

1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Handheld Thermometer With Sensor	1521	ASA339	211842	19 Aug 2022

2. The certificate is valid only to the item calibrated on date and place of calibration.

3. This Certificate is traceable to the International System of Unit maintained at:-
-National Institute of Metrology Thailand (NIMT)

Calibrated by: Kraipap Onrai
Issue Date: 29 December 2021

Approved Signatory:

[✓] Chakrit Watsanijus
[] Pornthippa Taneyakul
[] Pitak Srimongkol

0277435



Cert. No.: 21H2650
Page: 2 of 2

This instrument was connected with temperature probe Serial No. 19026813.

Result of Calibration:-

Without Adjustment			
Function: Temperature measurement for Tn.			
Standard Temperature	UUC* Reading	Error	Uncertainty of Measurement
(°C)	(°C)	(°C)	(±°C)
20.023	20.0	-0.023	0.42
30.026	30.0	-0.026	0.42
40.036	40.0	-0.036	0.42

This instrument was connected with temperature probe Serial No. 10026232.

Result of Calibration:-

Without Adjustment			
Function: Temperature measurement for Tg.			
Standard Temperature	UUC* Reading	Error	Uncertainty of Measurement
(°C)	(°C)	(°C)	(±°C)
20.023	20.1	0.077	0.42
30.026	30.1	0.074	0.42
40.036	40.0	-0.036	0.42

This instrument was connected with temperature probe Serial No. 10031655.

Result of Calibration:-

Without Adjustment			
Function: Temperature measurement for T.			
Standard Temperature	UUC* Reading	Error	Uncertainty of Measurement
(°C)	(°C)	(°C)	(±°C)
20.023	19.9	-0.123	0.42
30.026	29.9	-0.126	0.42
40.036	39.9	-0.136	0.42

UUC* : Unit Under Calibration

The reported uncertainty of measurement was based on standard uncertainty multiplied
by coverage factor k = 2.00, providing confidence level approximately 95%.

-00-

01088284



Certificate of Calibration

Aquion: Anion (ID#822)

This certificate is to verify that instrument below are calibrated
by Archemica Lab Co., Ltd.

Aquion S/N: 180344663

For

Emex Association Co., Ltd.

Operator Signature:

(Mr.Thitipong Piromkriput)

Applications Chemist



Date: January 10, 2022

เลขที่ใบขึ้น 7-244



ห้องปฏิบัติการวิเคราะห์หอยเชลล์
เลขที่ใบขึ้น 7-244

ใบรับรองการสอบเทียบ “เครื่อง Ion chromatography”
(Calibration Certificate of Ion chromatography)

Dionex Ion Chromatography
Preventive Maintenance Report

Customer Organization	Name/ Department
Emex Association Co., Ltd.	K. Kamchana
Engineer	Date
Thitipong Piromkripiuk	10-Jan-2022

Instrument Detail

Instrument Model	Application
Aquion (ID#822, 1 st Contract)	Anion
Instrument components	Serial Number
Aquion	180344663

Consumable Detail

Columns	Guard Columns	Suppressors	Concentrators	Etc.
AS22 (4mm)	AG22 (4mm)	AERS 500 (4mm)	-	-

Remark: -

Perform By
Archemica Lab Co., Ltd.Archemica Lab
10/1/22
Dateห้องปฏิบัติการวิเคราะห์เอกชน
เลขทะเบียน ว-244Customer
04/01/22
DateThermoFisher
SCIENTIFIC
Chromleon Operational Qualification

General Information

Computer Name Version Number:
Instrument Controller: DESKTOP-D97001E 7.2.7 Build 10369 (290782)
Client: DESKTOP-D97001E 7.2.7.10369
Operator: Thitipong Piromkripiuk
Overall Test Result: **Passed**

Comparison Format:

All Parameters:	Significant Digits:	10
-----------------	---------------------	----



Reviewer's Signature // Date

Operator's Signature // Date

Chromleon (c) Thermo Fisher Scientific 2017
Version 7.2.7.10369ห้องปฏิบัติการวิเคราะห์เอกชน
เลขทะเบียน ว-244CM_OQ / General Information
Printed: 10-Jan-2022 14:28Optima8300
Preventive Maintenance Report

ใบรับรองการสอบเทียบ “เครื่อง Inductively Coupled Plasma (ICP-OES)”
(Calibration Certificate of Inductively Coupled Plasma (ICP-OES))



Company Name: Emex Association Co., LTD.

Instrument Location: 27, 29 Soi Pharam2, Soi 30 Bang Mot,
Chom Thong, Bangkok 10150

Instrument Serial No.: 07851604262

Date: 2-Mar-2022



ICP-OES/Optima8300 Preventive Maintenance (PM)

Company Name:	Emex Association Co., LTD.		
Address (Instrument Location):	27, 29 Soi Pharam2, Soi 30 Bang Mot, Chom Thong, Bangkok 10150		
Serial Number:	07851604262	PM Number:	1 of 2
Customer Name (If applicable):	K. Kanchana	Telephone Number:	02-867-1128
Service Engineer Name:	K. Chayanan	Service Order Number:	WO-01612540
Date PM Performed: (DD-MMM-YYYY)	2-Mar-2022	Next PM Due Date: (DD-MMM-YYYY)	2-Aug-2022
Standard Labor Hours to Complete PM:	4 hours		

Part Number	Release	Publication Date	
09370141 Rev.5	A	January 2018	

Scope

The purpose of this PM is to ensure the continued functionality of the PerkinElmer / Optima8300 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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ICP-OES/Optima8300 Preventive Maintenance (PM)

Page 1 of 7

เลขทะเบียน 7-244

Component List

Component / Specific Model	Serial #	Configuration Notes
Optima8300	07851604262	Syngistix V 1.0.1.1275

Parts Lists

Parts Included with the PM		
Part Number (If applicable)	Description	Quantity
09995098	Air Filter-Spectrometer	1
N077520	Air Filter-RF Generator	1
09992731	Axial Window	1
B0610377	Radial Window	1
N0770438	O-ring kit, injector support adapter	2
N0780437	O-ring kit, torch	2

Additional Reagents and Standards Required for PM				
Part Number (If applicable)	Description	Quality	Batch/Lot #	Expired Date (MM/YY)
N0691579	Multi-Element Standard	AR	57-024CRX1	30-Mar-2023
N9900221	DI Standard diluted 100 X	AR	54-134CRY1	30-Aug-2022
N0582152	Wave Cal Solution	AR	3-207MJX1	30-Nov-2022
N0302946	VIS Wavecal Solution	AR	57-023CRT1	30-APR-2023

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เลขทะเบียน 7-244

ICP-OES/Optima8300 Preventive Maintenance (PM)

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Procedure Checklist

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

1. General:

- ✓ Ask customer about unit's performance since last visit.
- ✓ Check incoming AC line voltage under load for proper levels and grounding.
- ✓ Is the instrument operational? If not, please comment.

2. Mechanical:

- ✓ Inspect and clean all fans and filters.
- ✓ Inspect and replace torch components and necessary.
Torch Components Replaced: ☐ Yes ☒ No
- ✓ Inspect all tubing for signs of cracking or leaking and replace as necessary.
Tubing Replaced: ☒ Yes ☐ No
- ✓ Inspect the peristaltic pump for proper operation.
- ✓ Check and adjust if necessary, the external nitrogen, argon shear gas and water supply pressures.
- ✓ Check and adjust if necessary, the internal nitrogen, main argon, torch argon and shear gas pressures.

Regulator	Measured Pressure	Set Pressure
Nitrogen	NA	NA (calibrated in Factory)
Main Argon	75	75 psig
Torch Argon	67	67 psig
Shear Gas	65	65 psig
Water	35	35 psi

- ✓ Check shear gas nozzle for blockages and proper, uniform flow.
- ✓ Inspect nitrogen Hi/Low purge and shear gas solenoids for proper function.
- ✓ Inspect the function of all spectrometer motors. Drive the motors from the Spectrometer DCM. (sets XY motor)
- ✓ Inspect the function of the pneumatic shutter for proper operation.
- ✓ Perform preventative maintenance on the chiller as required. Make the customer aware of the importance of maintaining the chiller fluid level and filter replacement.
- ✓ Drain air compressor surge tank.
- ✓ Clean exterior of instrument.
- ✓ Visually inspect all PC boards for cleanliness and signs of corrosion.

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ICP-OES/Optima8300 Preventive Maintenance (PM)

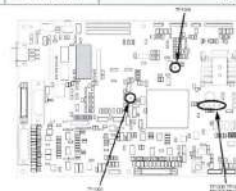
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3. Electrical

- ✓ Check all RF generator and spectrometer power supply voltages.

Spectrometer Control/Interface PCB Test Points

TP	Voltage (DC)	Tolerance	Description
1	+24V	± 500mV	From Main Supply
2	+12V	± 20mV	Onboard - For View X/Y Motors
3	+15V	± 600mV	Onboard - For Spectrometer Control Electronics
4	-15V	± 600mV	Onboard - For Spectrometer Control Electronics
5	+3.3V	± 100mV	Onboard - Source of 3.3V for Icarus Engine and SCB elect.
6	+2.5V	± 25mV	Onboard - For Xilinx FPGA
7	+5.0V		From Main Supply
8		± 5.0 GND	
9		± 5.0 GND	
10		± 5.0 GND	
11		± 5.0 GND	
12		± 5.0 GND	
13	+1.5V	± 45mV	Onboard - For Icarus Engine
22	+6.5V	-0mV, +100mV	UV TEC
23	+6.5V	-0mV, +100mV	VIS TEC



RF Controller PCB Test Points

TP	Voltage (DC)	RF Control PCB Location
1005	-14 to -16 (-15)	Right of U1001
1006	23-25 (24)	Right of U1001
1008	4.75-5.25 (5)	Upper Right of U1001
1009	14-16 (15)	Upper Left of U1001
1004	Ground	Lower Right of U1001

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เลขทะเบียน 7-244

ICP-OES/Optima8300 Preventive Maintenance (PM)

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Run instrument diagnostic checks from the appropriate Device Control Module.

RF Generator:

- Check the RF generator status screens.
- Check the function of all interlocks.

Spectrometer:

- Check the spectrometer status screens. Ensure Ready mode with no fatal errors.
- Check the spectrometer optical tube temperatures (top, bottom, fin, optical base).
- Check detector temperatures.
- Check TEC voltages (6.5VDC).

4. Optical:

- Clean or replace the axial and radial view windows as necessary.

Axial Window Replaced: ☐ Yes ☒ No
Radial Window Replaced: ☐ Yes ☒ No

5. PM Performance Tests:

- Perform View Align.

5.1 Spectral Resolution:

- Measure the spectrometers ability to separate two adjacent wavelengths.

Parameter	Specification	Test Result	Pass/Fail
As 193.696 - Resolution	≤ 0.007	0.005	Passed
Ni 231.604 - Resolution	≤ 0.008	0.005	Passed
Ni 341.476 - Resolution	≤ 0.012	0.007	Passed
La 408.672 - Resolution	≤ 0.010	0.015	Passed
Ba 455.403 - Resolution	≤ 0.025	0.019	Passed

5.2 Precision:

- Test for reproducibility of a set of measurement.

Parameter	Specification	Test Result	Pass/Fail
As 193.696	%RSD $\leq 1\%$	0.47	Passed
Zn 213.856	%RSD $\leq 1\%$	0.34	Passed
Mn 257.610	%RSD $\leq 1\%$	0.53	Passed
La 379.478	%RSD $\leq 1\%$	0.51	Passed
Ba 455.403	%RSD $\leq 1\%$	0.48	Passed
Ba 493.408	%RSD $\leq 1\%$	0.48	Passed

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ICP-OES Optima8300 Preventive Maintenance (PM)

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- Run an Axial & Radial BEC according to the A&T spec.

5.1 Axial BEC Cd:

Method "BEC-XL" For Samples "IB (2% HNO3)" and "IS (N930-0221/100)", record intensities.

Calculated BEC: $BEC = (IB * Conc of Std) / (IS - IB)$. Where Conc of Std = 500 PPB

Element	Conc.	IB	IS	
Cd 228	500	6467	114600.6	
IB*Conc	IS-IB	BEC	Spec	Pass/Fail
3233500	108133.6	29.9	<150 PPB	Passed

5.2 Radial BEC Mn:

Method "BEC-RL" For Samples "IB (2% HNO3)" and "IS (N069-1579)", record intensities.

Calculated BEC: $BEC = (IB * Conc of Std) / (IS - IB)$. Where Conc of Std = 1,000 PPB

Element	Conc.	IB	IS	
Mn 257	1,000	3617	101942.7	
IB*Conc	IS-IB	BEC	Spec	Pass/Fail
3617000	98325.7	36.78	<45 PPB	Passed

7. Review:

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

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ICP-OES Optima8300 Preventive Maintenance (PM)

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Additional Comments

Additional Comments Regarding the PM

Review

The preventive maintenance checks and if applicable performance tests for ICP-OES/Optima8300 have been completed.

This ICP-OES/Optima8300 Passes ☒ Fails ☐ the preventive maintenance.

Review of Preventive Maintenance:

Authorized PerkinElmer Representative: *Chayaman K* Date: 2-March-2022
(DD-MMM-YYYY)
Authorized Customer Representative: *วิภาวดี* Date:
(DD-MMM-YYYY)

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ICP-OES Optima8300 Preventive Maintenance (PM)

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Method: FT_Sens & Prep 2-400

Page 7

Date: 8/3/2565 10:51:17

Analyte Report

Logged in Analyst: user Technique: AA Flame
Spectrometer Model: Analyst 209, 6/3 20085030303 Autosampler Model:
Sample Information File: C:\data-AA\user\Sample Information\PM.sif
Batch ID:
Results Data Set: PM 08Mar2022
Results Library: C:\data-AA\Service\Results.mdb

Method Loaded Method Name: FT_Sens & Prep 2-400 Method Last Saved: 1/4/2565 11:20:05
Method Description: Using 2 ug/L Cu Standard - AA 2/4/00

Analyte Calibration Equation Wavelength Slit Width Temp Energy
Cu 324.75 Not a blank (bkg) 0 324.75 2.000.0 15 69

Sequence No.: 2 Autosampler Location:
Sample ID: CuLib Blank 1 Date Collected: 8/3/2565 10:51:57
Analyst: Data Type: Original

Replicate Data: CuLib Blank 1
Seq# Sample Conc Std Conc Blank Conc Time Signal
ug/L ug/L
1 10.00 0.000 13.61 50 Yes
2 10.00 0.000 13.61 50 Yes
3 10.00 0.000 13.61 50 Yes
4 10.00 0.000 13.61 50 Yes
5 10.00 0.000 13.61 50 Yes
6 10.00 0.000 13.61 50 Yes
7 10.00 0.000 13.61 50 Yes
8 10.00 0.000 13.61 50 Yes
9 10.00 0.000 13.61 50 Yes
10 10.00 0.000 13.61 50 Yes
Mean: 13.61 0.000
SD: 13.61 0.000
%RSD: 13.61 0.000
Auto-rec performed

Sequence No.: 3 Autosampler Location:
Sample ID: Eppan Cu std Date Collected: 8/3/2565 10:54:11
Analyst: Service PM Data Type: Original

Replicate Data: 2ppm Cu std
Seq# Sample Conc Std Conc Blank Conc Time Signal
ug/L ug/L
1 3.187 18.54 22 Yes
2 3.187 18.54 22 Yes
3 3.187 18.54 22 Yes
4 3.187 18.54 22 Yes
5 3.187 18.54 22 Yes
6 3.187 18.54 22 Yes
7 3.187 18.54 22 Yes
8 3.187 18.54 22 Yes
9 3.187 18.54 22 Yes
10 3.187 18.54 22 Yes
Mean: 3.187 18.54
SD: 3.187 18.54
%RSD: 3.187 18.54

Cu 223.75 - Measured Characteristic Concentration: 0.005 mg/L

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Request No. 21-65/0155 MTC No. EEL. BP. 12/1264

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%.

Nominal Output of Unit Under Test = 94 dB re 20µPa at 1000 Hz

Acoustic Output in dB re 20µPa, Corrected to Reference Conditions : 101.325 kPa, 23.0°C and 50 %RH

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit
1/2 inch Brüel&Kjaer 4180	93.94	-0.06	± 0.10	±0.75 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit
1/2 inch Brüel&Kjaer 4180	988.8	-11.2	± 1.5	±2.0%

3. Total distortion

Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit
1/2 inch Brüel&Kjaer 4180	1.22	± 0.50	±4.0%

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Date of Calibration : 17 Dec. 2021

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Request No. 21-65/0155 MTC No. EEL. BP. 11/1264

CALIBRATION CERTIFICATE

Submitted by : Integrated Research Center Company Limited.

Address : 122 Moo 2 T.Thatoom A.Srimaphote Prachinburi 25140.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.

: Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

Instrument Calibrated :

Ambient Environment

Description	: Sound Calibrator	Temperature	: (23 + 3) °C
Manufacturer	: Rion	Relative Humidity	: (50 ± 15) %
Model	: NC-74	Ambient Pressure	: (101.325 ± 1.500) kPa
Serial No.	: 35046798		

Standards used :

1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
2. Measuring Amplifier Brüel&Kjaer 2636 S/N 1537484.
3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
4. Digital Multimeter Agilent 34401A S/N MY44005560.
5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.
6. Audio Analyzer Keithley 2015-P S/N 4106495.
7. Condenser Microphone Brüel&Kjaer 4180 S/N 2889871.

Calibration Procedure: CP-102-04 based on IEC 60942:2003; The sound pressure level generated by sound calibrator under test shall be measured by standard microphone using an insert voltage technique.

This instrument has been calibrated against standards maintained at Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

Date of Receipt : 3 Dec. 2021

Date of Calibration : 16 Dec. 2021

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Request No. 21-65/0155 MTC No. EEL. BP. 12/1264

Nominal Output of Unit Under Test = 114 dB re 20µPa at 1000 Hz

Acoustic Output in dB re 20µPa, Corrected to Reference Conditions : 101.325 kPa, 23.0 °C and 50 %RH

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit
1/2 inch Brüel&Kjaer 4180	113.92	-0.08	± 0.10	±0.75 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit
1/2 inch Brüel&Kjaer 4180	988.8	-11.2	± 1.5	±2.0%

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit
1/2 inch Brüel&Kjaer 4180	0.18	± 0.50	±4.0%

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

(Mr. Weerachai Deechaiyae)

Approved by :

(Mr. Pawale Klunypa)

Acting Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 17 Dec. 2021

Date of Issue : 20 Dec. 2021

Ref : 2011264120305034003

End of Certificate

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Request No. 21-65/0155 MTC No. EEL. BP. 11/1264

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%.

Nominal Output of Unit Under Test = 94 dB re 20µPa at 1000 Hz

Acoustic Output in dB re 20µPa, Corrected to Reference Conditions: 101.325 kPa, 23.0 °C and 50 %RH.

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit
1/2 inch Brüel&Kjaer 4180	93.94	-0.06	± 0.10	±0.40 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit
1/2 inch Brüel&Kjaer 4180	1001.5	1.5	± 1.5	±1.0%

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit
1/2 inch Brüel&Kjaer 4180	0.95	± 0.50	±3.0%

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was included at level of 0.16 dB from manual.

Calibrated by :

(Mr. Weerachai Deechaiyae)

Approved by :

(Mr. Pawale Klunypa)

Acting Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 16 Dec. 2021

Date of Issue : 20 Dec. 2021

Ref : 2011264120305034002

End of Certificate

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CALIBRATION CERTIFICATE

Submitted by : Integrated Research Center Company Limited

Address : 122 Moo 2, T.Thatoom, A.Srimshaphote, Prachinburi 25140.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :
Description : Integrating Sound Level Meter
Manufacturer : ACO
Model : 6226
Serial No. : 100142
Microphone : Type 7052 No.79842
Preamplifier : -

Ambient Environment
Temperature : $(23 \pm 3) ^\circ\text{C}$
Relative Humidity : $(50 \pm 15) \%$
Ambient Pressure : $(101.325 \pm 1.5) \text{ kPa}$

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistonphone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 3 Dec. 2021

Date of Calibration : 10-11 Jan. 2022

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9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
10. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
11. Digital Multimeter Agilent 34401A S/N MY44005560.
12. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95%.

Date of Calibration : 10-11 Jan. 2022

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1. Absolute Sensitivity

1. Absolute Sensitivity					
Reference	Unit Under Test				Tolerance
Acoustic Signal (dB)	Measured Value (dB)		Deviation (dB)	Uncertainty (±dB)	Limit Class 2 (±dB)
	Before adjust	After adjust			
	113.97	114.4	114.0	0.0	

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 113.9 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (\pm dB)
21.2	0.10

2.2 The microphone of the sound level meter was replaced by electrical signal input device

Frequency Weighting	Measured Value (dB)	Uncertainty (\pm dB)
A-Weighting	15.4	0.10
C-Weighting	23.6	0.10
Flat	26.5	0.10

Date of Calibration : 10-11 Jan. 2022

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3. Acoustical signal test of frequency weightings

5. Acoustical signal test of frequency weighting					
Frequency (Hz)	Deviation from response curve			Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
125	0.3	0.1	0.1	0.40	2.0
1 000	-0.8	-0.7	-0.7	0.40	1.4
4 000	-0.4	-0.4	-0.2	0.40	3.6

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
63	0.1	0.1	0.1	0.20	2.5
125	0.1	0.2	0.2	0.20	2.0
250	0.1	0.1	0.1	0.20	1.9
500	0.1	0.0	0.0	0.20	1.9
1 000	0.0	0.0	0.0	0.20	1.4
2 000	-0.2	0.0	0.1	0.20	2.6
4 000	-0.3	-0.2	0.1	0.20	3.6
8 000	-0.3	-0.1	-0.1	0.20	5.6

Date of Calibration : 10-11 Jan. 2022

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5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
A-weighting	94.0	0.0	0.20	0.4
C-weighting	94.0	0.0	0.20	0.4
Flat	94.0	0.0	0.20	0.4

5.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
Fast	94.0	0.0	0.20	0.3
Slow	94.0	0.0	0.20	0.3
Leq	94.0	0.0	0.20	0.3

6. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
122	122.0	0.0	0.30	1.4
121	121.0	0.0	0.30	1.4
120	120.0	0.0	0.30	1.4
119	119.0	0.0	0.30	1.4
114	113.9	-0.1	0.30	1.4
109	108.9	-0.1	0.30	1.4

Date of Calibration : 10-11 Jan. 2022

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7. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
40-130	125	125.0	0.0	0.30	1.4
30-120	115	115.0	0.0	0.30	1.4
20-110	105	105.0	0.0	0.30	1.4
20-100	95	95.0	0.0	0.30	1.4
20-90	85	84.9	-0.1	0.30	1.4
20-80	75	74.9	-0.1	0.30	1.4

8. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (dB)
Fast	200	115.7	-0.3	0.20	\pm 1.3
	2	98.7	-0.3	0.20	+1.3; -2.8
	0.25	89.5	-0.5	0.20	+1.8; -5.3
Slow	200	109.5	-0.1	0.20	\pm 1.3
	2	89.9	-0.1	0.20	+1.3; -5.3
	0.25	81.3	0.3	0.20	+1.8; -5.3

Date of Calibration : 10-11 Jan. 2022

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E-mail : sumalee@tistr.or.th

6. Level linearity on the reference level range (cont.)

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
104	103.9	-0.1	0.30	1.4
99	99.0	0.0	0.30	1.4
94	94.0	0.0	0.30	1.4
89	88.9	-0.1	0.30	1.4
84	84.0	0.0	0.30	1.4
79	78.9	-0.1	0.30	1.4
74	74.0	0.0	0.30	1.4
69	69.0	0.0	0.30	1.4
64	63.8	-0.2	0.30	1.4
59	58.8	-0.2	0.30	1.4
54	53.9	-0.1	0.30	1.4
49	48.8	-0.2	0.30	1.4
44	43.9	-0.1	0.30	1.4
39	38.8	-0.2	0.30	1.4
34	33.9	-0.1	0.30	1.4
33	33.0	0.0	0.30	1.4
32	32.0	0.0	0.30	1.4
31	31.0	0.0	0.30	1.4
30	30.1	0.1	0.30	1.4

Date of Calibration : 10-11 Jan. 2022

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9. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (\pm dB)	Tolerance limits Class 2 (\pm dB)
Complete cycle	125.4	125.7	0.3	0.20	2.4
Positive half cycle	124.4	124.2	-0.2	0.20	1.4
Negative half cycle	124.4	124.2	-0.2	0.20	1.4

10. Overload indication

Measured value (dB)		Deviated value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
Positive one-half cycle	Negative one-half cycle			
133.2	133.2	0.0	0.30	1.8

Calibrated by :

Approved by :

Panya Phasingri

(Mr. Panya Phasingri)

Tawikiat Iamsamran

(Mr. Tawikiat Iamsamran)

Date of Calibration : 10-11 Jan. 2022

Date of Issue : 12 Jan. 2022



Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref : 2011264120305034004

End of Certificate

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E-mail : sumalee@tistr.or.th

CALIBRATION CERTIFICATE

Submitted by : Integrated Research Center Company Limited

Address : 122 Moo 2, T.Thatoom, A.Srimahaphote, Prachinburi 25140.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :

Description	: Integrating Sound Level Meter	Ambient Environment	Temperature	: (23 ± 3) °C
Manufacturer	: ACO	Relative Humidity	: (50 ± 15) %	
Model	: 6226	Ambient Pressure	: (101.325 ± 1.5) kPa	
Serial No.	: 100143			
Microphone	: Type 7052 No.57063			
Preamplifier	: -			

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistonphone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 3 Dec. 2021

Date of Calibration : 10-11 Jan. 2022

1 / 8

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1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test				Tolerance Limit Class 2 (±dB)
	Measured Value (dB)		Deviation (dB)	Uncertainty (±dB)	
	Before adjust	After adjust			
113.97	113.9	114.0	0.0	0.30	1.4

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 114.2 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)
20.9	0.10

2.2 The microphone of the sound level meter was replaced by electrical signal input device

Frequency Weighting	Measured Value (dB)	Uncertainty (±dB)
A-Weighting	14.5	0.10
C-Weighting	23.6	0.10
Flat	26.3	0.10

Date of Calibration : 10-11 Jan. 2022

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9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
10. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
11. Digital Multimeter Agilent 34401A S/N MY44005560.
12. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.

Date of Calibration : 10-11 Jan. 2022

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
	(dB)	(dB)	(dB)		
125	0.4	0.3	0.3	0.40	2.0
1 000	-0.4	-0.5	-0.5	0.40	1.4
4 000	0.0	0.2	-0.6	0.40	3.6

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
	(dB)	(dB)	(dB)		
63	0.4	0.1	0.1	0.20	2.5
125	0.3	0.2	0.2	0.20	2.0
250	0.3	0.1	0.1	0.20	1.9
500	0.1	0.0	0.0	0.20	1.9
1 000	0.0	0.0	0.0	0.20	1.4
2 000	-0.1	0.0	0.1	0.20	2.6
4 000	-0.3	-0.2	0.0	0.20	3.6
8 000	-0.3	-0.1	-0.1	0.20	5.6

Date of Calibration : 10-11 Jan. 2022

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5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
A-weighting	94.0	0.0	0.20	0.4
C-weighting	94.0	0.0	0.20	0.4
Flat	94.0	0.0	0.20	0.4

5.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
Fast	94.0	0.0	0.20	0.3
Slow	94.0	0.0	0.20	0.3
Leq	94.0	0.0	0.20	0.3

6. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
122	121.9	-0.1	0.30	1.4
121	120.9	-0.1	0.30	1.4
120	119.9	-0.1	0.30	1.4
119	118.9	-0.1	0.30	1.4
114	113.8	-0.2	0.30	1.4
109	108.8	-0.2	0.30	1.4

Date of Calibration : 10-11 Jan. 2022

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7. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
40-130	125	125.0	0.0	0.30	1.4
30-120	115	115.0	0.0	0.30	1.4
20-110	105	105.0	0.0	0.30	1.4
20-100	95	95.0	0.0	0.30	1.4
20-90	85	84.9	-0.1	0.30	1.4
20-80	75	74.9	-0.1	0.30	1.4

8. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (dB)
Fast	200	115.6	-0.4	0.20	+1.3
	2	98.7	-0.3	0.20	+1.3; -2.8
	0.25	89.6	-0.4	0.20	+1.8; -5.3
Slow	200	109.5	-0.1	0.20	+1.3
	2	89.9	-0.1	0.20	+1.3; -5.3
	200	110.1	0.1	0.20	+1.3
SEL	2	90.2	0.2	0.20	+1.3; -2.8
	0.25	81.2	0.2	0.20	+1.8; -5.3

Date of Calibration : 10-11 Jan. 2022

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6. Level linearity on the reference level range (cont.)

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
104	103.8	-0.2	0.30	1.4
99	99.0	0.0	0.30	1.4
94	94.0	0.0	0.30	1.4
89	88.8	-0.2	0.30	1.4
84	84.0	0.0	0.30	1.4
79	78.9	-0.1	0.30	1.4
74	74.1	0.1	0.30	1.4
69	69.0	0.0	0.30	1.4
64	63.9	-0.1	0.30	1.4
59	58.9	-0.1	0.30	1.4
54	53.9	-0.1	0.30	1.4
49	48.9	-0.1	0.30	1.4
44	44.0	0.0	0.30	1.4
39	38.8	-0.2	0.30	1.4
34	34.0	0.0	0.30	1.4
33	33.0	0.0	0.30	1.4
32	32.0	0.0	0.30	1.4
31	31.1	0.1	0.30	1.4
30	30.1	0.1	0.30	1.4

Date of Calibration : 10-11 Jan. 2022

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9. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (±dB)	Tolerance limits Class 2 (±dB)
Complete cycle	125.4	125.7	0.3	0.20	2.4
Positive half cycle	124.4	124.2	-0.2	0.20	1.4
Negative half cycle	124.4	124.2	-0.2	0.20	1.4

10. Overload indication

Measured value (dB)		Deviated value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
Positive one-half cycle	Negative one-half cycle			
133.1	133.1	0.0	0.30	1.8

Calibrated by :

Panya Phasingri
(Mr. Panya Phasingri)

Sakorn Jamsamran
(Mr. Tawikiat Jamsamran)

Approved by :

Mr. Private Khuyapi
(Mr. Private Khuyapi)

Acting Director
(Acting Director)

Date of Calibration : 10-11 Jan. 2022

Date of Issue : 12 Jan. 2022

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref : 2011264120305034005

End of Certificate

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CALIBRATION CERTIFICATE

Submitted by : Integrated Research Center Company Limited
Address : 122 Moo 2, T. Thatoom, A. Srimahaphote, Prachinburi 25140.
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
 Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A. Muang, Samutprakan 10280.

Instrument Calibrated :
 Description : Integrating Sound Level Meter
 Manufacturer : ACO
 Model : 6226
 Serial No. : 100144
 Microphone : Type 7052 No.79844
 Preamplifier :-

Ambient Environment
 Temperature : $(23 \pm 3) ^\circ\text{C}$
 Relative Humidity : $(50 \pm 15) \%$
 Ambient Pressure : $(101.325 \pm 1.5) \text{ kPa}$

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistophone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 3 Dec. 2021
Date of Calibration : 10-11 Jan. 2022

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 Fax. (66) 0 2579 8592
 E-mail : sumalee@tistr.or.th

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test				Tolerance
	Measured Value (dB)		Deviation (dB)	Uncertainty (±dB)	Limit Class 2 (±dB)
	Before adjust	After adjust			
113.98	114.6	114.0	0.0	0.30	1.4

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 114.1 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (\pm dB)
19.9	0.10

2.2 The microphone of the sound level meter was replaced by electrical signal input device

Frequency Weighting	Measured Value (dB)	Uncertainty (\pm dB)
A-Weighting	14.6	0.10
C-Weighting	23.8	0.10
Flat	26.6	0.10

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9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
10. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
11. Digital Multimeter Agilent 34401A S/N MY44005560.
12. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95%.

Date of Calibration : 10-11 Jan. 2022

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
125	0.4	0.2	0.1	0.40	2.0
1 000	-0.9	-0.9	-0.8	0.40	1.4
4 000	-0.5	-0.4	-0.3	0.40	3.6

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
63	0.3	0.2	0.1	0.20	2.5
125	0.1	0.1	0.1	0.20	2.0
250	-0.1	0.1	0.1	0.20	1.9
500	0.1	0.0	0.0	0.20	1.9
1 000	0.0	0.0	0.0	0.20	1.4
2 000	-0.2	0.0	0.0	0.20	2.6
4 000	-0.3	-0.2	0.0	0.20	3.6
8 000	-0.3	-0.2	-0.1	0.20	5.6

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5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
A-weighting	94.0	0.0	0.20	0.4
C-weighting	94.0	0.0	0.20	0.4
Flat	94.0	0.0	0.20	0.4

5.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
Fast	94.0	0.0	0.20	0.3
Slow	94.0	0.0	0.20	0.3
Leq	94.0	0.0	0.20	0.3

6. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
122	122.0	0.0	0.30	1.4
121	121.0	0.0	0.30	1.4
120	120.0	0.0	0.30	1.4
119	119.0	0.0	0.30	1.4
114	113.9	-0.1	0.30	1.4
109	108.9	-0.1	0.30	1.4

Date of Calibration : 10-11 Jan. 2022

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7. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
40-130	125	125.0	0.0	0.30	1.4
30-120	115	115.0	0.0	0.30	1.4
20-110	105	105.0	0.0	0.30	1.4
20-100	95	95.0	0.0	0.30	1.4
20-90	85	84.9	-0.1	0.30	1.4
20-80	75	74.9	-0.1	0.30	1.4

8. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (dB)
Fast	200	115.6	-0.4	0.20	± 1.3
	2	98.7	-0.3	0.20	± 1.3 ; -2.8
	0.25	89.6	-0.4	0.20	± 1.8 ; -5.3
Slow	200	109.5	-0.1	0.20	± 1.3
	2	89.9	-0.1	0.20	± 1.3 ; -5.3
SEL	200	110.1	0.1	0.20	± 1.3
	2	90.2	0.2	0.20	± 1.3 ; -2.8
	0.25	81.2	0.2	0.20	± 1.8 ; -5.3

Date of Calibration : 10-11 Jan. 2022

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6. Level linearity on the reference level range (cont.)

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
104	103.9	-0.1	0.30	1.4
99	99.0	0.0	0.30	1.4
94	94.0	0.0	0.30	1.4
89	89.0	0.0	0.30	1.4
84	84.0	0.0	0.30	1.4
79	78.9	-0.1	0.30	1.4
74	74.1	0.1	0.30	1.4
69	69.1	0.1	0.30	1.4
64	63.9	-0.1	0.30	1.4
59	58.9	-0.1	0.30	1.4
54	53.9	-0.1	0.30	1.4
49	48.9	-0.1	0.30	1.4
44	44.0	0.0	0.30	1.4
39	38.9	-0.1	0.30	1.4
34	34.0	0.0	0.30	1.4
33	33.0	0.0	0.30	1.4
32	32.0	0.0	0.30	1.4
31	31.1	0.1	0.30	1.4
30	30.2	0.2	0.30	1.4

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9. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (\pm dB)	Tolerance limits Class 2 (\pm dB)
Complete cycle	125.4	125.7	0.3	0.20	2.4
Positive half cycle	124.4	124.2	-0.2	0.20	1.4
Negative half cycle	124.4	124.2	-0.2	0.20	1.4

10. Overload indication

Measured value (dB)		Deviated value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
Positive one-half cycle	Negative one-half cycle			
133.1	133.1	0.0	0.30	1.8

Calibrated by :

Approved by :

Panya Phasingsri

(Mr. Panya Phasingsri)

(Mr. Tawikiat Jamsamran)

Date of Calibration : 10-11 Jan. 2022

Date of Issue : 12 Jan. 2022

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Ref : 2011264120305034006

End of Certificate

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CALIBRATION CERTIFICATE

Submitted by : Integrated Research Center Company Limited.

Address : 122 Moo 2 T.Thatoom, A.Srimahaphote, Prachinburi 25140.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :	Ambient Environment
Description : Integrating Sound Level Meter	Temperature : (23 ± 3)°C
Manufacturer : ACO	Relative Humidity : (50 ± 15) %
Model : 6236	Ambient Pressure : (101.325±1.5) kPa
Serial No. : 192014	
Microphone : Type 7052NR No.73303	
Preamplifier : -	

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistonphone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 3 Dec. 2021

Date of Calibration : 27-29 Dec. 2021

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1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test			Tolerance Limit Class 2 (±dB)
	Measured Value (dB)	Deviation (dB)	Uncertainty (±dB)	
113.97	114.0	0.0	0.30	1.4

Note: No adjustment. The internal calibration was display at 114.1 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)
19.4	0.10

2.2 The microphone of the sound level meter was replaced by electrical signal input device

Frequency Weighting	Measured Value (dB)	Uncertainty (±dB)
A-Weighting	13.1	0.10
C-Weighting	18.8	0.10
Flat	22.6	0.10

Date of Calibration : 27-29 Dec. 2021

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10. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
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This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

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The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.

Date of Calibration : 27-29 Dec. 2021

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
125	0.2	0.3	0.2	0.40	2.0
1 000	-0.8	-0.8	-0.7	0.40	1.4
4 000	0.0	0.1	0.4	0.40	3.6

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
63	0.2	0.0	0.0	0.20	2.5
125	0.1	0.0	0.0	0.20	2.0
250	0.1	0.0	0.0	0.20	1.9
500	0.1	0.1	0.0	0.20	1.9
1 000	0.0	0.0	0.0	0.20	1.4
2 000	-0.1	0.0	0.0	0.20	2.6
4 000	-0.4	-0.4	-0.1	0.20	3.6
8 000	-0.6	-0.6	-0.2	0.20	5.6

Date of Calibration : 27-29 Dec. 2021

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5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
A-weighting	94.0	0.0	0.20	0.4
C-weighting	94.0	0.0	0.20	0.4
Flat	94.1	0.1	0.20	0.4

5.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
Fast	94.0	0.0	0.20	0.3
Slow	94.0	0.0	0.20	0.3
Leq	94.0	0.0	0.20	0.3

6. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
122	122.0	0.0	0.30	1.4
121	121.0	0.0	0.30	1.4
120	120.0	0.0	0.30	1.4
119	119.0	0.0	0.30	1.4
114	114.0	0.0	0.30	1.4
109	109.0	0.0	0.30	1.4

Date of Calibration : 27-29 Dec. 2021

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Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

7. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
40-130	125	125.0	0.0	0.30	1.4
30-120	115	115.0	0.0	0.30	1.4
20-110	105	105.0	0.0	0.30	1.4
20-100	95	95.0	0.0	0.30	1.4
20-90	85	85.0	0.0	0.30	1.4
20-80	75	74.9	-0.1	0.30	1.4

8. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
Fast	200	115.8	-0.2	0.20	± 1.3
	2	98.8	-0.2	0.20	± 1.3 ; -2.8
	0.25	89.8	-0.2	0.20	± 1.8 ; -5.3
Slow	200	109.3	-0.3	0.20	± 1.3
	2	89.8	-0.2	0.20	± 1.3 ; -5.3
SEL	200	109.9	-0.1	0.20	± 1.3
	2	90.0	0.0	0.20	± 1.3 ; -2.8
	0.25	80.9	-0.1	0.20	± 1.8 ; -5.3

Date of Calibration : 27-29 Dec. 2021

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6. Level linearity on the reference level range (cont.)

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
104	104.0	0.0	0.30	1.4
99	99.0	0.0	0.30	1.4
94	94.0	0.0	0.30	1.4
89	89.0	0.0	0.30	1.4
84	84.0	0.0	0.30	1.4
79	79.0	0.0	0.30	1.4
74	74.1	0.1	0.30	1.4
69	69.1	0.1	0.30	1.4
64	64.0	0.0	0.30	1.4
59	59.0	0.0	0.30	1.4
54	54.0	0.0	0.30	1.4
49	49.0	0.0	0.30	1.4
44	44.0	0.0	0.30	1.4
39	38.9	-0.1	0.30	1.4
34	34.1	0.1	0.30	1.4
33	33.1	0.1	0.30	1.4
32	32.1	0.1	0.30	1.4
31	31.2	0.2	0.30	1.4
30	30.2	0.2	0.30	1.4

Date of Calibration : 27-29 Dec. 2021

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9. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (\pm dB)	Tolerance limits Class 2 (\pm dB)
Complete cycle	125.4	125.3	-0.1	0.20	2.4
Positive half cycle	124.4	124.3	-0.1	0.20	1.4
Negative half cycle	124.4	124.3	-0.1	0.20	1.4

10. Overload indication

Measured value (dB)		Deviated value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
Positive one-half cycle	Negative one-half cycle			
133.0	132.9	0.1	0.30	1.8

Calibrated by :

Approved by :

Panya Phasingsri
(Mr. Panya Phasingsri)
Tawikiat Jamsamran
(Mr. Tawikiat Jamsamran)

Panya Phasingsri
(Mr. Panya Phasingsri)
Tawikiat Jamsamran
(Mr. Tawikiat Jamsamran)

Date of Calibration : 27-29 Dec. 2021

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Issue : 4 Jan. 2022

Ref : 2011264120305034011

End of Certificate

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Request No. 21-65/0155

MTC No. EEL. BP. 21/1264

CALIBRATION CERTIFICATE

Submitted by : Integrated Research Center Company Limited

Address : 122 Moo 2, T.Thasoom, A.Srimahaphote, Prachinburi 25140.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Integrating Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial No. : 192015

Microphone : Type 7052NR No.73304

Preamplifier : -

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325±1.5) kPa

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistonphone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 3 Dec. 2021

Date of Calibration : 10-11 Jan. 2022

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Request No. 21-65/0155

MTC No. EEL. BP. 21/1264

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test				Tolerance
	Measured Value (dB)		Deviation (dB)	Uncertainty (±dB)	Limit Class 2 (±dB)
	Before adjust	After adjust			
113.96	113.0	114.0	0.0	0.30	1.4

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 115.3 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)
16.8	0.10

2.2 The microphone of the sound level meter was replaced by electrical signal input device

Frequency Weighting	Measured Value (dB)	Uncertainty (±dB)
A-Weighting	14.8	0.10
C-Weighting	21.1	0.10
Flat	25.7	0.10

Date of Calibration : 10-11 Jan. 2022

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Request No. 21-65/0155

MTC No. EEL. BP. 21/1264

9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.

10. Speaker Tannoy Limited, Great Britain British Patent No. 215300.

11. Digital Multimeter Agilent 34401A S/N MY44005560.

12. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.

Date of Calibration : 10-11 Jan. 2022

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Request No. 21-65/0155

MTC No. EEL. BP. 21/1264

3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
125	0.2	0.1	0.1	0.40	2.0
1 000	-0.8	-0.7	-0.7	0.40	1.4
4 000	-0.1	-0.1	0.3	0.40	3.6

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
63	0.2	0.0	0.0	0.20	2.5
125	0.0	0.1	0.1	0.20	2.0
250	0.0	0.0	0.0	0.20	1.9
500	0.0	0.0	0.0	0.20	1.9
1 000	0.0	0.0	0.0	0.20	1.4
2 000	-0.2	0.0	0.0	0.20	2.6
4 000	-0.5	-0.3	0.0	0.20	3.6
8 000	-0.6	-0.5	-0.1	0.20	5.6

Date of Calibration : 10-11 Jan. 2022

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5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
A-weighting	94.0	0.0	0.20	0.4
C-weighting	94.0	0.0	0.20	0.4
Flat	94.1	0.1	0.20	0.4

5.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
Fast	94.0	0.0	0.20	0.3
Slow	94.0	0.0	0.20	0.3
Leq	94.0	0.0	0.20	0.3

6. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
122	122.1	0.1	0.30	1.4
121	121.1	0.1	0.30	1.4
120	120.0	0.0	0.30	1.4
119	119.0	0.0	0.30	1.4
114	114.0	0.0	0.30	1.4
109	108.9	-0.1	0.30	1.4
104	104.0	0.0	0.30	1.4
99	99.0	0.0	0.30	1.4

Date of Calibration : 10-11 Jan. 2022

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7. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
40-130	125	125.1	0.1	0.30	1.4
30-120	115	115.0	0.0	0.30	1.4
20-110	105	105.0	0.0	0.30	1.4
20-100	95	95.0	0.0	0.30	1.4
20-90	85	85.0	0.0	0.30	1.4
20-80	75	75.0	0.0	0.30	1.4

8. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (dB)
Fast	200	115.7	-0.3	0.20	±1.3
	2	98.8	-0.2	0.20	+1.3; -2.8
	0.25	88.3	-1.7	0.20	+1.8; -5.3
Slow	200	109.4	-0.2	0.20	±1.3
	2	89.8	-0.2	0.20	+1.3; -5.3
	200	109.9	-0.1	0.20	±1.3
SEL	2	90.0	0.0	0.20	+1.3; -2.8
	0.25	80.9	-0.1	0.20	+1.8; -5.3

Date of Calibration : 10-11 Jan. 2022

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6. Level linearity on the reference level range (cont.)

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
94	94.0	0.0	0.30	1.4
89	89.0	0.0	0.30	1.4
84	83.9	-0.1	0.30	1.4
79	78.9	-0.1	0.30	1.4
74	74.2	0.2	0.30	1.4
69	69.2	0.2	0.30	1.4
64	64.1	0.1	0.30	1.4
59	59.0	0.0	0.30	1.4
54	54.1	0.1	0.30	1.4
49	49.1	0.1	0.30	1.4
44	44.1	0.1	0.30	1.4
39	39.0	0.0	0.30	1.4
34	34.2	0.2	0.30	1.4
33	33.2	0.2	0.30	1.4
32	32.3	0.3	0.30	1.4
31	31.3	0.3	0.30	1.4
30	30.4	0.4	0.30	1.4

Date of Calibration : 10-11 Jan. 2022

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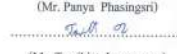
9. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (±dB)	Tolerance limits Class 2 (±dB)
Complete cycle	125.4	125.8	0.4	0.20	2.4
Positive half cycle	124.4	124.3	-0.1	0.20	1.4
Negative half cycle	124.4	124.3	-0.1	0.20	1.4

10. Overload indication

Measured value (dB)		Deviated value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
Positive one-half cycle	Negative one-half cycle			
133.1	133.1	0.0	0.30	1.8

Calibrated by :


(Mr. Panya Phasingri)

(Mr. Tawikiat Iamsamran)

Approved by :


(Mr. Prawate Khunyap)
Acting Director

Date of Calibration : 10-11 Jan. 2022

Date of Issue : 12 Jan. 2022

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref : 2011264120305034012

End of Certificate

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Request No. 21-65/0155

MTC No. EEL. BP. 17/1264

CALIBRATION CERTIFICATE

Submitted by : Integrated Research Center Company Limited.
Address : 122 Moo 2, T.Thatoom, A.Srimahaphote, Prachinburi 25140
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre,
Sri 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.
Instrument Calibrated :
Description : Sound Level Meter
Manufacturer : Delta OHM
Model : HD 2010UC
Serial No. : 11040842479
Microphone : Type UC-S2 No.114674
Preamplifier : Delta Type HD2010PNE2 No.11001018

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistonphone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 3 Dec. 2021

Date of Calibration : 17 Jan. 2022

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Request No. 21-65/0155

MTC No. EEL. BP. 17/1264

1. Absolute Sensitivity

1. Absolute Sensitivity					
Reference	Unit Under Test				Tolerance
Acoustic Signal (dB)	Measured Value (dB)		Deviation (dB)	Uncertainty (±dB)	Limit Class 2 (±dB)
	Before adjust	After adjust			
113.94	113.8	113.9	0.0	0.30	1.4

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 114.0 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)
23.5	0.10

2.2 The microphone of the sound level meter was replaced by electrical signal input device

Frequency Weighting	Measured Value (dB)	Uncertainty (±dB)
A-Weighting	19.5	0.10
C-Weighting	25.2	0.10
Flat	27.3	0.10

Date of Calibration : 17 Jan. 2022

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Request No. 21-65/0155

MTC No. EEL. BP. 17/1264

3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
125	0.3	0.3	0.2	0.40	2.0
1 000	-0.8	-0.8	-0.8	0.40	1.4
4 000	-0.1	0.0	-0.1	0.40	3.6

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
63	0.1	-0.1	-0.3	0.20	2.5
125	0.1	0.0	-0.1	0.20	2.0
250	0.1	0.0	-0.1	0.20	1.9
500	0.0	0.0	0.0	0.20	1.9
1 000	0.0	0.0	0.0	0.20	1.4
2 000	-0.1	0.1	-0.1	0.20	2.6
4 000	0.0	0.2	-0.4	0.20	3.6
8 000	0.0	0.1	-0.8	0.20	5.6

Date of Calibration : 17 Jan. 2022

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5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
A-weighting	94.0	0.0	0.20	0.4
C-weighting	94.0	0.0	0.20	0.4
Flat	94.0	0.0	0.20	0.4

5.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
Fast	94.0	0.0	0.20	0.3
Slow	94.0	0.0	0.20	0.3
Leq	94.0	0.0	0.20	0.3

6. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
120	119.9	-0.1	0.30	1.4
119	119.0	0.0	0.30	1.4
114	114.0	0.0	0.30	1.4
109	109.0	0.0	0.30	1.4
104	104.0	0.0	0.30	1.4
99	98.9	-0.1	0.30	1.4
94	94.0	0.0	0.30	1.4
89	88.9	-0.1	0.30	1.4
84	84.0	0.0	0.30	1.4

Date of Calibration : 17 Jan. 2022

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7. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
60-140	135	135.2	0.2	0.30	1.4
50-130	125	125.1	0.1	0.30	1.4
40-120	115	115.0	0.0	0.30	1.4
30-110	105	105.0	0.0	0.30	1.4
20-100	95	94.9	-0.1	0.30	1.4

8. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (dB)
Fast	200	115.9	-0.1	0.20	±1.3
	2	98.8	-0.2	0.20	+1.3; -2.8
	0.25	89.7	-0.3	0.20	+1.8; -5.3
Slow	200	109.4	-0.2	0.20	±1.3
	2	89.6	-0.4	0.20	+1.3; -5.3
SEL	200	110.0	0.0	0.20	±1.3
	2	89.9	-0.1	0.20	+1.3; -2.8
	0.25	80.8	-0.2	0.20	+1.8; -5.3

Date of Calibration : 17 Jan. 2022

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6. Level linearity on the reference level range (cont.)

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
79	79.0	0.0	0.30	1.4
74	73.9	-0.1	0.30	1.4
69	68.9	-0.1	0.30	1.4
64	63.9	-0.1	0.30	1.4
59	58.9	-0.1	0.30	1.4
54	53.9	-0.1	0.30	1.4
49	48.9	-0.1	0.30	1.4
44	43.9	-0.1	0.30	1.4
43	43.0	0.0	0.30	1.4
42	41.9	-0.1	0.30	1.4
41	41.0	0.0	0.30	1.4
40	39.9	-0.1	0.30	1.4
39	38.9	-0.1	0.30	1.4

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9. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (±dB)	Tolerance limits Class 2 (±dB)
Complete cycle	135.4	135.3	-0.1	0.20	2.4
Positive half cycle	134.4	134.2	-0.2	0.20	1.4
Negative half cycle	134.4	134.2	-0.2	0.20	1.4

10. Overload indication

Measured value (dB)		Deviated value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
Positive	Negative			
one-half cycle	one-half cycle	0.0	0.30	1.8
141.0	141.0			

Calibrated by :

Panya Phasingiri
(Mr. Panya Phasingiri)

Wittawat Supanich
(Mr. Wittawat Supanich)

Approved by :

Sumalee Khunyap
(Ms. Sumalee Khunyap)
Acting Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 17 Jan. 2022

Date of Issue : 17 Jan. 2022

Ref : 2011264120305034007

End of Certificate

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Request No. 21-65/0155

MTC No. EEL. BP. 16/1264

CALIBRATION CERTIFICATE

Submitted by : Integrated Research Center Company Limited.

Address : 122 Moo 2, T.Thatoom, A.Srimahaphote, Prachinburi 25140

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Sound Level Meter

Manufacturer : Delta OHM

Model : HD 2010UC

Serial No. : I1040842480

Microphone : Type UC-52 No.121411

Preamplifier : Delta Type HD2010PNE2 No.11001019

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistonphone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 3 Dec. 2021

Date of Calibration : 14 Jan. 2022

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9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.

10. Speaker Tannoy Limited, Great Britain British Patent No. 215300.

11. Digital Multimeter Agilent 34401A S/N MY44005560.

12. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.

Date of Calibration : 14 Jan. 2022

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1. Absolute Sensitivity

Reference	Unit Under Test				Tolerance
Acoustic Signal (dB)	Measured Value (dB)		Deviation	Uncertainty	Limit Class 2 (±dB)
	Before adjust	After adjust	(dB)	(±dB)	
113.93	113.8	113.9	0.0	0.30	1.4

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 114.0 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)
25.5	0.10

2.2 The microphone of the sound level meter was replaced by electrical signal input device

Frequency Weighting	Measured Value (dB)	Uncertainty (±dB)
A-Weighting	18.4	0.10
C-Weighting	25.1	0.10
Flat	27.2	0.10

Date of Calibration : 14 Jan. 2022

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
	(dB)	(dB)	(dB)		
125	0.5	0.5	0.4	0.40	2.0
1 000	-0.6	-0.6	-0.6	0.40	1.4
4 000	-0.8	-0.7	-0.9	0.40	3.6

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
	(dB)	(dB)	(dB)		
63	0.0	-0.3	-0.2	0.20	2.5
125	0.0	-0.2	-0.1	0.20	2.0
250	0.0	-0.4	-0.1	0.20	1.9
500	0.0	-0.2	-0.1	0.20	1.9
1 000	0.0	0.0	0.0	0.20	1.4
2 000	0.0	0.0	0.1	0.20	2.6
4 000	0.0	0.0	0.1	0.20	3.6
8 000	0.0	-0.1	0.1	0.20	5.6

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MTC No. EEL. BP. 16/1264

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
A-weighting	94.0	0.0	0.20	0.4
C-weighting	94.0	0.0	0.20	0.4
Flat	94.0	0.0	0.20	0.4

5.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
Fast	94.0	0.0	0.20	0.3
Slow	94.0	0.0	0.20	0.3
Leq	94.0	0.0	0.20	0.3

6. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
120	120.0	0.0	0.30	1.4
119	119.0	0.0	0.30	1.4
114	114.0	0.0	0.30	1.4
109	109.0	0.0	0.30	1.4
104	104.0	0.0	0.30	1.4
99	99.0	0.0	0.30	1.4
94	94.0	0.0	0.30	1.4
89	89.0	0.0	0.30	1.4
84	83.9	-0.1	0.30	1.4

Date of Calibration : 14 Jan. 2022

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FM.BLMTC.002 Rev.4

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Request No. 21-65/0155

MTC No. EEL. BP. 16/1264

7. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
60-140	135	135.0	0.0	0.30	1.4
50-130	125	125.0	0.0	0.30	1.4
40-120	115	115.0	0.0	0.30	1.4
30-110	105	105.0	0.0	0.30	1.4
20-100	95	95.0	0.0	0.30	1.4

8. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (dB)
Fast	200	115.9	-0.1	0.20	± 1.3
	2	99.0	0.0	0.20	+1.3; -2.8
	0.25	89.9	-0.1	0.20	+1.8; -5.3
Slow	200	109.6	0.0	0.20	± 1.3
	2	90.0	0.0	0.20	+1.3; -5.3
	0.25	80.9	-0.1	0.20	+1.8; -5.3

Date of Calibration : 14 Jan. 2022

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Request No. 21-65/0155

MTC No. EEL. BP. 16/1264

6. Level linearity on the reference level range (cont.)

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
79	78.9	-0.1	0.30	1.4
74	73.9	-0.1	0.30	1.4
69	68.9	-0.1	0.30	1.4
64	63.9	-0.1	0.30	1.4
59	58.9	-0.1	0.30	1.4
54	53.9	-0.1	0.30	1.4
49	49.0	0.0	0.30	1.4
44	44.0	0.0	0.30	1.4
43	43.0	0.0	0.30	1.4
42	41.9	-0.1	0.30	1.4
41	40.9	-0.1	0.30	1.4
40	39.9	-0.1	0.30	1.4
39	38.9	-0.1	0.30	1.4

Date of Calibration : 14 Jan. 2022

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Request No. 21-65/0155

MTC No. EEL. BP. 16/1264

9. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (\pm dB)	Tolerance limits Class 2 (\pm dB)
Complete cycle	135.4	135.0	-0.4	0.20	2.4
Positive half cycle	134.4	134.1	-0.3	0.20	1.4
Negative half cycle	134.4	134.1	-0.3	0.20	1.4

10. Overload indication

Measured value (dB)		Deviated value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
Positive one-half cycle	Negative one-half cycle			
141.0	141.0	0.0	0.30	1.8

Calibrated by :

Approved by :

Panya Phasingsri
(Mr. Panya Phasingsri)

Wittawat Sapanich
(Mr. Wittawat Sapanich)

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 14 Jan. 2022

Ref : 2011264120305034008

Date of Issue : 17 Jan. 2022

End of Certificate

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FM.BLMTC.002 Rev.4

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CALIBRATION CERTIFICATE

Submitted by : Integrated Research Center Company Limited.

Address : 122 Moo 2 T.Thatoom, A.Srimahaphote, Prachinburi 25140.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :
Description : Sound Level Meter
Manufacturer : Rion
Model : NL-42
Serial No. : 00646442
Microphone : Type UC-52 No.153069
Preamplifier : Type NH-24 No.46656

Ambient Environment

Temperature : $(23 \pm 3) ^\circ\text{C}$
Relative Humidity : $(50 \pm 15) \%$
Ambient Pressure : $(101.325 \pm 1.5) \text{ kPa}$

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistophone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 3 Dec. 2021

Date of Calibration : 28-29 Dec. 2021

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FMBL/MTC.002 Rev.4

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test			Tolerance Limit Class 2 (\pm dB)
	Measured Value (dB)	Deviation (dB)	Uncertainty (\pm dB)	
113.94	113.9	0.0	0.30	1.4

Note: No adjustment. The internal calibration was display at 124.1 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (\pm dB)
17.6	0.10

2.2 The microphone of the sound level meter was replaced by electrical signal input device

Frequency Weighting	Measured Value (dB)	Uncertainty (\pm dB)
A-Weighting	12.9	0.10
C-Weighting	18.2	0.10
Flat	23.9	0.10

Date of Calibration : 28-29 Dec. 2021

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FMBL/MTC.002 Rev.4

9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.

10. Speaker Tannoy Limited, Great Britain British Patent No. 215300.

11. Digital Multimeter Agilent 34401A S/N MY44005560.

12. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95%.

Date of Calibration : 28-29 Dec. 2021

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FMBL/MTC.002 Rev.4

3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
125	0.1	0.2	0.2	0.40	2.0
1 000	-0.4	-0.4	-0.4	0.40	1.4
4 000	-0.5	-0.5	-0.5	0.40	3.6

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
63	0.0	-0.1	-0.1	0.20	2.5
125	-0.1	0.0	0.0	0.20	2.0
250	-0.1	0.0	0.0	0.20	1.9
500	-0.1	0.0	0.0	0.20	1.9
1 000	0.0	0.0	0.0	0.20	1.4
2 000	0.0	0.0	0.0	0.20	2.6
4 000	0.0	0.0	0.0	0.20	3.6
8 000	0.0	0.0	0.0	0.20	5.6

Date of Calibration : 28-29 Dec. 2021

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FMBL/MTC.002 Rev.4

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
A-weighting	94.0	0.0	0.20	0.4
C-weighting	94.0	0.0	0.20	0.4
Flat	94.0	0.0	0.20	0.4

5.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
Fast	94.0	0.0	0.20	0.3
Slow	94.0	0.0	0.20	0.3
Leq	94.0	0.0	0.20	0.3

6. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
137	137.0	0.0	0.30	1.4
136	136.0	0.0	0.30	1.4
135	135.0	0.0	0.30	1.4
134	134.0	0.0	0.30	1.4
133	133.0	0.0	0.30	1.4
132	132.0	0.0	0.30	1.4
131	131.0	0.0	0.30	1.4

Date of Calibration : 28-29 Dec. 2021

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6. Level linearity on the reference level range (cont.)

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
27	26.9	-0.1	0.30	1.4
26	25.9	-0.1	0.30	1.4
25	24.9	-0.1	0.30	1.4

7. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
20-130	125	125.0	0.0	0.30	1.4

8. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (dB)
Fast	200	126.0	0.0	0.20	± 1.3
	2	108.9	-0.1	0.20	± 1.3 ; -2.8
	0.25	99.9	-0.1	0.20	± 1.8 ; -5.3
Slow	200	119.5	-0.1	0.20	± 1.3
	2	99.9	-0.1	0.20	± 1.3 ; -5.3
	0.25	90.8	-0.2	0.20	± 1.8 ; -5.3

Date of Calibration : 28-29 Dec. 2021

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6. Level linearity on the reference level range (cont.)

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
130	130.0	0.0	0.30	1.4
129	129.0	0.0	0.30	1.4
124	124.0	0.0	0.30	1.4
119	119.0	0.0	0.30	1.4
114	114.0	0.0	0.30	1.4
109	109.0	0.0	0.30	1.4
104	104.0	0.0	0.30	1.4
99	99.0	0.0	0.30	1.4
94	94.0	0.0	0.30	1.4
89	89.0	0.0	0.30	1.4
84	84.0	0.0	0.30	1.4
79	79.0	0.0	0.30	1.4
74	74.0	0.0	0.30	1.4
69	69.0	0.0	0.30	1.4
64	63.9	-0.1	0.30	1.4
59	58.9	-0.1	0.30	1.4
54	53.9	-0.1	0.30	1.4
49	48.9	-0.1	0.30	1.4
44	43.9	-0.1	0.30	1.4
39	38.9	-0.1	0.30	1.4
34	33.9	-0.1	0.30	1.4
29	28.9	-0.1	0.30	1.4
28	27.9	-0.1	0.30	1.4

Date of Calibration : 28-29 Dec. 2021

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9. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (\pm dB)	Tolerance limits Class 2 (\pm dB)
Complete cycle	125.4	125.3	-0.1	0.20	2.4
Positive half cycle	124.4	124.1	-0.3	0.20	1.4
Negative half cycle	124.4	124.1	-0.3	0.20	1.4

10. Overload indication

Measured value (dB)	Deviated value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
Positive one-half cycle	136.5	0.0	1.8
Negative one-half cycle	136.5	0.0	1.8

Calibrated by :

Approved by :

Panya Phasingsri
(Mr. Panya Phasingsri)

Mr. Panya Phasingsri
(Mr. Panya Phasingsri)

Tawikiat Iamsamran
(Mr. Tawikiat Iamsamran)

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 28-29 Dec. 2021

Date of Issue : 4 Jan. 2022

Ref : 2011264120305034010

End of Certificate

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Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

FMBL.MTC.002 Rev.4

CALIBRATION CERTIFICATE

Submitted by : Integrated Research Center Company Limited.

Address : 122 Moo 2 T.Thatoom, A.Srimahaphote, Prachinburi 25140.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :
Description : Sound Level Meter
Manufacturer : Rion
Model : NL-42
Serial No. : 01022362
Microphone : Type UC-52 No.142301
Preamplifier : Type NH-24 No.22410

Ambient Environment
Temperature : (23 ± 3) °C
Relative Humidity : (50 ± 15) %
Ambient Pressure : (101.325 ± 1.5) kPa

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistonphone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 3 Dec. 2021

Date of Calibration : 28-29 Dec. 2021

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1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test			Tolerance Limit Class 2 (±dB)
	Measured Value (dB)	Deviation (dB)	Uncertainty (±dB)	
113.98	114.0	0.0	0.30	±1.4

Note: No adjustment. The internal calibration was display at 124.1 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)
15.9	0.10

2.2 The microphone of the sound level meter was replaced by electrical signal input device

Frequency Weighting	Measured Value (dB)	Uncertainty (±dB)
A-Weighting	12.9	0.10
C-Weighting	18.2	0.10
Flat	24.1	0.10

Date of Calibration : 28-29 Dec. 2021

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9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.

10. Speaker Tannoy Limited, Great Britain British Patent No. 215300.

11. Digital Multimeter Agilent 34401A S/N MY44005560.

12. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.

Date of Calibration : 28-29 Dec. 2021

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
125	0.0	0.1	0.1	0.40	2.0
1 000	-0.3	-0.3	-0.3	0.40	1.4
4 000	-2.0	-2.0	-2.0	0.40	3.6

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
63	-0.1	-0.1	0.0	0.20	2.5
125	-0.1	0.0	0.0	0.20	2.0
250	-0.1	0.0	0.0	0.20	1.9
500	0.0	0.0	0.0	0.20	1.9
1 000	0.0	0.0	0.0	0.20	1.4
2 000	0.0	0.0	0.0	0.20	2.6
4 000	0.0	0.0	0.0	0.20	3.6
8 000	0.1	0.0	0.0	0.20	5.6

Date of Calibration : 28-29 Dec. 2021

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5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
A-weighting	94.0	0.0	0.20	0.4
C-weighting	94.0	0.0	0.20	0.4
Flat	94.0	0.0	0.20	0.4

5.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
Fast	94.0	0.0	0.20	0.3
Slow	94.0	0.0	0.20	0.3
Leq	94.0	0.0	0.20	0.3

6. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
137	137.0	0.0	0.30	1.4
136	136.0	0.0	0.30	1.4
135	135.0	0.0	0.30	1.4
134	134.0	0.0	0.30	1.4
133	133.0	0.0	0.30	1.4
132	132.0	0.0	0.30	1.4
131	131.0	0.0	0.30	1.4

Date of Calibration : 28-29 Dec. 2021

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6. Level linearity on the reference level range (cont.)

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
130	130.0	0.0	0.30	1.4
129	129.0	0.0	0.30	1.4
124	124.0	0.0	0.30	1.4
119	119.0	0.0	0.30	1.4
114	114.0	0.0	0.30	1.4
109	109.0	0.0	0.30	1.4
104	104.1	0.1	0.30	1.4
99	99.0	0.0	0.30	1.4
94	94.0	0.0	0.30	1.4
89	88.9	-0.1	0.30	1.4
84	84.0	0.0	0.30	1.4
79	78.9	-0.1	0.30	1.4
74	74.0	0.0	0.30	1.4
69	68.9	-0.1	0.30	1.4
64	63.9	-0.1	0.30	1.4
59	58.9	-0.1	0.30	1.4
54	54.0	0.0	0.30	1.4
49	48.9	-0.1	0.30	1.4
44	43.9	-0.1	0.30	1.4
39	38.9	-0.1	0.30	1.4
34	33.9	-0.1	0.30	1.4
29	28.9	-0.1	0.30	1.4
28	27.9	-0.1	0.30	1.4

Date of Calibration : 28-29 Dec. 2021

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6. Level linearity on the reference level range (cont.)

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
27	26.9	-0.1	0.30	1.4
26	25.9	-0.1	0.30	1.4
25	24.8	-0.2	0.30	1.4

7. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
20-130	125	125.0	0.0	0.30	1.4

8. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (dB)
Fast	200	126.0	0.0	0.20	± 1.3
	2	109.0	0.0	0.20	$\pm 1.3; -2.8$
	0.25	99.9	-0.1	0.20	$\pm 1.8; -5.3$
Slow	200	119.6	0.0	0.20	± 1.3
	2	100.0	0.0	0.20	$\pm 1.3; -5.3$
	0.25	90.9	-0.1	0.20	$\pm 1.8; -5.3$

Date of Calibration : 28-29 Dec. 2021

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9. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (\pm dB)	Tolerance limits Class 2 (\pm dB)
Complete cycle	125.4	125.3	-0.1	0.20	2.4
Positive half cycle	124.4	124.1	-0.3	0.20	1.4
Negative half cycle	124.4	124.1	-0.3	0.20	1.4

10. Overload indication

Measured value (dB)		Deviated value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
Positive one-half cycle	Negative one-half cycle			
136.5	136.5	0.0	0.30	1.8

Calibrated by :

Approved by :

Panya Phasingiri
(Mr. Panya Phasingiri)

Prasanna Khongkha
(Mr. Prasanna Khongkha)

Tawikiat Jamsamran
(Mr. Tawikiat Jamsamran)

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 28-29 Dec. 2021

Date of Issue : 4 Jan. 2022

Ref : 2011264120305034009

End of Certificate

8 / 8

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E-mail : surinlee@tistr.or.th

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number: E02N89E33A0615 Reference Number: 160-401673047-1
 Cylinder Number: KR0002787 Cylinder Volume: 31.6 CF
 Laboratory: 124 - Plumsteadville - PA Cylinder Pressure: 2217 PSIG
 PGVP Number: A12019 Valve Outlet: 330
 Gas Code: H2S, BALN Certification Date: Dec 17, 2019

Expiration Date: Dec 17, 2022

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 800R-12031, using the assay procedures listed. Analytical methodology does not require correction for analytical interference. This cylinder has a total 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 nominal basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 6.7 megapascals

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
HYDROGEN SULFIDE	50.00 PPM	50.05 PPM	G1	+/- 0.8% NIST Traceable	12/10/2019, 12/17/2019
NITROGEN	Balance				
CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
GMS	12240119340107	CC436701	50.81 PPM HYDROGEN SULFIDE/NITROGEN	+/-0.68%	Aug 29, 2022
ANALYTICAL EQUIPMENT					
Instrument/Make/Model			Analytical Principle		
AMETEK AE-621-9411			NDUV		
			Last Multipoint Calibration		
			Dec 04, 2019		

Triad Data Available Upon Request

NOTES: Net Wt. 1.03 Kgs
 Gross Wt. 9.06 KGS
 PO# 5219005793



Richard M. - J
 Approved for Release



Page 1 of 160-401673047-1

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number: E03N89E80A0020 Reference Number: 82-401285019-1
 Cylinder Number: LL193324 Cylinder Volume: 83.4 CF
 Laboratory: 124 - Riverton (SAP) - NJ Cylinder Pressure: 2215 PSIG
 PGVP Number: B52018 Valve Outlet: 660
 Gas Code: NO, NOX, SO2, BALN Certification Date: Sep 05, 2018

Expiration Date: Sep 05, 2026

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 800R-12031, using the assay procedures listed. Analytical methodology does not require correction for analytical interference. This cylinder has a total 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 nominal basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 6.7 megapascals

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	50.00 PPM	50.71 PPM	G1	+/- 1.4% NIST Traceable	08/27/2018, 09/05/2018
NITRIC OXIDE	50.00 PPM	50.67 PPM	G1	+/- 1.4% NIST Traceable	08/27/2018, 09/05/2018
SULFUR DIOXIDE	50.00 PPM	50.54 PPM	G1	+/- 1.0% NIST Traceable	08/27/2018, 09/05/2018
NITROGEN	Balance				
CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	16060625	CC442585	50.42 PPM NITRIC OXIDE/NITROGEN	+/- 0.8%	Jun 27, 2020
PRM	12368	5604119	29.88 PPM NITROGEN DIOXIDE/AIR	+/- 1.5%	Jun 02, 2017
GMS	7042010104	CC503941	5.101 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.0%	Jun 01, 2020
NTRM	1410322	KAL004376	49.68 PPM SULFUR DIOXIDE/NITROGEN	+/- 1.0%	Apr 17, 2024
The SRM, PRM or RGM noted above is only in reference to the GMS used in the assay and not part of the analysis.					
ANALYTICAL EQUIPMENT					
Instrument/Make/Model			Analytical Principle		
Nicolet 6700 APW1100391 NO			FTIR		
Nicolet 6700 APW1100391 NO2			FTIR		
Nicolet 6700 APW1100391 SO2			FTIR		
			Last Multipoint Calibration		
			Aug 09, 2018		
			Aug 31, 2018		
			Aug 30, 2018		

Triad Data Available Upon Request

NOTES: PO# 5218003935

Net weight: 2736 grams
 Gross weight: 17363 grams

This calibration std. has been certified in accordance with the May 2012 EPA Traceability Protocol. Document EPA-800R-12/531. All testing processes and measurements conform to the requirements of ISO/IEC 17025 and to Airgas ISO 9001:2008 and relate only to items identified on this certificate. All values are certified to be NIST Traceable with total uncertainty as detailed under Analytical Uncertainty. This document shall not be reproduced in full without written approval of the issuer.



TESTING CERT No. 3082.05

Don Mac...
 Approved for Release

Page 1 of 82-401285019-1

PREVENTIVE MAINTENANCE REPORT
ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL
AAAnalyst 200/400

Customer : บริษัท เอลเม็กซ์ ออทีเค จำกัด	Date Tested: 08-Mar-2022
Address : 27,29 ซอย พหลโยธินที่ 2 ซอย 30 อ.พหลโยธิน จ.พิจิตร 36000 พหลโยธิน 18159	Recommendation Recertification Period 6 Months Recertification Due: 08-Sep-2022 Date Last Certified: 20-Sep-2021
User Name: คุณกฤษณะ จันทา	Visit Number: 1 of 2
Phone: 02-8671128	PerkinElmer Phone: 02-719-6420 ext 311
Fax/Email: emex_anv@yahoo.com	PerkinElmer Fax: 02-319-7900

CONFIGURATION TESTED		
MODEL	SERIAL NUMBER	SOFTWARE
AAAnalyst 200	200S9030303	AA WinLab32 Version 6.5
TEST STANDARD USED		
Copper	N930-0183	OCT 30 2022
GFAAS Mixed	N930-0244	JUN 30 2023
MG0-141	N101-3000	
MG2-045		



ห้องปฏิบัติการวิเคราะห์ทางเคมี
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ใบรับรองการสอบเทียบ “เครื่อง Atomic Adsorption Spectrophotometer”
 (Calibration Certificate of Atomic Adsorption Spectrophotometer)

PREVENTIVE MAINTENANCE REPORT
ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL
AAnalyst 200/400

SERIAL NUMBER	20059030303	DATE TESTED	08-Mar-2022
1. INSTRUMENT CHECKS			
A. The mirror, prism and lenses condition. Clean if necessary.		<input type="checkbox"/>	OK
B. Inspect the grating.		<input type="checkbox"/>	OK
C. Inspect and clean or replace the dust filter.		<input type="checkbox"/>	OK
D. Clean the burner head, chamber and end cap.		<input type="checkbox"/>	OK
E. Clean the nebulizer.		<input type="checkbox"/>	OK
F. Check the condition of the end cap, chamber and nebulizer o-rings.		<input type="checkbox"/>	OK
G. Clean the drain system.		<input type="checkbox"/>	OK
H. Clean exterior the instrument.		<input type="checkbox"/>	OK
2. GAS SYSTEM CHECKS			
A. Leak test all internal and external gas box joints		<input type="checkbox"/>	OK
B. Inspect the acetylene cartridge filter. (Replacement cartridge filter every 1 year)		<input type="checkbox"/>	OK
C. Inspect the air cartridge filter. (Replacement cartridge filter every 6 months)		<input type="checkbox"/>	OK
3. ELECTRICAL			
A. Check incoming AC line voltage for proper levels and grounding.		<input type="checkbox"/>	OK
B. Check unit's software and firmware revisions and upgrade if necessary.		<input type="checkbox"/>	OK
4. FIAS CHECKS			
A. Pump and 5 Port Valve		<input type="checkbox"/>	N/A
B. Chemfold and Tubing		<input type="checkbox"/>	N/A
C. Power Supply		<input type="checkbox"/>	N/A
D. Flow meter and Gas system		<input type="checkbox"/>	N/A

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PREVENTIVE MAINTENANCE REPORT
ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL
AAnalyst 200/400

SERIAL NUMBER	20059030303	DATE TESTED	08-Mar-2022
PARAMETER	SPECIFICATION	ACTUAL VAULE	
5. PERFORMANCE TESTS			
1. Detector-Linearity with Barium (553.55 nm).			
Neutral Density Filter 0.2 :	0.1903 Abs. \pm 5%	0.1814 Abs.	
Neutral Density Filter 1.0 :	1.0547 Abs. \pm 5%	1.0373 Abs.	
2. Baseline Noise at 1 Abs with Barium (553.55 nm). (at an integration time of 0.5 seconds and 99 replicates)			
	SD \leq 0.010 Abs.	0.0014 Abs.	
3. AA Baseline with Copper (Cu 324.75 nm). (at an integration time of 0.5 seconds and 99 replicates)			
	SD \leq 0.001 Abs.	0.0002 Abs.	
4. D ₂ Background Compensation (Copper 324.75 nm). with Neutral Density Filter 1.0 Absorbance \leq 0.010 Abs.			
		0.0100 Abs.	
5. AA-BG Baseline Noise with Copper (324.75 nm). (at an integration time of 2.0 seconds and 99 replicates)			
	SD \leq 0.005 Abs.	0.0008 Abs.	
6. Flame Safety Interlock all Functions.			
			OK

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PREVENTIVE MAINTENANCE REPORT
ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL
AAnalyst 200/400

SERIAL NUMBER	20059030303	DATE TESTED	08-Mar-2022
PARAMETER	SPECIFICATION	ACTUAL VAULE	
7. Wavelength Accuracy with Nickel (232.00 nm).			
Nickel Prism Position	\pm 190 steps	0 Steps	
Nickel Grating Position	\pm 380, - 260 steps	- 48 Steps	
3 mg/L Ni Standard Mean Abs	\geq 0.200 Abs.	0.230 Abs.	
8. Flame Sensitivity with Copper (324.75 nm).			
Cu Prism Position	\pm 120 steps	0 Steps	
Cu Grating Position	\pm 360 steps	0 Steps	
(2 mg/L Cu Standard at an integration time of 10 seconds and 10 replicates)			
Mean Absorbance	\geq 0.250 Abs.	0.388 Abs.	
Capacitance value	\geq 1.0 pF.	2.5 pF.	

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PREVENTIVE MAINTENANCE REPORT
ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL
AAnalyst 200/400

SERIAL NUMBER	20059030303	DATE TESTED	08-Mar-2022
Remarks :			
- Neutral Density Filter refer to data sheet			
This is to certify that the above tests have been performed and the configuration tested			
<input checked="" type="checkbox"/> meets			
<input type="checkbox"/> does not meet			
the PerkinElmer Specifications listed on this certificate.			
This certificate does not modify PerkinElmer's standard terms and condition of sale, including warranty terms.			
Service Department PerkinElmer Ltd.			
Customer Service Engineer: <u>Chainarong Thanin</u>			
(Chainarong Thanin)			
Service Engineer			

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Certificate of Calibration

Equipment: Balance
Model: ME36S
Serial No. (or ID.): 27206085
Manufacturer: Sartorius
Condition: In condition

Certificate No.: C01213272
Issued Date: 16 November 2021
Job No.: KSPR2115020
Page: 1 of 3

Customer: Integrated Research Center Co., Ltd.
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition: Temperature 25 °C ± 0.3 °C
Humidity 54 %RH ± 2.4 %RH

Calibration Place: Integrated Research Center Co., Ltd. (ห้องเครื่องจักร)
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand

Calibration By: Mr. Adinan Niviboon
Calibration Date: 11 November 2021
The Method used: In house method, SPCC-WI-47, base on UKAS Lab 14
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through SPC RT Co., Ltd. Certificate No. C02210500, C02210714

Calibration Results:

Before Adjustment

Eccentric Error: Weight to be 1/4 or 1/3 of Maximum capacity, taken from the center of the pan as a zero reference.

(b)		(c)		(d)		Nominal Test Value		10000		(mg)																
						<table border="1"> <thead> <tr> <th colspan="5">Reference Points (mg)</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> <th>D</th> <th>E</th> </tr> </thead> <tbody> <tr> <td>-</td> <td>-0.002</td> <td>0.001</td> <td>0.000</td> <td>-0.001</td> </tr> </tbody> </table>						Reference Points (mg)					A	B	C	D	E	-	-0.002	0.001	0.000	-0.001
Reference Points (mg)																										
A	B	C	D	E																						
-	-0.002	0.001	0.000	-0.001																						

Repeatability: Determination of the standard deviation of weighing balance., Readability 0.001 (mg)

Nominal test value (mg)	Standard Deviation
2000	0.0012
20000	0.0012

Departure of indication from nominal value., Readability 0.001 (mg)

Nominal Value (mg)	Conventional Mass (mg)	Displayed Value (mg)	Correction of Balance (mg)	Uncertainty (mg)	k
1	1.0020	1.002	0.000	0.0035	2.01
5	5.0020	5.002	0.000	0.0035	2.01
10	10.0010	10.001	0.000	0.0049	2.00
50	50.0040	50.003	0.001	0.0063	2.00
100	99.9980	99.997	0.001	0.0082	2.00
500	499.9940	499.995	-0.001	0.013	2.00
1000	1000.0050	1000.002	0.003	0.016	2.00
5000	5000.0050	5000.002	0.003	0.027	2.00
10000	9999.9810	9999.976	0.005	0.033	2.00
20000	20000.0070	19999.981	0.026	0.048	2.00
30000	29999.9880	29999.933	0.055	0.080	2.00

(Mr. Adinan Niviboon)
Person in charge

SERT
บริษัท เอสพีซี แอร์ที จำกัด
SPC RT Co., Ltd.

(Mr. Rungrod Jenkitrakulchai)
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to International or national standard or other recognized national standard laboratories.
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of SPC RT Co., Ltd.

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SPC RT Co., Ltd.
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Bangkok 10260 154 ซอยเทศบาลนคร 57 แขวง/หมู่ 10/1 ถนนเทศบาลนคร 10260 Thailand
Tel: 0 2185 4333 Ext. 3300-3308 Fax: 0 2185 4424 E-mail: info@spc-rt.com Website: www.spc-rt.com

SPCC-FM-C01-10; 23 Nov 2020

SPCC-FM-C01-10; 23 Nov 2020

After Adjustment

Eccentric Error: Weight to be 1/4 or 1/3 of Maximum capacity, taken from the center of the pan as a zero reference.

Nominal Test Value		10000 (mg)				
Reference Points (mg)						
A	B	C	D	E		
-	-0.001	0.000	0.000	-0.001		

Repeatability: Determination of the standard deviation of weighing balance., Readability 0.001 (mg)

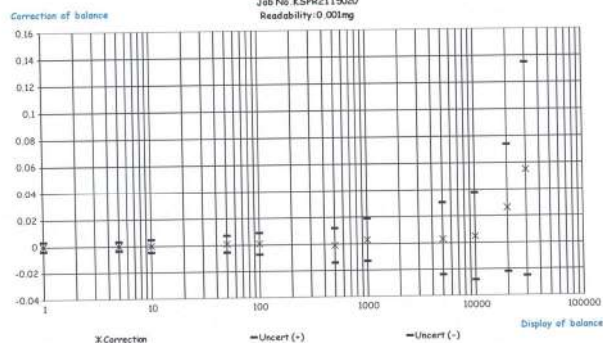
Nominal test value (mg)	Standard Deviation
2000	0.0011
20000	0.0012

Departure of indication from nominal value., Readability 0.001 (mg)

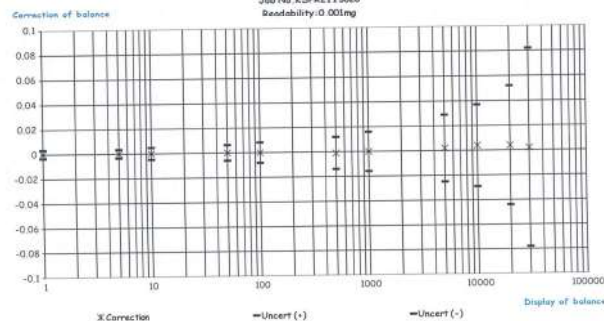
Nominal Value (mg)	Conventional Mass (mg)	Displayed Value (mg)	Correction of Balance (mg)	Uncertainty (mg)	k
1	1.0020	1.002	0.000	0.0035	2.01
5	5.0020	5.002	0.000	0.0035	2.01
10	10.0010	10.001	0.000	0.0049	2.00
50	50.0040	50.004	0.000	0.0063	2.00
100	99.9980	99.998	0.000	0.0082	2.00
500	499.9940	499.995	-0.001	0.013	2.00
1000	1000.0050	1000.005	0.000	0.016	2.00
5000	5000.0050	5000.003	0.002	0.027	2.00
10000	9999.9810	9999.977	0.004	0.033	2.00
20000	20000.0070	20000.003	0.004	0.048	2.00
30000	29999.9880	29999.986	0.002	0.080	2.00

The End of Certificate

Before Adjustment
Job No. KSPR2115020
Readability: 0.001mg



After Adjust
Job No. KSPR2115020
Readability: 0.001mg



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Mechanical Engineering Standards Laboratory Sol 1, Bangpoo Industrial Estate, Muang, Samutprakan 10280, Thailand.

Request No.23-65/0131

MTC.No.23-65/0131

Number of page(s) 2

CALIBRATION CERTIFICATE

Nomenclature : DRYCAL FLOWMETER

Manufacturer : Bios International Corporation, USA

Serial No.: 120879

Model : Defender 510 M

Scale range : 50 ml/min to 5000 ml/min

Subdivision : (0.00001, 0.0001, 0.001) l/min

Submitted by : INTEGRATED RESEARCH CENTER COMPANY LIMITED.

122 T.Thatoom A.Srimahaphote,

Prachinburi 25140, Thailand.

Received date : 3 December 2021

Condition of measured item : Normal

Calibration date : 14 December 2021

Standard :

Standard	Certificate No.	Date due	Traceability
RTD Thermometer	PSL-T 336/43	6-Apr-22	TISTR
Molbox/Pressure Transducer/UpStream	MP-0013-21	25-Jan-23	NIMT
Primary Flow Calibrator S/N 117982	MW-0011-21	8-Apr-23	NIMT
Primary Flow Calibrator S/N 119521	MW-0012-21	31-Mar-23	NIMT

Calibrated by : 

(Mr.Terasak Panna)

Approved by : 

(Ms.Kirana Luangthun)

Director

Mechanical Engineering Standards Laboratory

Ref. 2013264120305043001

Issued Date : 14 December 2021

The results relate only to the items tested/calibrated or value assigned.

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FM.BL.MTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Mechanical Engineering Standards Laboratory Sol 1, Bangpoo Industrial Estate, Muang, Samutprakan 10280, Thailand.

Request No.23-65/0131

2/2

MTC.No.23-65/0131

Calibration point : (0.05, 0.5, 1, 1.5, 2) l/min

Ambient condition : Temperature (23 ± 3) °C , Relative humidity (55 ± 15) %

Atmospheric pressure (1010 ± 13) hPa

Calibration method : The flowmeter (UUC) was calibrated by comparison method with standard flowmeter according to CP-370.01.

The reported value is the value that converted to value at reference condition within pressure and temperature of the actual gas entering the UUC

Measurement data :

UUC Value (l/min)	Standard Value (l/min)	Temperature (°C)	Pressure (hPa)	Deviation (%)	Uncertainty (%)
0.05528	0.055236	22.712	1010.27	+0.08	1.10
0.50726	0.50295	22.564	1010.35	+0.86	0.98
1.0082	0.99739	22.481	1010.59	+1.08	0.85
1.5085	1.4916	22.491	1010.86	+1.13	0.85
2.0231	1.9999	22.518	1011.11	+1.16	0.86

The reported expanded uncertainties are based on standard uncertainties multiplied by a coverage factor A=2, which provides a level of confidence of approximately 95%.

The end of calibration certificate.

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FM.BL.MTC.002 Rev.4

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Agilent CrossLab Compliance Services

Certificate of System Qualification

GC-OQ + GCMS-OQ

System ID: CN15083109
Organization Name: Emex Association Co., Ltd.
Organization Location: 29 Rama 2 Soi.30, Bangmod, Jomthong, Bangkok 10150 Thailand

Date: May 26, 2022 5:13:44 PM
E/QIP Name: AgilentRecommended, AgilentRecommended
E/QIP Revision: GC 02.51, GCMS 02.51
Overall Qualification Status: Pass

System Inspection and Basic Safety and Operation

Name: 7850
Setpoint Status: Pass

Overall System Inspection and Basic Safety and Operation Test Status
Pass

Inlet Pressure Accuracy

Name: 7850
Front: SSL
Setpoint Status: Pass
Setpoint: Actual
Inlet Pressure: 25.0 psi 25.2 psi
Accuracy: 0.2 psi
Agilent Recommended: <- 1.2

Overall Inlet Pressure Accuracy Test Status
Pass

GC Oven Temperature Accuracy

Name: 7850

Date: May 26, 2022 5:13:44 PM
System ID: CN15083109

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ใบรับรองการสอบเทียบ “เครื่อง Gas Chromatography–Mass Spectrometry”
(Calibration Certificate of Gas Chromatography–Mass Spectrometry)

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เลขทะเบียน 7-244

Setpoint Status:

Pass

Zone:

Oven

Temperature:

Setpoint/Actual

230.0 230.6 °C

Accuracy:

0.6 °C

Agilent Recommended:

>= -1.0 % setpoint in K (-5.0 °C)
 <= 1.0 % setpoint in K (5.0 °C)

Setpoint Status:

Pass

Zone:

Oven

Temperature:

Setpoint/Actual

100.0 100.5 °C

Accuracy:

0.5 °C

Agilent Recommended:

>= -1.0 % setpoint in K (-3.7 °C)
 <= 1.0 % setpoint in K (3.7 °C)

Overall QC Oven Temperature Accuracy Test Status

Pass

QC Oven Temperature Stability

Name:

7890

Setpoint Status:

Pass

Setpoint/Average

Temperature:

100.0 100.5167 °C

Stability:

0.1 °C

Agilent Recommended:

<= 0.5

Overall QC Oven Temperature Stability Test Status

Pass

Log Amp

Tested Combination1

Front

SSL

/ External

SQ

Name:

5977A

Setpoint Status:

Pass

Date:

May 25, 2022 5:13:44 PM

System ID:

CN15263109

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25 May 22

Overall Log Amp Test Status

Pass

RFPA

Tested Combination1

Front

SSL

/ External

SQ

Name:

5977A

Setpoint Status:

Pass

Amu

1050

m/z

Drift After Five Minutes

RFPA Voltage:

Agilent Recommended

1 mV

461 mV

>= -100

and

<= 100

<= 1100

Overall RFPA Test Status

Pass

Tune EI

Tested Combination1

Front

SSL

/ External

SQ

Name:

5977A

Setpoint Status:

Pass

Filament:

1

Setpoint Status:

Pass

Filament:

2

Overall Tune EI Test Status

Pass

Scouting Run

Tested Combination1

Front

SSL

/ External

SQ

Name:

7660A

Source:

EI - Inert

Date:

May 25, 2022 5:13:44 PM

System ID:

CN15263109

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25 May 22

Setpoint Status:

Completed

Injection Volume on Column:

1.0 µL

Overall Scouting Run Status

Completed

Instrument Detection Limit

Tested Combination1

Front

SSL

/ External

SQ

Name:

7660A

Source:

EI - Inert

Setpoint Status:

Pass

Injection Volume on Column:

1.0 µL

Minimum RSD:

4.50 %

Agilent Recommended:

<= 6.00

Status:

Pass

Retention Time

0.02 %

<= 1.00

Pass

Instrument Detection Limit:

15.15350 ng

Agilent Recommended:

<= 26.62000

Status:

Pass

Overall Instrument Detection Limit Test Status

Pass

Mass Ratio Precision

Tested Combination1

Front

SSL

/ External

SQ

Name:

7660A

Source:

EI - Inert

Setpoint Status:

Pass

Injection Volume on Column:

1.0 µL

Area Mass 1

Abundance's

Mass Ratio

RSD

1.27 %

0.18 %

Agilent Recommended

<= 5.00

<= 5.00

Pass

Pass

Overall Mass Ratio Precision Test Status

Pass

Date:

May 25, 2022 5:13:44 PM

System ID:

CN15263109

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25 May 22

Date:

May 25, 2022 5:13:44 PM

System ID:

CN15263109

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25 May 22

Instrument Details

Purpose

This section describes the as found system configuration.

Details

System

System ID	CN15263109
Manufacturer	Agilent Technologies
Name	7890
Flow Data Input	Manual Data
Temperature Data Input	Manual Data or Other Data Logging

Tested Combination1

Injection Technique	Injection Tower
Inlet	Front
Detector	External
LTM Included?	No

Sampler 1

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7650A
Model Number	G4597A
Serial Number	CN15210043
Firmware Revision	A.10.02
Usage	Sample Injection
Location	Front
Syringe Volume (µL)	10

OvenFrame 1

Manufacturer	Agilent Technologies
Name	7890
Model Number	G3440B
Serial Number	CN15293109
Firmware Revision	B.02.02.2
Oven Type	Standard

Date: May 25, 2022 5:12:44 PM
System ID: CN15263109

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25 มี.ค. 67

Inlet 1

Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

Detector 1

Manufacturer	Agilent Technologies
Name	Mass Spectrometer
Type	Mass Spectrometer
Location	External

Mass Spectrometer 1

Manufacturer	Agilent Technologies
Type	SD
Name	5977A
Serial Number	US1524L444
Firmware Revision	6.00.25
High Vacuum System	Turbo Pump
Scouting Run Standard	OFN Std

MS EI Source 1

Manufacturer	Agilent Technologies
Source Type	EI - Inert
Number of filaments	2

Date: May 25, 2022 5:13:44 PM
System ID: CN15263109

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25 มี.ค. 67

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Purpose

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Details

Full Name of Signer	Saengulal Tarak
Logged On User Name	saengulal.tarak@non.agilent.com
Signature Creation Date	May 25, 2022
Reason for Signature	Executed protocol and published this original version of document

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Date: May 25, 2022 5:13:44 PM
System ID: CN15263109

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เลขทะเบียน ว-244

25 มี.ค. 67

User Name: saengulal.tarak
Hardware: LAPTOP-GC23A26V

System ID: CN15263109
Print Date: May 25, 2022 5:13:47 PM

EMEX_CN15263109 Transaction Log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 26, 2022 9:29:20 AM	Auto	Session Created	Session	None
April 26, 2022 9:29:20 AM	Start	Configuration	Session	None
April 26, 2022 9:29:20 AM	Auto	Customs	Learning	User is Nonpaying and does not require an unlock code
April 26, 2022 9:37:13 AM	Auto	Excludable	Session	EQP details for primary technique (Dc): File path: (Protocol)Packs/Gs/Gs/Configurations/02.51/Gs/Gs/02.51.spt EQP File Name: (Dc 02.51.spt), EQP Name: (AgilentRecommended) EQP details for hypermediated technique (Gs): File path: (Protocol)Packs/Gs/Gs/Configurations/02.51/Gs/Gs/02.51.spt EQP File Name: (Gs/Gs 02.51.spt), EQP Name: (AgilentRecommended)
April 26, 2022 9:37:15 AM	End	Configuration	Session	None
April 26, 2022 9:37:20 AM	Start	Qualification	Session	OQ
April 26, 2022 9:37:20 AM	Start	Execution	System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No seignets associated	None
April 26, 2022 9:37:43 AM	End	Execution	System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No seignets associated	Run Count: 1
April 26, 2022 9:37:45 AM	Start	Execution	Inlet Pressure Accuracy - Front SSL - Pressure Controlled Line: 25.0 psi ± 1.2 psi	None

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Date: May 25, 2022 5:13:44 PM
System ID: CN15263109

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เลขทะเบียน ว-244

25 มี.ค. 67

User Name: saengjai@lab.com System ID: CN15283108
 Hostname: LAPTOP-GQ35KQWV Print Date: May 25, 2022 5:13:47 PM

EMEX_CN15283108 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 26, 2022 9:37:52 AM	End	Execution	Inlet Pressure Accuracy - Front SSI - Pressure Controlled Inlet - 0.25.0 psi - L - 1.2 psi	Run Count: 1
April 26, 2022 9:37:54 AM	Start	Execution	GC Oven Temperature Accuracy - 7850 - Temperature - Over - 5. 230.0°C - L - 1.0 AND 1.0 % setpoint in K	None
April 26, 2022 9:38:14 AM	Auto	Data	GC Oven Temperature Accuracy - 7850 - Temperature - Over - 5. 230.0°C - L - 1.0 AND 1.0 % setpoint in K	Manual Data Entry
April 26, 2022 9:38:15 AM	End	Execution	GC Oven Temperature Accuracy - 7850 - Temperature - Over - 5. 230.0°C - L - 1.0 AND 1.0 % setpoint in K	Run Count: 1
April 26, 2022 9:38:16 AM	Start	Execution	GC Oven Temperature Accuracy - 7850 - Temperature - Over - 5. 100.0°C - L - 1.0 AND 1.0 % setpoint in K	None
April 26, 2022 9:38:36 AM	Auto	Data	GC Oven Temperature Accuracy - 7850 - Temperature - Over - 5. 100.0°C - L - 1.0 AND 1.0 % setpoint in K	Manual Data Entry
April 26, 2022 9:38:42 AM	End	Execution	GC Oven Temperature Accuracy - 7850 - Temperature - Over - 5. 100.0°C - L - 1.0 AND 1.0 % setpoint in K	Run Count: 1
April 26, 2022 9:38:43 AM	Start	Execution	GC Oven Temperature Stability - 7850 - Temperature - Over - 5. 100.0°C - L - 0.1°C	None
April 26, 2022 9:40:00 AM	Auto	Data	GC Oven Temperature Stability - 7850 - Temperature - Over - 5. 100.0°C - L - 0.1°C	Manual Data Entry

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User Name: saengjai@lab.com System ID: CN15283108
 Hostname: LAPTOP-GQ35KQWV Print Date: May 25, 2022 5:13:47 PM

EMEX_CN15283108 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 26, 2022 9:40:01 AM	End	Execution	GC Oven Temperature Stability - 7850 - Temperature - Over - 5. 100.0°C - L - 0.1°C	Run Count: 1
April 26, 2022 11:31:17 AM	Auto	Acquisition	Session	None
April 26, 2022 12:26:01 PM	Auto	Acquisition	Session	None
April 26, 2022 12:26:23 PM	Auto	Acquisition	Session	None
April 26, 2022 12:26:24 PM	Start	Qualification	Session	OQ
April 26, 2022 1:20:44 PM	Auto	Acquisition	Session	None
May 17, 2022 3:17:18 PM	Auto	Acquisition	Session	None
May 17, 2022 3:17:20 PM	Auto	Session Reloaded	Session	None
May 17, 2022 3:17:25 PM	Start	Qualification	Session	OQ
May 17, 2022 3:31:51 PM	Auto	Acquisition	Session	None
May 18, 2022 9:10:10 AM	Auto	Acquisition	Session	None
May 18, 2022 9:18:39 AM	Auto	Acquisition	Session	None
May 23, 2022 11:42:08 AM	Auto	Acquisition	Session	None
May 23, 2022 11:42:55 AM	Auto	Session Reloaded	Session	None
May 23, 2022 11:42:55 AM	Start	Qualification	Session	OQ
May 23, 2022 1:48:14 PM	Auto	Acquisition	Session	None
May 28, 2022 8:55:44 AM	Auto	Acquisition	Session	None
May 28, 2022 8:55:45 AM	Auto	Session Reloaded	Session	None
May 28, 2022 8:55:49 AM	Start	Qualification	Session	OQ
May 28, 2022 2:51:10 PM	Start	Execution	Log Amp - 5877A SQ - Source: EI - Inlet	None
May 28, 2022 2:52:09 PM	End	Execution	Log Amp - 5877A SQ - Source: EI - Inlet	Run Count: 1

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Date: May 25, 2022 5:13:44 PM
 System ID: CN15283108

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22 พ.ค. 65

Date: May 25, 2022 5:13:44 PM
 System ID: CN15283108

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 เลขทะเบียน 7-244

22 พ.ค. 65

User Name: saengjai@lab.com System ID: CN15283108
 Hostname: LAPTOP-GQ35KQWV Print Date: May 25, 2022 5:13:47 PM

EMEX_CN15283108 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 25, 2022 2:52:11 PM	Start	Execution	RPPA - 5877A SQ - Source: EI - Inlet	None
May 26, 2022 2:53:05 PM	Start	Execution	RPPA - 5877A SQ - Source: EI - Inlet	None
May 25, 2022 2:54:07 PM	End	Execution	RPPA - 5877A SQ - Source: EI - Inlet	Run Count: 1
May 25, 2022 2:54:05 PM	Start	Execution	Tune EI - 5877A SQ - Source: EI - Inlet Filament 1 (Qualitative - No setpoints associated)	None
May 25, 2022 2:54:28 PM	End	Execution	Tune EI - 5877A SQ - Source: EI - Inlet Filament 1 (Qualitative - No setpoints associated)	Run Count: 1
May 25, 2022 2:54:32 PM	Start	Execution	Tune EI - 5877A SQ - Source: EI - Inlet Filament 2 (Qualitative - No setpoints associated)	None
May 25, 2022 2:54:47 PM	End	Execution	Tune EI - 5877A SQ - Source: EI - Inlet Filament 2 (Qualitative - No setpoints associated)	Run Count: 1
May 26, 2022 2:54:57 PM	Start	Execution	Sounding Run - Injection Tower: Front SSI, SQ - Source: EI - Inlet Part of GCMS System Preparation	None
May 25, 2022 2:55:37 PM	Auto	Data	Sounding Run - Injection Tower: Front SSI, SQ - Source: EI - Inlet Part of GCMS System Preparation	Data File Path: F:\INSTR.D
May 26, 2022 2:56:19 PM	End	Execution	Sounding Run - Injection Tower: Front SSI, SQ - Source: EI - Inlet Part of GCMS System Preparation	Run Count: 1

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User Name: saengjai@lab.com System ID: CN15283108
 Hostname: LAPTOP-GQ35KQWV Print Date: May 25, 2022 5:13:47 PM

EMEX_CN15283108 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 25, 2022 2:55:27 PM	Start	Execution	Instrument Detection Limit - Injection Tower: Front SSI, SQ - Source: EI - Inlet - RSD L (Area) <= 8.00% - RSD L (Ret. Time) <= 1.00%	None
May 25, 2022 2:57:03 PM	Auto	Data	Instrument Detection Limit - Injection Tower: Front SSI, SQ - Source: EI - Inlet - RSD L (Area) <= 8.00% - RSD L (Ret. Time) <= 1.00%	Data File Path: F:\INSTR.D
May 26, 2022 2:57:03 PM	Auto	Data	Instrument Detection Limit - Injection Tower: Front SSI, SQ - Source: EI - Inlet - RSD L (Area) <= 8.00% - RSD L (Ret. Time) <= 1.00%	Data File Path: F:\INSTR.D
May 25, 2022 2:57:03 PM	Auto	Data	Instrument Detection Limit - Injection Tower: Front SSI, SQ - Source: EI - Inlet - RSD L (Area) <= 8.00% - RSD L (Ret. Time) <= 1.00%	Data File Path: F:\INSTR.D
May 25, 2022 2:57:03 PM	Auto	Data	Instrument Detection Limit - Injection Tower: Front SSI, SQ - Source: EI - Inlet - RSD L (Area) <= 8.00% - RSD L (Ret. Time) <= 1.00%	Data File Path: F:\INSTR.D
May 25, 2022 2:57:03 PM	Auto	Data	Instrument Detection Limit - Injection Tower: Front SSI, SQ - Source: EI - Inlet - RSD L (Area) <= 8.00% - RSD L (Ret. Time) <= 1.00%	Data File Path: F:\INSTR.D
May 25, 2022 2:57:03 PM	Auto	Data	Instrument Detection Limit - Injection Tower: Front SSI, SQ - Source: EI - Inlet - RSD L (Area) <= 8.00% - RSD L (Ret. Time) <= 1.00%	Data File Path: F:\INSTR.D

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Date: May 25, 2022 5:13:44 PM
 System ID: CN15283108

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Date: May 25, 2022 5:13:44 PM
 System ID: CN15283108

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22 พ.ค. 65

Host Name: xcmg01pu.srv			System ID: CM18031008		
Institute: LAMP-CG-CIS@UN			Print Date: May 25, 2022 5:02:47 PM		
EMEX_CN1203105 Transaction Log					
Time	Transaction State	Activity Performed	Type of Transaction	Optional Information	
May 25, 2022 4:35:30 PM	Auth	Data	Mass Ratio Precision - Injection Tower: Front SSL, S2 - Source: EI - Inert - L (RSD): <= 5.00%	Data File Path: F:\MPP\12	
May 26, 2022 4:50:30 PM	Auth	Data	Mass Ratio Precision - Injection Tower: Front SSL, S2 - Source: EI - Inert - L (RSD): <= 5.00%	Data File Path: F:\MPP\12	
May 26, 2022 4:55:30 PM	Auth	Data	Mass Ratio Precision - Injection Tower: Front SSL, S2 - Source: EI - Inert - L (RSD): <= 5.00%	Data File Path: F:\MPP\12	
May 26, 2022 4:55:30 PM	Auth	Data	Mass Ratio Precision - Injection Tower: Front SSL, S2 - Source: EI - Inert - L (RSD): <= 5.00%	Data File Path: F:\MPP\12	
May 26, 2022 4:55:30 PM	Auth	Data	Mass Ratio Precision - Injection Tower: Front SSL, S2 - Source: EI - Inert - L (RSD): <= 5.00%	Data File Path: F:\MPP\12	
May 25, 2022 4:35:30 PM	Auth	Data	Mass Ratio Precision - Injection Tower: Front SSL, S2 - Source: EI - Inert - L (RSD): <= 5.00%	Data File Path: F:\MPP\12	
May 25, 2022 4:55:42 PM	End	Execution	Mass Ratio Precision - Injection Tower: Front SSL, S2 - Source: EI - Inert - L (RSD): <= 5.00%	Run Count: 1	
May 25, 2022 4:58:03 PM	End	Qualification	Session	09	
May 25, 2022 4:58:03 PM	Start	Reporting	Session	None	
May 25, 2022 5:13:05 PM	Auth	Reporting	Session	Report Generated Certificate	



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Cert. No.: 21H2648

Page: 2 of 2

This instrument was connected with temperature probe Serial No. 17011154.

Result of Calibration:-

Without Adjustment

Function:

Temperature measurement for T_n .

Standard Temperature	UUC* Reading	Error	Uncertainty of Measurement
(°C)	(°C)	(°C)	(±°C)
20.023	19.9	-0.123	0.42
30.026	29.9	-0.126	0.42
40.036	40.0	-0.036	0.42

This instrument was connected with temperature probe Serial No. 10028228.

Result of Calibration:-

Without Adjustment

Function:

Temperature measurement for T_g .

Standard Temperature	UUC* Reading	Error	Uncertainty of Measurement
(°C)	(°C)	(°C)	(±°C)
20.023	20.0	-0.023	0.42
30.026	30.0	-0.026	0.42
40.036	40.0	-0.036	0.42

This instrument was connected with temperature probe Serial No. 10031669.

Result of Calibration:-

Without Adjustment

Function:

Temperature measurement for T_r .

Standard Temperature	UUC* Reading	Error	Uncertainty of Measurement
(°C)	(°C)	(°C)	(±°C)
20.023	20.0	-0.023	0.42
30.026	30.0	-0.026	0.42
40.036	40.0	-0.036	0.42

UUC* : Unit Under Calibration

The reported uncertainty of measurement was based on standard uncertainty multiplied by coverage factor $k = 2.00$, providing confidence level approximately 95%.

-000-



Certificate of Calibration

Certificate No.: 21H2649
Page: 1 of 2

Equipment: Heat Stress Monitor

Manufacturer: Delta Ohm

Model: HD 32.2

Serial No.: 10027485

ID No.: -

Condition As-Received: Used Item

Received Date: 24 December 2021

Calibration Date: 28 December 2021

Reference: 2112-0696WC

Submitted by: Integrated Research Center Co., Ltd.

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

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.

122 Moo 2, T.Thatoom, A.Srimahaphote, Prachinburi 25140

Procedure used: Calibration were conducted using in-house calibration procedure CP-H03 according to comparison with
standard temperature probe for temperature measurement function into humidity / temperature chamber.

Condition of this result of calibration

1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Handheld Thermometer With Sensor	1521	A5A339	211842	19 Aug 2022

2. The certificate is valid only to the item calibrated on date and place of calibration.

3. This Certification is traceable to the International System of Unit maintained at:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by: Kraisopon Onrat
Issue Date: 28 December 2021

Approved Signatory: 

[✓] Chakrit Waewanjua
[] Ponthippa Tameyakul
[] Pitak Srimongkol

n 0277434



Cert. No.: 21H2649
Page: 2 of 2

This instrument was connected with temperature probe Serial No. 10028254.

Result of Calibration: Without Adjustment

Temperature measurement for T _n .			
Standard	UUC*	Error	Uncertainty of Measurement
Temperature (°C)	Reading (°C)		
20.023	20.0	-0.023	0.42
30.026	30.1	0.074	0.42
40.036	40.1	0.064	0.42

This instrument was connected with temperature probe Serial No. 10028231.

Result of Calibration: Without Adjustment

Temperature measurement for T _g .			
Standard	UUC*	Error	Uncertainty of Measurement
Temperature (°C)	Reading (°C)		
20.023	20.0	-0.023	0.42
30.026	30.0	-0.026	0.42
40.036	39.9	-0.136	0.42

This instrument was connected with temperature probe Serial No. 10031667.

Result of Calibration: Without Adjustment

Temperature measurement for T.			
Standard	UUC*	Error	Uncertainty of Measurement
Temperature (°C)	Reading (°C)		
20.023	20.1	0.077	0.42
30.026	30.1	0.074	0.42
40.036	40.0	-0.036	0.42

UUC*: Unit Under Calibration

The reported uncertainty of measurement was based on standard uncertainty multiplied
by coverage factor k = 2.00, providing confidence level approximately 95%.

-000-



n 1088285

บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด

โครงการเพิ่มกำลังการผลิตโรงงานผลิตเยื่อกระดาษโรงที่ 1 ของบริษัท ตี๋บเปิ้ล เอ (1991) จำกัด (มหาชน) (Pulp1)

ช่วงดำเนินการ ระหว่างเดือนมกราคม - มิถุนายน พ.ศ. 2565

List of Instruments Certification for Water Wastewater and Sludge Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Laboratory Instrument/Equipments.									
1	Inductively Coupled Plasma-Optical Emission Spectrometer (ICP-OES)	Heavy Metals : Na, SAR, Hg, Fe, Mg, As, Ba, Cd, Pb, Ag, Cr, Se	Agilent Technologies	System ID:G8015A G8015AA / MY18030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	9 Dec 21	8 Dec 22	-
2	Atomic Absorption Spectrometer (AAS)		Agilent Technologies	System ID:G8432A AA240FS / MY13160001	Thailand Institute Of Science And Technological Research (TISTR)	MTC.ACL. No. 486/65	7 Mar 22	6 Mar 23	-
3	UV-VIS Spectrophotometer	Phenol, Sulphate, Color (ADMI) Nitrate -Nitrogen , Ammonia-Nitrogen	Agilent Technologies	Cary60 G6860A / MY15410009	DQE Services Co.,Ltd.	SP22-016	31 May 22	31 May 23	-
4	UV-VIS Spectrophotometer	Fluoride Cyanide	Hitachi	U-1900 / 2021-064	DQE Services Co.,Ltd.	SP22-007	20 Jan 22	19 Jan 23	-
5	UV-VIS Spectrophotometer	Total Phosphate Turbidity	Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP22-008	20 Jan 22	19 Jan 23	-
6	pH Meter	pH Temperature	Mettler-Toledo	Seven Easy S20 / 1231155210	National Food Institute, Ministry of Industry, Thailand	2201793-001-01	1 Mar 22	28 Feb 23	-
7	Conductivity Meter	Conductivity	SI Analytics	Lab955 / 16300356	SPC Calibration Center Co.,Ltd.	C24220084	22 Mar 22	21 Mar 23	-
8	Analytical Balance (Repeatability 0.01 mg)	Total Solids	Mettler-Toledo	AX105DR / 1122100406	National Food Institute, Ministry of Industry, Thailand	2200708-001-01	24 Nov 21	23 Nov 22	-
9	Hot Air Oven	Total Solids	Memmert	UF55 / B216.1666	Technology Promotion Association (Thailand-Japan)	21TM1876	29 Oct 21	28 Oct 22	-
10	Distillation Unit (Kjeldahl Method)	Nitrate -Nitrogen , Ammonia-Nitrogen	FOSS TECATOR	KT200 / 91790524	FOSS South East Asia	5874	30 Nov 21	29 Nov 22	-
11	Distillation Unit (Kjeldahl Method)	Nitrate -Nitrogen , Ammonia-Nitrogen	FOSS TECATOR	2100 / 520001424	Sithiporn Associates Co.,Ltd.	MS63FOT0084B	25 Feb 21	24 Feb 22	-
12	Incubator	Fecal Coliform Bacteria, E.Coli, Total Coliform Bacteria	Memmert	IPP 260 / V616.0066	Technology Promotion Association (Thailand-Japan)	22TM672	5 May 22	4 May 23	-
13	Incubator	Fecal Coliform Bacteria, E.Coli, Total Coliform Bacteria	Memmert	IPP 260 / V615.0187	Technology Promotion Association (Thailand-Japan)	22TM563	7 Apr 22	6 Apr 23	-
14	Water Bath	Fecal Coliform Bacteria, E.Coli, Total Coliform Bacteria	Memmert	WNE 14 / L416.0612	Technology Promotion Association (Thailand-Japan)	22TM334	17 Feb 22	17 Feb 23	-

โครงการเพิ่มกำลังการผลิตโรงงานผลิตเยื่อกระดาษโรงที่ 1 ของบริษัท ตี๋บเปิ้ล เอ (1991) จำกัด (มหาชน) (Pulp1)

ช่วงดำเนินการ ระหว่างเดือนมกราคม - มิถุนายน พ.ศ. 2565

List of Instruments Certification for Water Wastewater and Sludge Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Laboratory Instrument/Equipments.									
15	Water Bath	Fecal Coliform Bacteria, E.Coli, Total Coliform Bacteria	Memmert	WNE 14 / L416.0614	Technology Promotion Association (Thailand-Japan)	22TM332	17 Feb 22	17 Feb 23	-
16	Analytical Balance	Fecal Coliform Bacteria, E.Coli, Total Coliform Bacteria	Mettler-Toledo	MS603S / B0070110311	National Food Institute, Ministry of Industry, Thailand	2200705-001-01	24 Nov 21	23 Nov 22	-
17	Auto Clave	Fecal Coliform Bacteria, E.Coli, Total Coliform Bacteria	ALP	CL-40L / 802664	Technology Promotion Association (Thailand-Japan)	22TM89	17 Feb 22	16 Feb 23	-
18	Auto Clave	Fecal Coliform Bacteria, E.Coli, Total Coliform Bacteria	ALP	CL-40L / 808763	Technology Promotion Association (Thailand-Japan)	22TM681	27 May 22	27 May 23	-

Due Date of Calibration* : กำหนดตามแผนการสอบเทียบประจำปี อย่างน้อยปีละ 1 ครั้ง

Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

Agilent Preventive Maintenance provides factory recommended service for your analytical systems to assure reliable operation and the accuracy of your results. Delivered by highly-trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak.

For more information about Agilent Technologies services please visit our web site using the following URL <http://www.agilent.com/en-us/services/analytical-instrument-services>

Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- For customers using HF applications, the instrument should be returned to its standard sample introduction system.
- A customer representative should be available to the engineer while performing the preventive maintenance procedures.
- Any parts, not included in the Parts Lists section of this document, are not part of the recommended Preventive Maintenance service, nor are they included in the price of this service.
- If a system requires the use of additional or special procedures and/or parts for the instrument service, then these must be ordered separately and charged as a repair, which may incur additional

Service Engineer's Responsibilities

- Only complete/printout pages that relate to the system being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using a "X" or tick mark "✓" in the checkbox.
- Complete Not Applicable check boxes to indicate services not delivered, as needed.
- Complete the PM service in the order of the tasks listed.
- Complete the Service Review section together with the customer.

Issued: 4 March 2021, Revision: A.01

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เอกสารไม่ควบคุม

Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

System Information

Instrument system name and ID	ICP-OES 5110 v01
Instrument system site and location	UAE Consultant
List system component product numbers	List the serial numbers of each component
1. 81015A	1. MY 15030001
2.	2.
3.	3.
4.	4.
5.	5.
6.	6.
7.	7.
8.	8.
9.	9.
10.	10.

ICP-OES Configuration table	Circle the type or write in the type if other
Nebulizer Type	SeaSpray OneNeb other
Spray Chamber	Cyclonic Single Pass Cyclonic Double Pass other
Torch	Radial Dual View other
Injector Diameter	2.4mm 1.8mm 1.4mm 0.8mm other
Injector Material	Quartz Ceramic other

Issued: 4 March 2021, Revision: A.01

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Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

General Preparation

- Discuss any specific questions or issues with the customer prior to starting.
- Review the instrument logbook.
- Perform general external inspection of system for cleanliness.
- Check for proper installation of safety-related parts, assemblies, sensors etc.
- Check for required firmware/software updates and verify with customers if they would like it installed.
- For HF application systems, if standard sample introduction system was not installed, ask the customer to install it.
- Run Instrument Performance test and record results in Instrument Performance Test Results Table - Pre PM.

Inspect and clean the system

- Look for any obvious external damage or problems.
- Inspect water cooling hoses, gas lines and power cord for excessive wear or damage.
- Perform a general internal inspection of the system for excessive dust accumulation, clean if necessary.
- Inspect sample introduction components and record any required maintenance in the Service Engineer Comments and notify the customer as the required actions required.
- Record the instrument operating conditions in the ICP-OES Status Results Table.
- Replace the polychromator purge filter.
- Replace the radial pre-optics window
- Replace the axial pre-optics window for SVDV and VDV instruments.
- Check exhaust flow for the correct positive extraction at the exhaust duct to insure they meet minimum specifications.
- Replace air inlet dust filter.
- Replace high capacity air inlet dust filter element if installed.
- Remove and clean instrument water inlet filter.

Agilent Water Recirculator

- Section NOT Applicable
- Drain cooling fluid and remove any particles from the chiller reservoir
- Remove, clean, and reinstall water inlet metal mesh filter if present.
- Re-fill with Polyclear Plus cooling fluid.
- Clean the cooling system Air filter and the condenser.

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เอกสารไม่ควบคุม

Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

SPS 3 Auto Sampler

- Section NOT Applicable
- Power cycle the autosampler and verify successful initialization.
- Inspect X and Z axis belts for wear. Replace is necessary.
- Clean X and Z axis slide shafts.
- Using customer's racks and the Agilent software move the sample probe to the 4 outermost corners and rinse port, ensure that the probe is approximately centered in the vial.

SPS 4 Auto Sampler

- Section NOT Applicable
- Clean the spill tray, rack location mat, end frames and chassis with a damp soft cloth and diluted mild detergent.
- Clean the auto sampler cover panels, if cover kit is installed, with domestic window cleaner
- Check the X-axis and Z-axis drive belts for cracks, splits, damaged teeth, excessive fraying, color changes or degradation from fumes.
- Check the X-axis, Theta-axis and Z-axis FFC cables for cracks, incorrect positioning, damaged edges or damaged connectors.
- Pump Tubing Replacement. Replace peristaltic pump tubing. Replace all tubing that goes from the rinse station to the pump and from the pump to the waste/rinse bottles

AVS 4, 6, 7

- Section NOT Applicable
- Replace valve rotor seal
- Check fittings for signs of leaks
- Check tubing including autosampler tubing for kinks or excessive wear
- Check high flow pump for signs of leaks

Instrument Adjustment

- Check position of Zn peak, adjust if required.
- Check Argon Ratio, adjust to specified value if required.
- Perform Detector Calibration.
- Perform Instrument Calibration.
- Run Instrument Performance Test and record results in Instrument Performance Test Results Table - Post PM.
- For systems using ICP Expert version 7.3 and above run the following Instrument tests and record the result in the Instrument Test Results Table
 - Subsystem Communications Test
 - Air Flow

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Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

- ☒ Water Flow
- ☒ Gas Flows
- ☒ RF Generator
- ☒ Camera Test
- ☒ Optics Test
- ☒ Nebulizer Test

Instrument Performance Test Results Table

Note: These measurements do not form part of any specification and are for reference only.

	Pre PM Sensitivity Check		Post PM Sensitivity Check	
	Radial	Axial *	Radial	Axial*
Zn 213.857 nm SRBR	4.011.3	3.456.1	4.191.3	3.610.3
Mn 279.610 nm SRBR	11415.1	30434.3	11493.6	34460.9
Al 396.152 nm SBR	7.5	15.3	9.3	13.5
K 766.491 nm SBR	5.3	36.9	5.3	44.6

* Axial result is not applicable for G8016AA, G8012AA Radial View instruments.

Instrument Test Results Table

Note: The Instrument Test results are for systems using ICP Expert version 7.3 and above only.

Instrument Test	Result
Subsystem Communications Test	Pass
Air Flow	Pass
Water Flow	Pass
Gas Flows	Pass
RF Generator	Pass
Camera Test	Pass
Optics Test	Pass
Nebulizer test	Pass

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Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

ICP-OES Status Results Table

Note: These measurements do not form part of any specification and are for reference only.

Measurement	Standby Mode	Plasma On
Mains Voltage	115.713 VAC	114.510 VAC
Mains Current	0.119 A	0.133 A
Instrument Temperature	23.4 °C	23.5 °C
RF Air Flow (sensor speed)	14.0 Hz	14.0 Hz
Plasma Exhaust Temperature	No measurement	15.0 °C
Water Flow Oscillator	No measurement	2.03 L/min
Water Flow Detector	0.00 L/min	1.37 L/min
Water Inlet Temperature	14.2 °C	15.4 °C
Polychromator Temperature	35.0 °C	35.0 °C
CCD Temperature	26.9 °C	-34.3 °C
Thermal Stabilizer	31.0 °C	35.0 °C
Argon Supply Pressure	614.15 kPa	614.93 kPa
Purge Gas Supply Pressure*1	641.34 kPa	644.67 kPa
Option Gas Supply Pressure*1	— kPa	— kPa
Nebulizer Flow	No measurement	0.90 L/min
Nebulizer Back Pressure	No measurement	143.85 kPa
Plasma Gas Flow	No measurement	15.40 L/min
Auxiliary Gas Flow	No measurement	1.10 L/min
RF Power	No measurement	1203.1 W
RF Supply Current	No measurement	9.233 A
RF Supply Voltage	No measurement	194.518 V

*1 If option installed

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Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

ICP-OES Parts List Table

Part description	Part Number	Product /Model # where used	Quantity Consumed
Axial Pre-Optic Window	G8010-68014	G8010A, G8011A, G8014A/G8015A	1
Radial Pre-Optic Window	G8010-68015	All	1
Polyclear Plus Cooling Fluid	G3292-80012	Agilent Water Recirculator	—
Purge Gas Filter	G8010-60136	All	1
Air inlet filter	G8000-68002	All	1
High Capacity Air Filter	G8010-60189	Optional	—
Rotor seal for 6-7 port valve for AVS6/7	G8494-60002	G8494A/G8495	—
Rotor seal for 4 port valve for AVS4	G8493-60002	G8493A	—
Rinse solution to rinse station 2.5mm id x 1m	G8410-80123	SPS 4	—
Barb connector 2.5mm-1.5mm ID	G8410-80124	SPS 4	—
PVC waste tubing, 8mm od x 5mm id, 2m	G8410-80122	SPS 4	—
Additional Parts may be required from engineers stock:			
X axis drive belt	5410047500	SPS 3	—
Z axis drive belt	5410047400	SPS 3	—
Peristaltic pump tubing, PVC SolvaFlex, 3 bridged,	3710049000	SPS 4	—

Restore system

For IIF applications, ask the customer to reinstall their sample introduction system.

Leave system in an idle state: on and purging.

Guidance: If the PM service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

Service Review

- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Engineer Comments section below if there are additional comments.

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Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

- ☒ Review the service and any test results with the customer.
- ☒ If the Instrument firmware was updated, record the details of the change in the Service Engineer's Comments box below or if necessary, in the customer's IQ records.

Service Engineer Comments (optional)

If there are any specific points you wish to note as part of performing the installation or other items of interest for the customer, please write in this box.

Other Important Customer Web Links

How to get information on your product:

- ☒ Literature Library - <http://www.agilent.com/en-us/products/icp-oes/icp-oes-systems/5110-icp-oes-literature>
- ☒ Need to know more? - <http://www.agilent.com/crosslab/university/>
- ☒ Need technical support, FAQs? - <http://www.agilent.com/en-us/support/landing/icp-oes>
- ☒ Need supplies? - www.agilent.com/chem/supplies

Service Completion

Service request number 6004337212 Date service completed 04/11/21

Agilent signature Nelson L. Customer signature Aphorn Orkong

Document part number: G8014-90075

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เอกสารไม่ควบคุม

Report Summary	
Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY18030001
Software Version	7.3.1.9507
Firmware Version	3442
Tested By	Nukoon L.
Test Completed On	12/9/2021 9:14:59 AM
Result Summary	
Subsystem Communications Test	Skipped
Air Flow Test	Skipped
Water Flow Test	Skipped
Gas Flows Test	Skipped
RF Generator Test	Skipped
Camera Test	Skipped
Optics Test	Skipped
Advanced Valve System Test	Skipped
Resolution Test	Pass
Sensitivity Test	Pass
Precision Test	Pass

เอกสารไม่ควบคุม

Resolution Test			Pass
Element Wavelength	Specification	Width	
N (174.213 nm)	≤ 9.40	7.27	
As (188.980 nm)	≤ 8.20	6.23	
C (193.027 nm)	≤ 11.50	8.26	
Mo (202.032 nm)	≤ 8.20	6.42	
Cr (206.158 nm)	≤ 13.40	9.27	
Zn (213.857 nm)	≤ 8.70	6.77	
Pb (220.353 nm)	≤ 9.50	7.12	
Co (228.615 nm)	≤ 17.20	11.88	
Ba (230.424 nm)	≤ 9.40	7.36	
Mn (257.610 nm)	≤ 13.30	9.52	
Mn (260.558 nm)	≤ 20.30	14.30	
Cr (267.716 nm)	≤ 11.00	7.99	
Cu (324.754 nm)	≤ 25.00	19.06	
Cu (327.395 nm)	≤ 14.20	11.32	
Sr (338.071 nm)	≤ 33.50	24.39	
Ba (455.403 nm)	≤ 44.00	33.86	
Sr (460.733 nm)	≤ 36.00	17.38	
Ba (493.408 nm)	≤ 36.00	25.53	
Ba (514.171 nm)	≤ 42.00	24.99	
Ar (675.283 nm)	≤ 74.00	59.49	
K (766.491 nm)	≤ 80.00	65.27	

เอกสารไม่ควบคุม

Sensitivity Test			Pass		
Radial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	167.2	1131.3	42.4
Se (196.026 nm)	≥ 41.0	SRBR	119.1	1177.1	84.2
Zn (213.857 nm)	≥ 1421.0	SRBR	4082.3	49908.2	148.6
Pb (220.353 nm)	≥ 46.0	SRBR	191.1	2682.8	172.6
Mn (257.610 nm)	≥ 3518.0	SRBR	11415.2	265002.2	536.8
Al (396.152 nm)	≥ 3.4	SBR	7.8	49838.0	5676.5
Ba (493.408 nm)	≥ 34.0	SBR	116.1	1999041.4	17066.5
K (766.491 nm)	≥ 1.8	SBR	5.3	101078.4	16104.6
Axial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	252.9	3214.2	147.0
Se (196.026 nm)	≥ 159.0	SRBR	216.2	3839.7	272.2
Zn (206.200 nm)	≥ 234.0	SRBR	1203.3	14046.1	133.7
Zn (213.857 nm)	≥ 1743.0	SRBR	7856.1	171323.1	472.9
Cd (214.439 nm)	≥ 4227.0	SRBR	7054.9	129539.3	335.4
Pb (220.353 nm)	≥ 320.0	SRBR	531.7	13218.2	566.2
Mn (257.610 nm)	≥ 10625.0	SRBR	30884.7	1314844.0	1807.4
Cr (267.716 nm)	≥ 1048.0	SRBR	4442.1	174420.3	1515.1
Cu (324.754 nm)	≥ 19.0	SBR	50.7	374603.6	7249.0
Al (396.152 nm)	≥ 6.0	SBR	15.7	279915.3	16790.4
Ba (493.408 nm)	≥ 60.0	SBR	209.7	10899956.6	51728.3
K (766.491 nm)	≥ 24.0	SBR	38.9	1983197.5	49746.6

เอกสารไม่ควบคุม

Precision Test		Pass
Radial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 2.60	0.81
Se (196.026 nm)	≤ 2.60	1.21
Zn (213.857 nm)	≤ 1.50	0.39
Pb (220.353 nm)	≤ 2.60	0.41
Mn (257.610 nm)	≤ 1.50	0.45
Al (396.152 nm)	≤ 1.50	0.41
Ba (493.408 nm)	≤ 1.50	0.51
K (766.491 nm)	≤ 1.50	0.36
Axial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.50	0.51
Se (196.026 nm)	≤ 1.50	0.73
Zn (206.200 nm)	≤ 1.50	0.30
Zn (213.857 nm)	≤ 1.50	0.37
Cd (214.439 nm)	≤ 1.50	0.36
Pb (220.353 nm)	≤ 1.50	0.28
Mn (257.610 nm)	≤ 1.50	0.63
Cr (267.716 nm)	≤ 1.50	0.30
Cu (324.754 nm)	≤ 1.50	0.54
Al (396.152 nm)	≤ 1.50	0.45
Ba (493.408 nm)	≤ 1.50	0.64
K (766.491 nm)	≤ 1.50	0.56

เอกสารไม่ควบคุม

Report Summary		
Instrument Model	Agilent 5100/5110 VDV ICP-OES	
Instrument ID	G8011A/G8015A	
Instrument Serial Number	MY18030001	
Software Version	7.3.1.9507	
Firmware Version	3442	
Tested By	Nukoon L	
Test Completed On	12/9/2021 12:55:49 PM	
Result Summary		
Subsystem Communications Test	Skipped	
Air Flow Test	Skipped	
Water Flow Test	Skipped	
Gas Flows Test	Skipped	
RF Generator Test	Skipped	
Camera Test	Skipped	
Optics Test	Pass	
Advanced Valve System Test	Skipped	
Resolution Test	Pass	
Sensitivity Test	Pass	
Precision Test	Pass	
Optics Test		
	Pass	
	Radial	Axial
Intensity	5296135	5755042
Wavelength	737.212	737.212

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เอกสารไม่ควบคุม

Resolution Test			Pass
Element	Wavelength	Specification	Width
N	(174.213 nm)	≤ 9.40	7.22
As	(188.980 nm)	≤ 8.20	6.15
C	(193.027 nm)	≤ 11.50	8.22
Mo	(202.032 nm)	≤ 8.20	6.33
Cr	(208.158 nm)	≤ 13.40	9.21
Zn	(213.857 nm)	≤ 8.70	6.87
Pb	(220.353 nm)	≤ 9.50	7.02
Co	(228.615 nm)	≤ 17.20	11.81
Ba	(230.424 nm)	≤ 9.40	7.48
Mn	(257.610 nm)	≤ 13.30	9.49
Mn	(260.568 nm)	≤ 20.30	14.19
Cr	(267.716 nm)	≤ 11.00	7.90
Cu	(324.754 nm)	≤ 25.00	18.92
Cu	(327.395 nm)	≤ 14.20	11.32
Sr	(338.071 nm)	≤ 33.50	24.29
Ba	(455.403 nm)	≤ 44.00	33.68
Sr	(460.733 nm)	≤ 36.00	17.84
Ba	(483.408 nm)	≤ 36.00	25.56
Ba	(614.171 nm)	≤ 42.00	24.75
Ar	(675.283 nm)	≤ 74.00	59.18
K	(766.491 nm)	≤ 80.00	65.19

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เอกสารไม่ควบคุม

Sensitivity Test				Pass		
Radial						
Element	Wavelength	Specification	Method	Ratio	Standard	Blank
As	(188.980 nm)	≥ 46.0	SRBR	154.8	1242.3	58.5
Se	(196.026 nm)	≥ 41.0	SRBR	117.4	1259.6	97.9
Zn	(213.857 nm)	≥ 1421.0	SRBR	4192.8	52402.6	156.3
Pb	(220.353 nm)	≥ 46.0	SRBR	196.4	2814.2	179.9
Mn	(257.610 nm)	≥ 3518.0	SRBR	11993.6	281210.1	547.6
Al	(396.152 nm)	≥ 3.4	SBR	8.7	55103.6	5662.9
Ba	(493.408 nm)	≥ 34.0	SBR	125.4	2152916.9	17032.2
K	(766.491 nm)	≥ 1.8	SBR	5.7	107908.7	16079.8
Axial						
Element	Wavelength	Specification	Method	Ratio	Standard	Blank
As	(188.980 nm)	≥ 208.0	SRBR	297.5	4054.8	170.4
Se	(196.026 nm)	≥ 159.0	SRBR	260.2	4794.9	298.5
Zn	(206.200 nm)	≥ 234.0	SRBR	1305.9	16162.3	150.3
Zn	(213.857 nm)	≥ 1743.0	SRBR	8920.7	200915.6	504.7
Cd	(214.439 nm)	≥ 4227.0	SRBR	7958.3	149327.5	350.4
Pb	(220.353 nm)	≥ 320.0	SRBR	606.7	15244.5	584.0
Mn	(257.610 nm)	≥ 10625.0	SRBR	34460.9	1493092.8	1872.5
Cr	(267.716 nm)	≥ 1048.0	SRBR	5018.6	198000.6	1532.6
Cu	(324.754 nm)	≥ 19.0	SBR	57.5	423683.7	7248.6
Al	(396.152 nm)	≥ 6.0	SBR	18.5	320004.9	16441.4
Ba	(493.408 nm)	≥ 60.0	SBR	233.3	11882915.4	50714.5
K	(766.491 nm)	≥ 24.0	SBR	44.6	2218974.4	46657.9

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Precision Test		Pass
Radial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 2.60	1.38
Se (196.026 nm)	≤ 2.60	0.91
Zn (213.857 nm)	≤ 1.50	0.38
Pb (220.353 nm)	≤ 2.60	0.44
Mn (257.610 nm)	≤ 1.50	0.43
Al (396.152 nm)	≤ 1.50	0.38
Ba (493.408 nm)	≤ 1.50	0.66
K (766.491 nm)	≤ 1.50	0.36
Axial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.50	0.61
Se (196.026 nm)	≤ 1.50	0.52
Zn (206.200 nm)	≤ 1.50	0.36
Zn (213.857 nm)	≤ 1.50	0.33
Cd (214.439 nm)	≤ 1.50	0.41
Pb (220.353 nm)	≤ 1.50	0.36
Mn (257.610 nm)	≤ 1.50	0.74
Cr (267.716 nm)	≤ 1.50	0.25
Cu (324.754 nm)	≤ 1.50	0.71
Al (396.152 nm)	≤ 1.50	0.44
Ba (493.408 nm)	≤ 1.50	0.73
K (766.491 nm)	≤ 1.50	0.97

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เอกสารไม่ควบคุม

Report Summary

Instrument Model Agilent 5100/5110 VDV ICP-OES
Instrument ID G8011A/G8015A
Instrument Serial Number MY18030001
Software Version 7.3.1.9507
Firmware Version 3442
Tested By Nukoon L.
Test Completed On 12/9/2021 1:34:10 PM

Result Summary

Subsystem Communications Test Pass
Air Flow Test Pass
Water Flow Test Pass
Gas Flows Test Pass
RF Generator Test Pass
Camera Test Pass
Optics Test Skipped
Advanced Valve System Test Skipped
Resolution Test Skipped
Sensitivity Test Skipped
Precision Test Skipped

Subsystem Communications Test Pass

Air Flow Test Pass

30% Air Flow (relative speed) 15.00
75% Air Flow (relative speed) 19.00

Water Flow Test Pass

RF Water Flow (L/min) 1.98
Camera Water Flow (L/min) 1.36
Water Inlet Temperature (°C) 17.16

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Gas Flows Test Pass

Nebulizer Target Flow	Actual Flow	Back Pressure	Auxiliary Target Flow	Actual Flow	Back Pressure
0.70	0.70	203.80	2.00	1.99	108.66

Makeup Target Flow 2.00
Actual Flow 2.00
Back Pressure 113.89
Plasma Target Flow 18.00
Actual Flow 17.93
Back Pressure 24.24

RF Generator Test Pass

RF Power Supply Test Passed
RF Power Supply (V) 141.475

RF Oscillator Test Passed
RF Oscillator Frequency (MHz) 25.874
Work Coil Current (A) 45.931
RF Power Supply Current (A) 2.000

Camera Test Pass

	Integration Time (ms)	Standard Deviation	Status
Electronic Offset Test	1000	5.261	Passed
Dark Current Test	6000	0.734	Passed
Array Test	5	0.024	Passed
Linearity Test		0.118	Passed

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เอกสารไม่ควบคุม



Request No. 25-65 / 0398

MTC. ACL.No. 486 / 65

CALIBRATION CERTIFICATE

NOMENCLATURE : 1. Atomic Absorption Spectrophotometer "Agilent Technologies"
Model AA240FS, Serial No. MY13160001
2. Working standard solution "Inorganic Ventures"
Multi Analyte Custom Grade Solution, Lot No. P2-MEB675610
SUBMITTED BY : United Analyst and Engineering Consultant Co., Ltd.
3. Soi Udomsuk41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

CALIBRATION PROCEDURE : 1. Performance Verification of Atomic Absorption Spectrophotometer (WI-500-02-30)
2. Estimation Uncertainty of Measurement in Analytical Chemistry (QP-513)

REFERENCE MATERIAL : Traceable to NIST "Agilent Technologies", "Carlo Erba"
Cadmium Lot No. 0108047046, Chromium Lot No. 0106315418, Copper Lot No. 0107480530, Iron Lot No. 0104697566,
Lead Lot No. 0104659473, Manganese Lot No. T109228A, Nickel Lot No. 0104978044, Zinc Lot No. 0100792297
CALIBRATION RANGE : 0.02,0.10,0.30,0.50,0.70 mg/l at 228.8 nm.Cd, 0.10,0.20,0.30,0.50,0.70 mg/l at 357.9 nm.Cr,
0.05,0.10,0.30,0.50,0.70 mg/l at 324.7 nm.Cu, 0.10,0.30,0.50,0.70,1.00 mg/l at 248.3 nm.Fe, 0.20,0.50,0.70,1.00,1.50 mg/l
at 217.0 nm.Pb, 0.05,0.10,0.30,0.50,0.70 mg/l at 279.5 nm.Mn, 0.10,0.30,0.50,0.70,1.00 mg/l at 232.0 nm.Ni,
0.05,0.10,0.30,0.50,0.70 mg/l at 213.9 nm.Zn
AMBIENT CONDITIONS : Temperature 22 °C Relative humidity 60 %

The Atomic Absorption Spectrophotometer set has been calibrated against Reference Material traceable to National Institute of Standards and Technology (NIST) by The Analytical Chemistry Laboratory. The results are attached herewith.

Calibrated by (Mr. Danal Srithongkum)

Approved by (Mrs. Thippaya Univee Fortune)
Director of Analytical Chemistry Laboratory
Ref. 2025265020400522001
Calibration Date : 3 February 2022

The results relate only to the items tested/calibrated or value assigned.

Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.B.MTC.002 Rev.4

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เอกสารไม่ควบคุม

Request No. 25-65 / 0398

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MTC. ACL. No. 486 / 65

CALIBRATION DATA

1. Noise Level in term of standard deviation

Element	Cd	Cr	Cu	Fe	Pb	Mn	Ni	Zn
Absorbance	-0.0004	0.0002	0.0007	0.0002	-0.0016	-0.0001	-0.0004	-0.0001
	0.0002	-0.0005	0.0010	0.0007	0.0000	-0.0003	0.0007	-0.0014
	-0.0002	0.0001	0.0008	0.0000	-0.0001	-0.0003	-0.0012	-0.0006
	0.0000	-0.0007	0.0007	0.0000	-0.0005	-0.0004	-0.0004	-0.0012
	0.0001	0.0004	0.0013	0.0014	-0.0001	-0.0001	0.0003	-0.0008
	0.0000	-0.0004	0.0003	-0.0012	-0.0005	-0.0007	-0.0004	-0.0008
	0.0000	-0.0009	0.0009	-0.0002	-0.0010	-0.0008	0.0007	-0.0003
	-0.0004	-0.0003	0.0015	0.0010	-0.0005	-0.0003	-0.0002	-0.0004
	0.0004	0.0008	0.0014	-0.0004	-0.0014	-0.0005	-0.0006	-0.0003
	-0.0006	-0.0013	0.0012	-0.0006	-0.0006	-0.0006	-0.0007	-0.0007
	0.0005	-0.0003	0.0014	-0.0004	-0.0008	-0.0003	-0.0006	-0.0011
	-0.0007	-0.0014	0.0004	-0.0001	-0.0001	0.0000	0.0000	-0.0003
	0.0008	0.0004	0.0005	-0.0006	-0.0008	0.0000	-0.0005	-0.0009
	0.0011	0.0002	0.0005	0.0017	-0.0016	-0.0008	0.0004	-0.0005
	0.0002	0.0010	0.0014	-0.0002	-0.0010	-0.0010	0.0002	-0.0001
	0.0001	-0.0011	0.0011	-0.0003	-0.0011	-0.0003	-0.0008	-0.0012
	0.0000	-0.0015	0.0009	-0.0010	-0.0011	-0.0013	0.0000	-0.0004
	0.0015	-0.0012	0.0005	0.0002	-0.0017	-0.0001	0.0005	-0.0002
	0.0006	0.0014	0.0010	0.0002	-0.0003	0.0001	-0.0006	-0.0010
	0.0001	0.0003	0.0003	-0.0001	-0.0004	-0.0002	-0.0001	-0.0001
Average Absorbance	0.000	0.000	0.001	0.000	-0.001	0.000	0.000	-0.001
Standard Deviation	0.0005	0.0008	0.0004	0.0007	0.0005	0.0004	0.0005	0.0004

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Request No. 25-65 / 0398

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MTC. ACL. No. 486 / 65

2. Precision

Element	Conc. (mg/l)	Absorbance										Ave. Abs.	SD	%RSD
Cd	0.02	0.0074	0.0062	0.0065	0.0062	0.0070	0.0068	0.0070	0.0065	0.0065	0.0069	0.007	0.0004	5.76
	0.30	0.0952	0.0959	0.0951	0.0957	0.0952	0.0950	0.0952	0.0948	0.0956	0.0943	0.095	0.0005	0.49
	0.70	0.2213	0.2180	0.2203	0.2208	0.2234	0.2211	0.2196	0.2219	0.2201	0.2194	0.221	0.0015	0.67
Cr	0.10	0.0096	0.0098	0.0097	0.0102	0.0106	0.0097	0.0098	0.0099	0.0103	0.0093	0.010	0.0004	3.83
	0.30	0.0309	0.0302	0.0300	0.0316	0.0306	0.0299	0.0309	0.0297	0.0311	0.0296	0.030	0.0007	2.20
	0.70	0.0659	0.0667	0.0664	0.0648	0.0656	0.0662	0.0658	0.0638	0.0638	0.0669	0.066	0.0011	1.70
Cu	0.05	0.0080	0.0075	0.0078	0.0075	0.0077	0.0081	0.0080	0.0075	0.0074	0.0076	0.008	0.0003	3.26
	0.30	0.0417	0.0419	0.0412	0.0421	0.0424	0.0420	0.0423	0.0403	0.0418	0.0415	0.042	0.0006	1.47
	0.70	0.0969	0.0965	0.0972	0.0957	0.0961	0.0958	0.0961	0.0963	0.0959	0.0972	0.096	0.0006	0.58
Fe	0.10	0.0090	0.0105	0.0078	0.0099	0.0091	0.0093	0.0096	0.0094	0.0093	0.0084	0.009	0.0007	8.11
	0.50	0.0462	0.0470	0.0464	0.0464	0.0467	0.0462	0.0467	0.0460	0.0468	0.0466	0.047	0.0003	0.67
	1.00	0.0867	0.0886	0.0910	0.0892	0.0897	0.0873	0.0892	0.0885	0.0888	0.0874	0.089	0.0013	1.43
Pb	0.20	0.0091	0.0095	0.0088	0.0087	0.0082	0.0094	0.0090	0.0087	0.0082	0.0090	0.009	0.0004	4.94
	0.70	0.0322	0.0321	0.0324	0.0318	0.0335	0.0326	0.0327	0.0315	0.0336	0.0321	0.032	0.0007	2.09
	1.50	0.0653	0.0645	0.0663	0.0664	0.0652	0.0671	0.0662	0.0666	0.0657	0.0648	0.066	0.0008	1.28
Mn	0.05	0.0092	0.0092	0.0097	0.0087	0.0085	0.0079	0.0096	0.0085	0.0084	0.0099	0.009	0.0007	7.33
	0.30	0.0616	0.0630	0.0632	0.0633	0.0634	0.0628	0.0640	0.0633	0.0640	0.0629	0.063	0.0007	1.08
	0.70	0.1396	0.1366	0.1386	0.1377	0.1386	0.1386	0.1396	0.1380	0.1374	0.1383	0.138	0.0009	0.67
Ni	0.10	0.0102	0.0092	0.0097	0.0104	0.0091	0.0105	0.0105	0.0096	0.0098	0.0102	0.010	0.0005	5.22
	0.50	0.0488	0.0489	0.0489	0.0495	0.0484	0.0490	0.0481	0.0492	0.0495	0.0492	0.049	0.0004	0.91
	1.00	0.0976	0.0979	0.0975	0.0992	0.0977	0.0973	0.0986	0.0962	0.0985	0.0982	0.098	0.0008	0.85
Zn	0.05	0.0340	0.0349	0.0340	0.0352	0.0337	0.0351	0.0344	0.0345	0.0349	0.0343	0.035	0.0005	1.49
	0.30	0.1669	0.1653	0.1628	0.1642	0.1657	0.1637	0.1659	0.1652	0.1654	0.1657	0.165	0.0012	0.72
	0.70	0.3456	0.3467	0.3445	0.3430	0.3422	0.3444	0.3437	0.3438	0.3435	0.3438	0.344	0.0013	0.37

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Request No. 25-65 / 0398

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MTC. ACL. No. 486 / 65

3.4 Reading on wavelength- Iron (Fe) at 248.3 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Fe	0.1003	0.106	0.006	5.88	± 0.008
	0.5015	0.522	0.021	4.09	± 0.017
	1.0030	0.993	-0.010	1.00	± 0.032

3.5 Reading on wavelength- Lead (Pb) at 217.0 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Pb	0.1988	0.197	-0.002	0.91	± 0.014
	0.6958	0.722	0.026	3.77	± 0.022
	1.4910	1.463	-0.028	1.88	± 0.041

3.6 Reading on wavelength- Manganese (Mn) at 279.5 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Mn	0.04955	0.054	0.004	8.98	± 0.004
	0.29730	0.317	0.0197	6.63	± 0.006
	0.69370	0.682	-0.0117	1.69	± 0.012

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MTC. ACL. No. 486 / 65

3. Trueness

3.1 Reading on wavelength- Cadmium (Cd) at 228.8 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cd	0.02004	0.019	-0.001	5.19	± 0.004
	0.30060	0.291	-0.010	3.19	± 0.006
	0.70140	0.678	-0.023	3.34	± 0.012

3.2 Reading on wavelength- Chromium (Cr) at 357.9 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cr	0.1002	0.101	0.001	0.80	± 0.007
	0.3006	0.298	-0.003	0.86	± 0.012
	0.7014	0.635	-0.066	9.47	± 0.023

3.3 Reading on wavelength- Copper (Cu) at 324.7 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cu	0.0502	0.046	-0.004	8.37	± 0.004
	0.3012	0.295	-0.006	2.06	± 0.010
	0.7028	0.694	-0.009	1.25	± 0.021

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3.7 Reading on wavelength- Nickel (Ni) at 232.0 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Ni	0.099	0.102	0.003	3.03	± 0.007
	0.495	0.489	-0.006	1.21	± 0.010
	0.990	0.975	-0.015	1.52	± 0.020

3.8 Reading on wavelength- Zinc (Zn) at 213.9 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Zn	0.050	0.050	0.000	0.00	± 0.012
	0.300	0.307	0.007	2.33	± 0.011
	0.700	0.660	-0.040	5.71	± 0.015

Remark : The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2 (k = 2)
which gives a level of confidence of approximately 95%

Calibrated by: Dani Srithongkum
(Mr. Danai Srithongkum)

Approved by: (Mrs. Thippaya Jinnave Fortune)
Director of Analytical Chemistry Laboratory
Calibration date : 3 February 2022

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CERTIFICATE OF CALIBRATION

Certificate No. : SP22-016

Page 1 of 5

Customer : United Analyst and Engineering Consultant Co.,Ltd. (Head Office)

Address : 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

Location of calibration : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : Agilent Technologies

Model : Cary 60

Serial No. : MY15410009

ID No. : N/A

Received Date : 23 May 2022

Calibration Date : 23 May 2022

Issue Date : 26 May 2022

Condition Instrument : Good

Calibrated by : 

(Mr. Tanawut Rittidach)

Technical Manager

Approved by : 

(Ms. Chonthicha Sangsri)

Quality Manager


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

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 DQE Services Co., Ltd.

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FM-708-02 R01 1/11/2021

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REPORT OF CALIBRATION

Certificate No. : SP22-016

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Environment Condition : Ambient Temperature 25 ± 5 °C

Relative humidity 55 ± 20 %RH

Calibration method : In-house method CP-01 Based on ASTM E275-08

Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	95935	22 October 2023
Absorbance Standard set	25757	95929	22 October 2023
Wavelength Standard set	25806	95916	22 October 2023
Wavelength Standard set	25758	95915	22 October 2023

Traceability This certification is traceable to the International System of Unit maintained at National Institute of Standards and Technology (NIST) through Starna Scientific Limited

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 90 nm/min

Scan Interval of UUC : 0.15 nm.


Resolution of UUC : Photometric 0.0001 Abs.

Wavelength 0.1 nm.

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REPORT OF CALIBRATION

Certificate No. :SP22-016

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Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.0000	0.0000	0.0028	2.00
	0.5787	0.5755	0.0032	0.0031	2.00
	1.0490	1.0436	0.0054	0.0029	2.00
	2.1900	2.1847	0.0053	0.0075	2.00
440	0.0000	0.0000	0.0000	0.0028	2.00
	0.5607	0.5588	0.0019	0.0034	2.00
	1.0247	1.0232	0.0015	0.0035	2.00
	2.1229	2.1211	0.0018	0.0082	2.00
465	0.0000	0.0000	0.0000	0.0028	2.00
	0.5236	0.5197	0.0039	0.0029	2.00
	0.9634	0.9625	0.0009	0.0028	2.00
	1.9763	1.9752	0.0011	0.0070	2.00
546.1	0.0000	-0.0001	0.0001	0.0028	2.00
	0.5191	0.5171	0.0020	0.0031	2.00
	1.0003	0.9984	0.0019	0.0033	2.00
	1.9987	1.9946	0.0041	0.0084	2.00
590	0.0000	0.0000	0.0000	0.0028	2.00
	0.5523	0.5509	0.0014	0.0030	2.00
	1.0809	1.0799	0.0010	0.0029	2.00
	2.0391	2.0329	0.0062	0.0080	2.00
635	0.0000	0.0000	0.0000	0.0028	2.00
	0.5601	0.5584	0.0017	0.0031	2.00
	1.0512	1.0498	0.0014	0.0029	2.00
	1.9294	1.9265	0.0029	0.0082	2.00

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FM-708-02 R01 1/11/2021

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REPORT OF CALIBRATION

Certificate No. :SP22-016

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Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.0001	-0.0001	0.0050	2.00
	0.7478	0.7421	0.0057	0.0056	2.00
257	0.0000	0.0000	0.0000	0.0050	2.00
	0.8686	0.8619	0.0067	0.0059	2.00
313	0.0000	0.0000	0.0000	0.0050	2.00
	0.2912	0.2896	0.0016	0.0051	2.00
350	0.0000	0.0000	0.0000	0.0050	2.00
	0.6448	0.6403	0.0045	0.0055	2.00

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REPORT OF CALIBRATION

Certificate No. : SP22-016 Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.72	242.0	-0.28	0.18	2.00
279.45	279.5	-0.05	0.18	2.00
287.81	287.5	0.31	0.18	2.00
334.06	333.5	0.56	0.18	2.00
360.93	360.5	0.43	0.18	2.00
418.59	418.0	0.59	0.18	2.00
445.94	445.4	0.54	0.18	2.00
453.66	453.2	0.46	0.18	2.00
460.02	459.7	0.32	0.18	2.00
536.59	536.2	0.39	0.18	2.00
637.98	638.3	-0.32	0.18	2.00
431.38	431.0	0.38	0.18	2.00
472.50	472.5	0.00	0.18	2.00
513.47	513.5	-0.03	0.18	2.00
528.88	528.5	0.38	0.18	2.00
573.17	573.0	0.17	0.18	2.00
585.35	585.0	0.35	0.20	2.00
684.40	684.7	-0.30	0.18	2.00
740.72	740.8	-0.08	0.20	2.00
748.55	748.5	0.05	0.18	2.00
807.03	807.3	-0.27	0.18	2.00
879.28	879.0	0.28	0.18	2.00

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

- 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%

- * Indicates not TISI accredited

- End of Certificate -

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CERTIFICATE OF CALIBRATION

Certificate No. : SP22-007 Page 1 of 5

Customer : United Analyst and Engineering Consultant Co.,Ltd. (Head Office)

Address : 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong.
Bangkok 10260

Location of calibration : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-1900

Serial No. : 2021-064

ID No. : UAE.WAS.006/2552

Received Date : 20 January 2022

Calibration Date : 20 January 2022

Issue Date : 24 January 2022

Condition Instrument : Good

Calibrated by :  (Mr. Tanawut Rintadach)
Technical Manager

Approved by :  (Ms. Chonchicha Sangngem)
Quality Manager

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

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 DQE Services Co., Ltd.

PM-708-02 R01 1/11/2021

เอกสารไม่ควบคุม

DQE Services Co.,Ltd.
32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230
Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com

REPORT OF CALIBRATION

Certificate No. : SP22-007 Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °C
Relative humidity 55 ± 20 %RH

Calibration method : In-house method CP-01 Based on ASTM E275-08

Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	95935	22 October 2023
Absorbance Standard set	25757	95929	22 October 2023
Wavelength Standard set	25806	95916	22 October 2023
Wavelength Standard set	25758	95915	22 October 2023

Traceability This certification is traceable to the International System of Unit maintained at National Institute of Standards and Technology (NIST) through Starna Scientific Limited

Spectral Band Width of UUC : 4.0 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.
Wavelength 0.1 nm.

PM-708-02 R01 1/11/2021

เอกสารไม่ควบคุม

DQE Services Co.,Ltd.
32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230
Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com

REPORT OF CALIBRATION

Certificate No. : SP22-007 Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5787	0.577	0.0017	0.0031	2.00
	1.0490	1.050	-0.0010	0.0029	2.00
	2.1900	2.183	0.0070	0.0080	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5607	0.560	0.0007	0.0034	2.00
	1.0247	1.023	0.0017	0.0035	2.00
	2.1229	2.118	0.0049	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5236	0.521	0.0026	0.0030	2.00
	0.9634	0.963	0.0004	0.0029	2.00
	1.9763	1.974	0.0023	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5191	0.518	0.0011	0.0031	2.00
	1.0003	1.000	0.0003	0.0033	2.00
	1.9987	1.996	0.0027	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5523	0.552	0.0003	0.0030	2.00
	1.0809	1.082	-0.0011	0.0030	2.00
	2.0391	2.033	0.0061	0.0079	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5601	0.562	-0.0019	0.0031	2.00
	1.0512	1.052	-0.0008	0.0030	2.00
	1.9294	1.925	0.0044	0.0079	2.00

PM-708-02 R01 1/11/2021

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32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230
Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com

REPORT OF CALIBRATION

Certificate No. : SP22-007 Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7478	0.746	0.0018	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8686	0.861	0.0076	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2912	0.291	0.0002	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6448	0.638	0.0068	0.0055	2.00

DQE Services Co., Ltd.
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Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com

REPORT OF CALIBRATION

Certificate No. : SP22-007 Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.54	240.8	0.74	0.18	2.00
279.40	278.5	0.90	0.18	2.00
288.70	288.0	0.70	0.18	2.00
334.22	333.5	0.72	0.18	2.00
361.26	360.5	0.76	0.18	2.00
418.48	418.0	0.48	0.18	2.00
446.70	446.0	0.70	0.18	2.00
453.20	453.0	0.20	0.18	2.00
460.06	459.5	0.56	0.18	2.00
536.90	536.0	0.90	0.18	2.00
637.94	637.2	0.74	0.18	2.00
440.74	440.0	0.74	0.18	2.00
472.22	471.6	0.62	0.18	2.00
513.70	513.0	0.70	0.18	2.00
528.72	528.0	0.72	0.18	2.00
574.60	573.8	0.80	0.18	2.00
585.48	584.6	0.88	0.20	2.00
684.63	684.0	0.63	0.18	2.00
740.27	739.8	0.47	0.20	2.00
748.28	747.8	0.48	0.18	2.00
807.16	806.4	0.76	0.18	2.00
879.70	878.8	0.90	0.18	2.00

Remark : - UUC = Unit Under Calibration
- N/A = Not Available
- 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%
- * Indicates non TISI accredited
- End of Certificate -

PM-708-02 R01 1/11/2021

PM-708-02 R01 1/11/2021

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

DQE Services Co., Ltd.
32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230
Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com

CERTIFICATE OF CALIBRATION

Certificate No. : SP22-008 Page 1 of 5

Customer : United Analyst and Engineering Consultant Co., Ltd. (Head Office)

Address : 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

Location of calibration : Laboratory 213

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-2900

Serial No. : 21E22-009


ID No. : UAE.WAT.051/2564


Received Date : 20 January 2022

Calibration Date : 20 January 2022

Issue Date : 24 January 2022

Condition Instrument : Good

Calibrated by :  (Mr. Tansawat Rittidech)
Technical Manager

Approved by :  (Ms. Chonticha Sangngern)
Quality Manager

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

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 DQE Services Co., Ltd.

DQE Services Co., Ltd.
32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230
Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com

REPORT OF CALIBRATION

Certificate No. : SP22-008 Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °C
Relative humidity 55 ± 20 %RH

Calibration method : In-house method CP-01 Based on ASTM E275-08

Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	95935	22 October 2023
Absorbance Standard set	25757	95929	22 October 2023
Wavelength Standard set	25806	95916	22 October 2023
Wavelength Standard set	25758	95915	22 October 2023

Traceability This certification is traceable to the International System of Unit maintained at National Institute of Standards and Technology (NIST) through Sarna Scientific Limited

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.
Wavelength 0.1 nm.

PM-708-02 R01 1/11/2021

PM-708-02 R01 1/11/2021

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DQE Services Co., Ltd.
32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230
Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com

REPORT OF CALIBRATION

Certificate No. : SP22-008 Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5787	0.576	0.0027	0.0031	2.00
	1.0490	1.046	0.0030	0.0029	2.00
	2.1900	2.182	0.0080	0.0075	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5607	0.559	0.0017	0.0034	2.00
	1.0247	1.023	0.0017	0.0035	2.00
	2.1229	2.116	0.0069	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5236	0.521	0.0026	0.0030	2.00
	0.9634	0.962	0.0014	0.0029	2.00
	1.9763	1.970	0.0063	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5191	0.519	0.0001	0.0031	2.00
	1.0003	0.999	0.0013	0.0033	2.00
	1.9987	1.992	0.0067	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5523	0.552	0.0003	0.0030	2.00
	1.0809	1.080	0.0009	0.0030	2.00
	2.0391	2.031	0.0081	0.0079	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5601	0.560	0.0001	0.0031	2.00
	1.0512	1.052	-0.0008	0.0030	2.00
	1.9294	1.922	0.0074	0.0079	2.00

PM-708-02 R01 1/11/2021

เอกสารไม่ควบคุม

DQE Services Co., Ltd.
32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230
Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com

REPORT OF CALIBRATION

Certificate No. : SP22-008 Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7478	0.747	0.0008	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8686	0.865	0.0036	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2912	0.290	0.0012	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6448	0.640	0.0048	0.0055	2.00

PM-708-02 R01 1/11/2021

เอกสารไม่ควบคุม

DQE Services Co., Ltd.
32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230
Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com

REPORT OF CALIBRATION

Certificate No. : SP22-008 Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.72	241.0	0.72	0.18	2.00
279.45	279.0	0.45	0.18	2.00
287.81	287.0	0.81	0.18	2.00
334.06	333.5	0.56	0.18	2.00
360.93	360.0	0.93	0.18	2.00
418.59	418.0	0.59	0.18	2.00
445.94	445.5	0.44	0.18	2.00
453.66	453.0	0.66	0.18	2.00
460.02	459.5	0.52	0.18	2.00
536.59	536.0	0.59	0.18	2.00
637.98	637.5	0.48	0.18	2.00
431.38	431.0	0.38	0.18	2.00
472.50	472.0	0.50	0.18	2.00
513.47	513.0	0.47	0.18	2.00
528.88	528.5	0.38	0.18	2.00
573.17	573.0	0.17	0.18	2.00
585.35	585.0	0.35	0.20	2.00
684.40	684.0	0.40	0.18	2.00
740.72	740.5	0.22	0.20	2.00
748.55	748.5	0.05	0.18	2.00
807.03	807.0	0.03	0.18	2.00
879.28	879.5	-0.22	0.18	2.00

Remark : - UUC = Unit Under Calibration

- NA = Not Available

- 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%

- * Indicates non-TISI accredited

- End of Certificate -

PM-708-02 R01 1/11/2021

เอกสารไม่ควบคุม



Calibration Certificate

Certificate No.: 2201793-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road, Bangchack, Prakhong, Bangkok 10260

Page 1 of 5

Equipment: pH Meter
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1231155210
ID No.: UAE WAT.010/2553
Order No.: 2201793
Operation No.: 2201793-001
Date of Receipt: 21 February 2022
Date of Calibration: 1 March 2022

Calibrated by: Mr. Phatphat Nijomchait
Scientist
Approved by: (Mr. Nuttapol Niyomchait)
Specialist, Division of Calibration Laboratory
Responsible for the Technical Management Team
Date of issue: 1 March 2022

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

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 units 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 National Food Institute.

P-C3-005 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2201793-001-01
Equipment: pH Meter
Resolution: 0.01 pH : 1 mV
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1231155210
Type: Bench top
ID No.: UAE.WAT.0102553

Date of Calibration: 1 March 2022 Page 2 of 5

Location: Chemical Calibration Laboratory, NATIONAL FOOD INSTITUTE
Environment Condition: Ambient Temperature: (23.5 ± 1.5) °C Relative Humidity: (53 ± 5) %
Condition of Equipment: Good Condition

Condition of this Results of Calibration

1. Calibration Method: In house method : W.CC-002 based on direct measurement by using standard voltage calibrator and certified reference material (CRM)

2. Reference Standards / Certified Reference Material

Instruments	Serial / ID No.	Manufacturer	Certificate No.	Due Date
2.1 DC Voltage Calibrator	270907	Fuke	SCL-21F-0687	24 June 2022
2.2 Digital Thermometer	270907	Fuke	CC-640595-01	30 October 2022
2.3 Thermo-Hygro Meter	NF18TH004/18	PONPE	GR22-0195	27 January 2023

Certified Reference Material	Lot No.	Manufacturer	Ref. N	Expiry Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)	741339	CPAchem	PH016 LLS	19 April 2023
2.5 pH buffer 6.868 (Primary pH buffer Solution)	741340	CPAchem	PH017 LLS	19 April 2023
2.6 pH buffer 10.01 (Primary pH buffer Solution)	741342	CPAchem	PH020 LLS	19 April 2022
2.7 pH buffer 7.00 (Standard pH buffer Solution)	735836	CPAchem	PH107 LLS	16 March 2022

3. This certification is traceable to the International System of Unit (SI Unit)
3.1 Instruments No.2.1 through NSC-TIS-115 17025 Laboratory Accreditation of Calibration No.0075
3.2 Instruments No.2.2 through NSC-TIS-115 17025 Laboratory Accreditation of Calibration No.0061
3.3 Instruments No.2.3 through NSC-TIS-115 17025 Laboratory Accreditation of Calibration No.0282

3.4 Certified Reference Material No. 2.4 to 2.6 traceable to Primary measurement method- Harned cell using calibrated thermometer, barometer, and nanovoltmeter. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
3.5 Certified Reference Material No. 2.7 traceable to BIM RefH Hi-7 Lot# 30.04.2020; BIM RefH Hi-8 Lot# 26.05.2020; BIM RefH Hi-9 Lot# 30.04.2020; BIM RefH Hi-10 Lot# 26.05.2020. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025

4. This certificate was certified only for the instrument we calibrated.
5. The result of calibration was found accurate as shown on date and place of calibration only.

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

P. Jungsantit
1 March 2022

Calibration Report

Certificate No.: 2201793-001-01
Equipment: pH Meter
Resolution: 0.01 pH : 1 mV
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1231155210
Type: Bench top
ID No.: UAE.WAT.0102553

Date of Calibration: 1 March 2022 Page 3 of 5

Calibration Results: 1. Calibration of pH Meter (Manual Temperature Compensation at 25 °C)

Nominal pH	DC Voltage Standard (mV)	Average Indicator Reading		Uncertainty (±mV)	Coverage Factor (k)
		mV	pH		
0.00	414.117	414	0.00	0.58	2.00
2.00	295.811	296	2.00	0.58	2.00
4.01	177.462	178	4.00	0.58	2.00
6.00	55.159	59	6.00	0.58	2.00
7.00	-9.021	0	7.00	0.58	2.00
8.00	-93.109	-93	8.00	0.58	2.00
10.00	-177.469	-177	10.00	0.58	2.00
12.00	-295.812	-296	12.00	0.58	2.00
14.00	-414.119	-414	14.00	0.58	2.00

2. Calibration of pH Meter with Electrode (Manual Temperature Compensation at 25 °C)

Equipment: pH Electrode
Manufacturer: METTLER TOLEDO
Serial No.: 1150682
Type: Combined Electrode
Model: InLablocke
ID No.: N/A

Performance of Electrode system (Three-Point Calibration at pH4, pH7 and pH10)

Certified Value (25 °C (pH))	Average Indicator Reading		Relative Slope (%)	Uncertainty (±pH)	Coverage Factor (k)
	pH	mV			
4.008	4.30	-180	95.25	0.0076	2.00
6.868	6.88	16	-	0.0079	2.00
10.012	10.01	-162	96.13	0.0094	2.00
6.995	7.00	9	-	0.0097	2.00

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

P. Jungsantit
1 March 2022

Calibration Report

Certificate No.: 2201793-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C
Model: SevenEasy pH
Serial No.: 1231155210
ID No.: UAE.WAT.0102553
Manufacturer: METTLER TOLEDO

Date of Calibration: 1 March 2022 Page 4 of 5

Location: Chemical Calibration Laboratory, NATIONAL FOOD INSTITUTE
Environment Condition: Ambient Temperature: 24 °C ± 1 °C
Relative Humidity: 53 % ± 2 %

Condition of this results of Calibration:

- Calibration Method :
 - In house method: W-TG-025 by comparison with standard thermometer.
 - The Calibration is determined by comparing with a known temperature from a standard resistance thermometer.
 - The temperature scale in use at this laboratory is the International Temperature scale of 1990 (ITS-90).

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1523	2118154	PSL-T 985164	03-Jun-22	TISTR
Platinum Resistance Thermometer (PRT)	5627A	877332			

Support Equipment : Low Temperature Bath (SOCAL-6), Model: Europa-8 Plus Basic, S/N: 3415922

- This certificate is traceable to International System of Units (SI Units).
- This certificate was certified only for the instrument we calibrated.
- This result of calibration was found accurate as shown on date and place of calibration only.
- Condition of Calibrated item : Good
- Result of Calibration : ☒ Without adjustment ☐ After adjustment

P. Jungsantit
1 March 2022

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2201793-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C
Model: SevenEasy pH
Serial No.: 1231155210
ID No.: UAE.WAT.0102553
Manufacturer: METTLER TOLEDO

Date of Calibration: 1 March 2022 Page 5 of 5

Calibration point: 15.0, 25.0 and 35.0 °C

Calibration result:

- The probe was immersed in liquid bath or dry bath to a minimum depth of 100 mm.
- Description of probe, model : N/A S/N : N/A
Dimension of probe : Diameter 4 mm, Length 100 mm.
Sheath material : Stainless Steel

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.1	15.000	-0.1	0.099
25.1	25.004	-0.1	0.099
35.1	35.003	-0.1	0.099

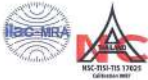
P. Jungsantit
1 March 2022

Note
- UUC* : Unit Under Calibration
The report uncertainty of measurement was based on standard uncertainty multiplied by coverage factor k= 2, providing a level of confidence of approximately 95 %.

----- End -----

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม



Certificate of Calibration

Equipment: CONDUCTIVITY METER
 Model: Lab955
 Serial No. (or ID.): 16300356
 Manufacturer: SI Analytics
 Electrode Serial No.: 16070067
 Condition: In Condition

Certificate No.: C24220084
 Issued Date: 22 March 2022
 Job No.: KSPR2203267
 Page: 1 of 2
 Model: LF413T
 Brand: SI Analytics

Customer: United Analyst and Engineering Consultant Company Limited
 3 Soi Udomsuk 41 Sukhumvit Road,
 Bangchak, Prakanong, Bangkok 10260 Thailand

Environment Condition: Temperature 23 °C ± 2 °C
 Humidity 50 %RH ± 15 %RH

Calibration Place: Environment Laboratory, SPC RT Co., Ltd.
 1194 Soi Wachirathamsathit 57, Sukhumvit 101/1 Rd.,
 Bangchak, Prakanong, Bangkok 10260 Thailand

Calibration By: Mr. Wasan Nuchnabee
 Calibration Date: 22 March 2022
 The Method used: In house method, SPCC-WI-49, base on ASTM D 1125-14 and D 5391-14
 Traceability: This certificate is traceable to the SI Units maintained by CRM of NIST(SRM) through CPA chem Co., Ltd. (ISO/IEC 17034) Certificate No. 794135, 794136, 772624

Calibration Results:


Before Adjustment

Standard	Unit Under Calibration	Correction	Coverage Factor	Uncertainty (±)
Conductivity Solution	Reading		(k)	
25.000 µS/cm	25.9 µS/cm	-0.900 µS/cm	2.00	0.22 µS/cm
1413.0 µS/cm	1444 µS/cm	-31.0 µS/cm	2.00	8.9 µS/cm
111.3 mS/cm	107.9 mS/cm	3.40 mS/cm	2.00	0.66 mS/cm

After Adjustment : at 1413 µS/cm

Standard	Unit Under Calibration	Correction	Coverage Factor	Uncertainty (±)
Conductivity Solution	Reading		(k)	
25.000 µS/cm	25.0 µS/cm	0.000 µS/cm	2.00	0.22 µS/cm
1413.0 µS/cm	1413 µS/cm	0.0 µS/cm	2.00	8.9 µS/cm
111.3 mS/cm	107.2 mS/cm	4.10 mS/cm	2.00	0.66 mS/cm

The End of Certificate


 (Mr. Wasan Nuchnabee)
 Person in charge


 บริษัท เอสพีซี อาร์ที จำกัด
 SPC RT Co., Ltd.


 (Mr. Dumrong Boonsopon)
 Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
 The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).
 These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of SPC RT Co., Ltd.

บริษัท เอสพีซี อาร์ที จำกัด
 SPC RT CO., LTD.
 เลขที่ 00009 1194 ซอย Wachirathamsathit 57 ถนนสุขุมวิท 101/1 แขวงบางนาพรุ เขตบางนา กรุงเทพมหานคร 10260
 Branch 00009 1194 Soi Wachirathamsathit 57, Sukhumvit 101/1 Road, Bangchak, Prakanong, Bangkok 10260 Thailand
 Tel: 0 2185 4333 Ext. 3330-3338 Fax: 0 2185 4424 E-mail: info@spcrt.com Website: www.spcrt.com

เอกสารไม่ควบคุม
 SPCC-FM-C24-06: 23 Nov 2020

บริษัท เอสพีซี อาร์ที จำกัด
 SPC RT CO., LTD.
 เลขที่ 00009 1194 ซอย Wachirathamsathit 57 ถนนสุขุมวิท 101/1 แขวงบางนาพรุ เขตบางนา กรุงเทพมหานคร 10260
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เอกสารไม่ควบคุม
 SPCC-FM-C24-06: 23 Nov 2020

ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: KSPR2203267

ชนิดเครื่องมือ: CONDUCTIVITY METER

รุ่น: Lab955

หมายเลขเครื่อง: 16300356

ตรวจสอบ (วัน)		รายการตรวจเช็ค	ตรวจสอบ (สี)		หมายเหตุ
22 Mar 2022			22 Mar 2022		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
General					
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด (ของใช้ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิตช์ ปิด - เปิด เครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Spectrophotometer					
<input type="checkbox"/>	<input type="checkbox"/>	6. แบตเตอรี่ไฟฟ้า (Battery Backup) >= 2.5 VDC	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	7. ควบคุมเลือกความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	9. แสงอัลตราไวโอเล็ต (UV < 3,000 hour)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	10. แสงที่มองเห็นแสง (Visible < 5,000 hour)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	11. ช่องวัดหลายตัวอย่าง (Carousel Module)	<input type="checkbox"/>	<input type="checkbox"/>	
pH Meter and Conductivity Meter					
<input checked="" type="checkbox"/>	<input type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดกันปลาย Electrode (Dust Protection Hood)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	15. ขาตั้งอิเล็กโทรด (Stand)	<input type="checkbox"/>	<input type="checkbox"/>	
Turbidimeter					
<input type="checkbox"/>	<input type="checkbox"/>	16. ค่าความขุ่นที่ต่ำสุด (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	17. ระดับการส่องสว่างของแสง (>= 2.5 ไม่น้อย 3.0)	<input type="checkbox"/>	<input type="checkbox"/>	
Automatic titrator					
<input type="checkbox"/>	<input type="checkbox"/>	18. ภาพ Piston Burettes	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	19. Function Rinsing and Dosing	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	20. ระบบท่อสายยางและอุปกรณ์ประกอบ	<input type="checkbox"/>	<input type="checkbox"/>	

ข้อแนะนำ : Electrode วัดอุณหภูมิได้ 24.9 °C โดย Control Waterbath ที่ 25.0 ± 0.1 °C

Mr. Wasan Nuchnabee
 Service Engineer

เอกสารไม่ควบคุม
 SPCC-FM-R31-02: 23 Nov 2020



Calibration Certificate

Certificate No.: 2200708-001-01
 Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
 Address: 3 Soi Udomsuk 41, Sukhumvit Road,
 Bangchak, Prakanong, Bangkok 10260

Page 1 of 4

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: AX 105 DR

Serial No.: 1122100466

ID No.: UAE.WAO.004/2546


Order No.: 2200708

Operation No.: 2200708-001

Date of Receipt: 24 November 2021

Date of Calibration: 24 November 2021

Calibrated by Mr. Worapob Sookkong
 Scientist

Approved by 
 (Mr. Pheraphat Tuanjit)

Manager, Division of Calibration Laboratory
 Responsible for the Technical Management Team

Date of Issue: 30 November 2021

The uncertainties are for a confidence probability of approximately 95%

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 units 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 National Food Institute.

F-C5-009 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2200708-001-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: AX 105 DR
Resolution: 0.00001 g / 0.0001 g
Serial No.: 1122100406
ID No.: UAE.WAO.004/2546
Capacity: 110 g

Date of Calibration: 24 November 2021 Page 2 of 4

Environment Condition: Ambient Temperature: 22.0 ± 0.5 °C Relative Humidity: 39 ± 1 %

Place of Calibration: Balance Room, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

1. Calibration Method: NFI Method W-AE-001 In-House Method based on UKAS Lab 14 : 2019

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	15880	TCS	M20011955	28 November 2021
Standard Weight Class E2	1-500g	15882	TCS	M20011965	28 November 2021

Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	11A1	22222222	Quality Room	QR21-0297	15 February 2022

3. This certification is traceable to SI UNIT

4. This certificate was certified only for the instrument we calibrated.

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

Calibration Results:

1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
15	0.000057
30	0.0000094
50	0.000053
100	0.000048

2. Off-Center Error:

A mass of 50 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.

<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3
(g)	(g)	(g)
50.0000	50.0000	49.9999
50.0000	50.0000	50.0000
49.9999	50.0000	49.9999
49.9999	50.0000	49.9999
(Maximum Difference)		
0.0001		

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2200708-001-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: AX 105 DR
Resolution: 0.00001 g / 0.0001 g
Serial No.: 1122100406
ID No.: UAE.WAO.004/2546
Capacity: 110 g

Date of Calibration: 24 November 2021 Page 3 of 4

Calibration Results: (Continued)

Calibration Range: 0-100 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 0 - 30 g; Resolution: 0.00001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (g)	Coverage Factor k
Unread	0.00000	0.00000	0.00000	0.0000089	2.00
0.01	0.009998	0.010000	0.000002	0.000011	2.00
0.02	0.019997	0.020000	0.000003	0.000012	2.00
0.05	0.049991	0.050000	0.000009	0.000011	2.00
0.1	0.100002	0.100000	-0.000002	0.000012	2.00
0.2	0.200004	0.200000	-0.000004	0.000013	2.00
0.5	0.499994	0.500000	0.000006	0.000014	2.00
1	0.999986	1.000000	0.000014	0.000026	2.00
2	1.999989	1.999998	0.000011	0.000019	2.00
5	4.999979	4.999998	0.000019	0.000032	2.00
10	10.000026	9.999994	-0.000032	0.000074	2.00
20	20.000037	19.999961	-0.000076	0.000099	2.00
30	30.000063	30.000000	-0.000063	0.00013	2.00

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2200708-001-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: AX 105 DR
Resolution: 0.00001 g / 0.0001 g
Serial No.: 1122100406
ID No.: UAE.WAO.004/2546
Capacity: 110 g

Date of Calibration: 24 November 2021 Page 4 of 4

Calibration Results: (Continued)

Calibration Range: 0-100 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 31 - 100 g; Resolution: 0.00001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (g)	Coverage Factor k
40	40.00000	39.9999	0.0001	0.00014	2.00
45	44.99998	44.9999	0.0001	0.00015	2.00
50	49.99998	49.9999	0.0001	0.00016	2.00
55	54.99997	54.9998	0.0002	0.00016	2.00
60	60.00002	59.9999	-0.0001	0.00018	2.00
65	65.00000	64.9999	-0.0001	0.00018	2.00
70	70.00003	69.9999	-0.0001	0.00019	2.00
75	75.00001	74.9999	-0.0001	0.00020	2.00
80	80.00005	79.9998	-0.0002	0.00021	2.00
85	85.00002	84.9998	-0.0002	0.00022	2.00
90	89.99999	89.9998	-0.0002	0.00021	2.00
100	99.99997	99.9998	-0.0002	0.00020	2.00

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 %.

***** End *****

เอกสารไม่ควบคุม

F-CS-012 Revision: 00 Date: 14-12-61



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
 CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
 3344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
 TEL: 0-2717-3000-27 FAX: 0-2719-9484



Certificate of Calibration

Cert. No.: 217M1876
Page: 1 of 3

Equipment : Hot Air Oven
Manufacturer : Memmert
Model : UF 55
Serial No. : B216.1666
ID No. : UAE.WAO.027/2559
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
 3 Soi Udornasuk 41, Sukhumvit Road,
 Bangkok, Phrakhanong,
 Bangkok 10260
Location : Lab Floor 2
Received Order : 29 October 2021
Calibration Date : 29 October 2021
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Kunchit Promprat
Approved by : 
 Approved Signatory
 () Ponthipapa Tameyakul
 () Malee Butkruea
 () Suwit Imjai
Issue Date : 4 November 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 & Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2110-0701OC-1
Procedure Used :-

Cert. No.: 21TM1876
Page: 2 of 3

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD) and Thermocouple Type T.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44067817	21LM10	20 Jul 2022

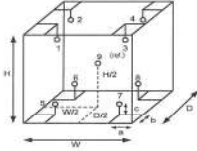
2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



Environment during calibration		
	Beginning	Finished
Temp. (°C)	28	28
REL.Humid. (%)	56	55
AC Supply (Volt)	230	230

Ref. Std. ID No.: @ Calibration Point		
Position	(140, 180) °C	(104) °C
1	21-15TC-01	15RTD2/11
2	21-15TC-02	15RTD2/12
3	21-15TC-03	15RTD2/13
4	21-15TC-04	15RTD2/14
5	21-15TC-05	15RTD2/15
6	21-15TC-06	15RTD2/20
7	21-15TC-07	15RTD2/17
8	21-15TC-08	15RTD2/18
9 (ref.)	21-15TC-09	15RTD2/19

Probe Installation Details : Dimension of Chamber :
a = 5.0 cm D = 0.33 m
b = 5.0 cm W = 0.40 m
c = 5.0 cm H = 0.40 m
Capacity = 0.053 m³



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2110-0701OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 21TM1876
Page: 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
104.0	104.0	104.0	0.11	0.52	0.72	0.42	2
140.0	140.0	140.0	0.25	1.1	1.4	1.1	2
180.0	180.0	180.0	0.18	0.87	1.2	1.1	2

Measured Temperature (°C)									
Calibration Point (°C)	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
104.0	103.852	103.978	104.382	104.323	103.776	104.015	104.312	104.196	103.907
140.0	140.309	140.730	140.426	140.270	139.531	139.666	140.067	139.695	139.750
180.0	180.596	180.339	180.755	180.619	179.716	179.829	180.204	180.365	179.975

Average* : The average of 30 values in each position.

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.

Temperature 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 or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity.

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 %.

-000-

FOSS

Customer Service Report

Date: 30/11/21
Customer: UAE
Instrument: KT200

Hours: Travel To Customer 0.80, Start 0.80, Finish 1.60
Labour: 7.60
Travel From Customer: 1.60, 1.50, 0.10

Application	Special	Standard
Normal	Courtesy Visit	Installation
Distributor	PMA Onboarding	Quote
Internal	Warranty	Repair
Digital Service	Sales Support	Remote
		Other

PQ/Quote Number: 10000415
PMA Type: FossCare Pro, Contract No.: 10000415

Details of Work / Test	Condition / Status
- Check Instrument	Pass
- Check PM kit for KT200	Pass
- Check Safety Valve	Pass
- Check Rubber Gasket	Pass
- Check Seal	Pass
- Check Heating Element	Pass
- Check Panel PCB	Pass
- Check Safety door	Pass
- Check Lubricant	Pass
- Check Leaky	Pass
- Check Valve set 3mm for 2mm	Pass

Part No.	Batch	Description	Qty
10000415	11.23.2021	Foss PM kit for KT200	1
10000415	11.23.2021	Safety Valve	1
10000415	11.23.2021	Rubber Gasket for Heating Element	1
10000415	11.23.2021	Seal	1
10000415	11.23.2021	KT200 new panel PCB	1
10000415	11.23.2021	Safety door complete	1

I confirm this report is accurate and complete
Signed Foss: [Signature], Signed Customer: [Signature]
Name: [Name], Name: [Name]
Would you be willing to participate in a brief survey in order to tell us how we performed? []

เอกสารไม่ควบคุม

FOSS Preventive Maintenance Protocol

Customer : UAE

Instrument	Kjelltec™ 2100 - 4°C/1°C 200	
Recommended PM interval (whichever occurs first between interval and no. of samples analysed)	12 months	No. of samples analysed (if applicable):
Preventive maintenance kit (P/N)	10009965	S/N 91790524

Introduction

A maintenance protocol provides systematic and functional means of maintaining a specific instrument type. The recommended PM interval depends on the operational conditions and is based on our extensive experience and knowledge of manufacturing and maintaining analytical instruments.

Apart from sample throughput, the environmental conditions also need to be considered. A demanding environment, such as high ambient temperature, humidity, dirtiness etc can measurably shorten component lifetime and also the maintenance and component replacement intervals.

NOTE:

The content of this protocol is subject to change over time. In order to safeguard that you obtain the correct parts, please make sure to indicate serial no and date of installation when contacting your FOSS representative.

Dedicated Analytical Solutions

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Web: www.foss.se

Customer Support: 1001 4572 / Rev. 3

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เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Maintenance Procedure

Exchange of Parts and Cleaning

Step	Action	Part	P/N	OK
1	Replace	Adapter for dig. tube 250 ml	1000 0056	<input type="checkbox"/>
2	Replace	Non return valve	1000 3538	<input type="checkbox"/>
3	Replace valves in alkali pump	Valve kit reagent/water pump	1575 0093	<input type="checkbox"/>
4	Replace steam tubing	Silicone tubing 8/12 mm	1582 0006	<input type="checkbox"/>
5	Replace alkali tubing	Tubing reinforced for alkali	1582 0011	<input type="checkbox"/>
6	Replace water tubing	Tubing PVC 8/11 mm	1582 0004	<input type="checkbox"/>
7	Cleaning	Steam generator		<input type="checkbox"/>
8	Cleaning	Splash head		<input type="checkbox"/>

Check and Adjustments

Step	Action	Module	Measured	Limits	OK
1	Check alkali volume, 10 ml/stroke	Alkali pump	8.8	At 50 ml -0/+3 ml	<input checked="" type="checkbox"/>
2	Check distillation volume		120ml	100 - 150 ml/4 min	<input checked="" type="checkbox"/>
3	Check front panel switches				<input checked="" type="checkbox"/>
4	Check cables and electrical connections				<input checked="" type="checkbox"/>
5	Check level pins in steam generator				<input checked="" type="checkbox"/>
6	Check safety door switch				<input checked="" type="checkbox"/>

Customer Support: 1001 4572 / Rev. 3

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เอกสารไม่ควบคุม

Preventive Maintenance Protocol

Instrument: Kjeltac™ 2100	Model 2100 S/N: 53001424
Customer: บริษัท อุตสาหกรรมอาหารและเครื่องดื่ม จำกัด	Job No.: MSOFO100648
Certified performed PM interval (whichever occurs first between interval and no. of samples analysed)	12 Months No. of samples analysed (if applicable):

Introduction

A maintenance protocol provides a systematic and functional means of maintaining a specific instrument type, the certified performed PM interval depends on the operational conditions, and is based on our extensive experience and knowledge of manufacturing and maintaining analytical instruments.

Apart from sample throughput, the environmental conditions also need to be taken into account. Demanding environments, such as high ambient temperature, humidity, dirtiness etc can measurably shorten component lifetime and also the maintenance and component replacement intervals.

The content of this protocol is subject to change over time. In order to ensure you the correct parts, please make sure to indicate serial number and date of installation when contacting you FOSS representative.

Maintenance Procedure

Parts to be Exchanged


Step	Action	Part	P/N	OK
1	Replace	Adapter for dig. tube 250 ml	10000056	<input type="checkbox"/>
2	Replace	Non return valve	10003538	<input type="checkbox"/>
3	Replace valves in alkali pump	Valve kit reagent/water pump	15750093	<input type="checkbox"/>
4	Replace steam tubing	Silicone tubing 8/12 mm	15820006	<input type="checkbox"/>
5	Replace alkali tubing	Tubing reinforced for alkali	15820011	<input type="checkbox"/>
6	Replace water tubing	Tubing PVC 8/11 mm	15820004	<input type="checkbox"/>
7	Cleaning	Steam generator		<input type="checkbox"/>
8	Cleaning	Splash head		<input type="checkbox"/>


451-451/1 บริษัท อุตสาหกรรมอาหารและเครื่องดื่ม จำกัด 10700 โทร. 0-2433-8331, 0-2433-8800, 0-2434-9191 แฟกซ์ 0-2433-1679, 0-2434-9510
451-451/1 Srinthorn Road, Bangkum, Bangkok 10700, Thailand Tel.(662) 433-8331, 435-8800, 434-9191 Fax 0-2433-1679, 0-2434-9510
เอกสารไม่ควบคุม
EMAIL: center@sithiphorn.com www.sithiphorn.com

Check and Adjustment

Step	Action	Module	Measured	Limits	OK
1	Check alkali volume, 10 ml/stroke	Alkali pump	8.8 ml	At 50 ml -0/+3 ml	<input checked="" type="checkbox"/>
2	Check distillation volume		120 ml	100 - 150 ml/4min	<input checked="" type="checkbox"/>
3	Check front panel switches				<input checked="" type="checkbox"/>
4	Check cable, electrical connection and main power supply AC 220 Volts				<input checked="" type="checkbox"/>
5	Check level pins in steam generator				<input checked="" type="checkbox"/>
6	Check safety door switch				<input checked="" type="checkbox"/>

Remark _____

Customer's Signature: 

Engineer's Signature: 

Date: 25/05/2021



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3- EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, BANGKOK 10250
TEL: 0-2717-3000-27 FAX: 0-2719-9484



Cert. No.: 22TM672
Page: 1 of 3

Certificate of Calibration

Equipment : Incubator
Manufacturer : Memmert
Model : IPP 260
Serial No. : V616.0066
ID No. : UAE.MIC.032/2559
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory (302)
Received Order : 3 May 2022
Calibration Date : 5 May 2022
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Preecha Hiahib
Approved by : 
Approved Signatory
() Pornthippa Tameyakul
(✓) Malee Butkruea
() Suwit Imjai

Issue Date : 11 May 2022

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3- Equipment Calibration and Testing Services

เอกสารไม่ควบคุม



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2205-0003OC-3
Procedure Used :-

Cert. No.: 22TM672
Page.: 2 of 3

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44067817	21LM10	20 Jul 2022

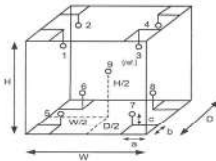
2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available



Probe Installation Details :

a = 5.0 cm
b = 5.0 cm
c = 5.0 cm

Dimension of Chamber :

D = 0.50 m
W = 0.60 m
H = 0.80 m
Capacity = 0.24 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	25	23
REL.Humid. (%)	62	57
AC Supply (Volt)	221	221

Position :	Ref. Std. ID No.:
1	19-15RTD-01
2	19-15RTD-02
3	19-15RTD-03
4	19-15RTD-04
5	19-15RTD-05
6	21-15RTD-06
7	19-15RTD-07
8	19-15RTD-08
9 (ref.)	19-15RTD-09

เอกสารไม่ควบคุม



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2205-0003OC-3
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 22TM672
Page.: 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
25.0	25.0	25.0	0.021	0.18	0.33	0.30	2
36.0	36.0	36.0	0.077	0.96	1.8	0.33	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
25.0	25.221	25.148	25.127	25.113	24.968	24.986	24.933	25.017	25.047
36.0	35.637	35.238	36.130	36.515	36.928	36.845	36.630	36.761	36.113

Average* : The average of 30 values in each position.

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.

Temperature 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 or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

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 %.

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เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
3540 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-5600-27 FAX. 0-2719-9484



Cert. No.: 22TM563
Page.: 1 of 3

Certificate of Calibration

Equipment : Incubator
Manufacturer : Memmert
Model : IPP 260
Serial No. : V615.0187
ID No. : UAE.MIC.003/2559
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory
Received Order : 7 April 2022
Calibration Date : 7 April 2022
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Prawit Sodavitchit
Approved by :
() Ponthippa Tameyakul
(✓) Malee Butkruea
() Suwit Injai
Issue Date : 18 April 2022

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม

A 0040248



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2204-0016OC-1
Procedure Used :-

Cert. No.: 22TM563
Page.: 2 of 3

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44067817	21LM10	20 Jul 2022

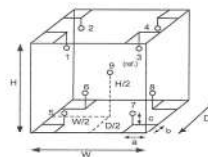
2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



Probe Installation Details :

a = 5.0 cm
b = 5.0 cm
c = 5.0 cm

Dimension of Chamber :

D = 0.50 m
W = 0.84 m
H = 0.80 m
Capacity = 0.26 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	26	26
REL.Humid. (%)	60	62
AC Supply (Volt)	220	220

Position :	Ref. Std. ID No.:
1	15RTD2/11
2	15RTD2/12
3	15RTD2/13
4	15RTD2/14
5	15RTD2/15
6	15RTD2/16
7	15RTD2/17
8	15RTD2/18
9 (ref.)	15RTD2/19

เอกสารไม่ควบคุม

a 1104310



Equipment : Incubator
 Condition As-Received : Used Item
 Reference : 2204-00160C-1
 Result of Calibration : (*) Without Adjustment
 Function of UUC* : Temperature Source
 Fresh air setting : Close

Cert. No.: 22TM563
 Page.: 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
35.0	35.0	35.0	0.12	0.53	0.79	0.30	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
35.0	35.170	35.167	34.938	34.844	34.816	34.854	34.584	34.730	34.780

Average* : The average of 30 values in each position.
Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.
Temperature 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 or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.
UUC* : Unit Under Calibration
Note : The reported uncertainty of measurement was included stability and excluded uniformity .
 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 %.

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เอกสารไม่ควบคุม

a 1104309



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
 CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
 3344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
 TEL. 0-2717-3000-17 FAX. 0-2719-9484



Cert. No.: 22TM334
 Page.: 1 of 3

Certificate of Calibration

Equipment : Water Bath
 Manufacturer : Memmert
 Model : WNE 14
 Serial No. : L416.0612
 ID No. : UAE.MIC.003/2560
 Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
 3 Soi Udomsuk 41, Sukhumvit Road,
 Bangkok, Phrakhanong,
 Bangkok 10260
 Microbiology Laboratory
 Location :
 Received Order : 17 February 2022
 Calibration Date : 17 February 2022
 Ambient Temperature : (26 ± 10) °C
 Relative Humidity : (50 ± 30) %
 Calibrated by : Suwit Imjai
 Approved by : 
 Approved Signatory
 () Pornthipha Tameyakul
 (/) Malee Butkrues
 Issue Date : 22 February 2022

The Uncertainties are for a confidence probability of approximately 95 %

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 Approval of the head of Corporate Services & Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม

A 0038095



Equipment : Water Bath
 Condition As-Received : Used Item
 Reference : 2202-0444OC-4
 Procedure Used :-

Cert. No.: 22TM334
 Page.: 2 of 3

Calibration were conducted using in-house calibration procedure CP-OT04 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (IPRT).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44067817	21LM10	20 Jul 2022

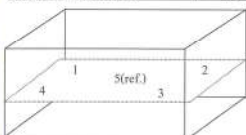
2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certificate is traceable to the International System of Unit.

Result of Calibration : (*) Without Adjustment

Function of UUC* : Temperature Source

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	21	65	229
Finished of Calibration	22	57	230



Front

Position	Ref. Std. ID No.:
1	70RC143
2	70RC144
3	70RC145
4	70RC146
S(ref.)	70RC147

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เอกสารไม่ควบคุม

a 1096055



Equipment : Water Bath
 Condition As-Received : Used Item
 Reference : 2202-0444OC-4
 Result of Calibration : (*) Without Adjustment
 Function of UUC* : Temperature Source

Cert. No.: 22TM334
 Page.: 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)				
			Position				
			1	2	3	4	5 (ref.)
44.5	44.5	44.5	44.572	44.514	44.507	44.530	44.565

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Uncertainty (± °C)	Coverage Factor k
44.5	0.10	0.042	0.15	2

Average* : The average of 30 values in each position.

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 or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity.

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 %.

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เอกสารไม่ควบคุม

a 1096054



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
53/44 PATTANAKARN ROAD SOI 11, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-21 FAX. 0-2719-4884



Certificate of Calibration

Cert. No.: 22TM332
Page: 1 of 3

Equipment : Water Bath
Manufacturer : Memmert
Model : WNE 14
Serial No. : L416.0614
ID No. : UAE.MIC.020/2561
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomeuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory
Received Order : 17 February 2022
Calibration Date : 17 February 2022
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Suwit Imjai

Approved by :
Approved Signatory

() Pornthippa Tameyakul
(✓) Malee Butkrua

Issue Date : 22 February 2022

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services / Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม

A 0038096



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2202-0444OC-5
Procedure Used :-

Cert. No.: 22TM332
Page: 2 of 3

Calibration were conducted using in-house calibration procedure CP-OT04 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (IPRT).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44067817	21LM10	20 Jul 2022

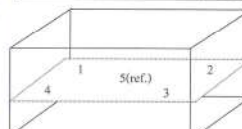
2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certificate is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment.

Function of UUC* : Temperature Source

	Environmental		AC Voltage Supply (Volt)
	(°C)	(%R.H.)	
Beginning of Calibration	21	65	229
Finished of Calibration	22	56	230



Front

Position :	Ref. Std. ID No. :
1	70RC143
2	70RC144
3	70RC145
4	70RC146
5(ref.)	70RC147

เอกสารไม่ควบคุม

A 1096053



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2202-0444OC-5
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 22TM332
Page: 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)				
			Position				
			1	2	3	4	5 (ref.)
44.5	44.5	44.5	44.546	44.517	44.513	44.537	44.578
50.0	50.0	50.0	50.089	50.051	50.036	50.061	50.092

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Uncertainty (± °C)	Coverage Factor k
44.5	0.10	0.043	0.15	2
50.0	0.11	0.042	0.15	2

Average* : The average of 30 values in each position.

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 or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity.

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 %.

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เอกสารไม่ควบคุม

A 1096052



National Food Institute, Ministry of Industry, Thailand

2009 Soi 36, Anu Amarin Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel : +66 (0) 2422 8688 Fax : +66 (0) 2422 8058 Website : www.nfi.or.th E-mail : cal@nfi.or.th



Calibration Certificate

Certificate No.: 2200705-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomeuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260

Page 1 of 3

Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: MS6025/01
Serial No.: 8007010311
ID No.: UAE.MIC.008/2553
Order No.: 2200705
Operation No.: 2200705-001
Date of Receipt: 24 November 2021
Date of Calibration: 24 November 2021

Calibrated by Mr.Jumporn Pimsri
Scientist

Approved by
(Mr.Pheraphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team

Date of Issue: 30 November 2021

The uncertainties are for a confidence probability of approximately 95%

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 units 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 National Food Institute.

F-CS-009 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2200705-001-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: MS6035/01
Resolution: 0.001 g
Serial No.: 8007010311
ID No.: UAE.MIC.008/2553
Capacity: 620 g g

Date of Calibration: 24 November 2021 **Page 2 of 3**

Environment Condition: Ambient Temperature: 24.1 ± 0.6 °C Relative Humidity: 48 ± 2.5 %

Place of Calibration: 305 Balance Room, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

1. Calibration Method: NFI Method W-MA-001 In-House Method based on UKAS Lab 14 : 2019

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	830806854	TCS	HQ2010975	12 January 2022
Standard Weight Class E2	1-500g	8308068128	TCS	HQ2010985	13 January 2022

Instrument **Model** **Serial No.** **Calibrated By** **Certificate No.** **Due Date**
 Thermo-Hygro Meter POME 490 NPLBTH 001/L7 Quality Reborn QK21-0209 15 February 2022

3. This certification is traceable to SI UNIT

4. This certificate was certified only for the instrument we calibrated.

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

Calibration Results:

1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
300	0.00052
600	0.00063

2. Off-Center Error:

A mass of 200 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.

1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
200.001	200.000	200.002	200.001	200.000	200.002	0.002

F-C5-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2200705-001-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: MS6035/01
Resolution: 0.001 g
Serial No.: 8007010311
ID No.: UAE.MIC.008/2553
Capacity: 620 g g

Date of Calibration: 24 November 2021 **Page 3 of 3**

Calibration Results: (Continued)

Calibration Range: 0-600 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Nominal value (g)	Standard value (g)	Average Reading (g)	Correction (g)	Uncertainty (g)	Coverage Factor k
Unload	0.0000	0.000	0.000	0.00088	2.00
0.1	0.1000	0.099	0.001	0.00088	2.00
0.5	0.5000	0.500	0.000	0.00088	2.00
1	1.0000	1.000	0.000	0.00088	2.00
5	5.0000	5.000	0.000	0.00088	2.00
10	10.0000	10.000	0.000	0.00088	2.00
20	20.0000	20.000	0.000	0.00088	2.00
50	49.9999	50.001	-0.001	0.00088	2.00
70	69.9999	70.000	0.000	0.00088	2.00
100	100.0000	100.000	0.000	0.00090	2.00
150	149.9999	150.000	0.000	0.00091	2.00
200	200.0001	199.999	0.001	0.00093	2.00
300	300.0001	300.000	0.000	0.00097	2.00
400	400.0000	400.001	-0.001	0.0011	2.00
500	499.9999	500.001	-0.001	0.0012	2.00
600	599.9999	600.000	0.000	0.0013	2.00

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 %.

----- End -----

F-C5-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
 CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
 334/4 PATTANAKARN ROAD SOI 14, RUANLUANG, RUANLUANG BANGKOK 10231
 TEL: 0-2717-3000-37 FAX: 0-2719-9484



Certificate of Calibration

Cert. No.: 22TM89
Page: 1 of 3

Equipment: Autoclave
Manufacturer: ALP
Model: CL-40L
Serial No.: 802664
ID No.: UAE.MIC.014/2550
Submitted by: United Analyst and Engineering Consultant Co., Ltd.
 3 Soi Udumak 41, Sukhumvit Road,
 Bangchak, Phrakhanong,
 Bangkok 10260
Location: Air Analysis Unit
Received Order: 17 February 2022
Calibration Date: 17 February 2022
Ambient Temperature: 26 ± 10 °C
Relative Humidity: (50 ± 30) %
Calibrated by: Kunchit Promrat

Approved by:
 Approved Signatory

() Pormthippa Tameyakul
 (✓) Malee Butkruea
 () Suwit Imjai

Issue Date: 22 February 2022

The Uncertainties are for a confidence probability of approximately 95%

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 Approval of the head of Corporate Services & Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม



Equipment: Autoclave
Condition As-Received: Used Item
Reference: 2202-0444OC-1
Procedure Used :-

Cert. No.: 22TM89
Page: 2 of 3

Calibration were conducted using in-house calibration procedure CP-OT03 according to direct measurement method with Data Acquisition which connected with Thermocouple Type T

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44035217	21LM30	23 Dec 2022

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

3. This certification is traceable to the International System of Unit.

4. This result of calibration covers laboratory autoclaves for the sterilization of goods and material which could be infected with organisms categorized as Hazard Group 1, 2 and 3**

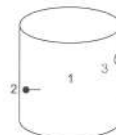
(** = Categorization of pathogens according to hazard and categories of containment, second edition, 1990)

It does not cover autoclaves for use with material infect with organisms in Hazard Group 4, for which complete containment and sterilization of infected condensate is considered to be essential.

This result of calibration does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical or veterinary purposes which are directly concerned with patient care, or those used for fabrics subjected to sterilization which are required to be dry at the end of cycle.

Result of Calibration :- (*) Without Adjustment

Function of UUC :- Temperature Source



	Environmental		
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	27	68	228
Finished of Calibration	27	65	226

Position	Description	Ref. Std. ID No.:
1 =	Center of chamber	22-10TC-01
2 =	Temperature sensor	22-10TC-02
3 =	Exhaust port	22-10TC-03

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Equipment : Autoclave
Condition As-Received : Used Item
Reference : 2202-0444OC-1

Cert. No.: 22TM89
Page.: 3 of 3

Result of Calibration :- (°) Without Adjustment

Operating parameter Set : Temperature = 122 °C
Sterilization period = 30 minute

UUC* Setting (°C)	UUC* Reading (°C)	Position	Average* Standard Reading (°C)	Stability (± °C)	Pressure Reading (MPa)	Uncertainty (± °C)	Coverage Factor k
122	122	1	122.373	0.32	0.12	1.2	2
		2	122.421				
		3	122.292				

Average* : The average of 30 values in each position.

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity.

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 %.

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
334/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 22TM681
Page.: 1 of 3

Certificate of Calibration

Equipment : Autoclave
Manufacturer : ALP
Model : CL-40L
Serial No. : 808763
ID No. : UAE.MIC.026/2563
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Microbiology Laboratory (301)
Location :
Received Order : 27 May 2022
Calibration Date : 27 May 2022
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by : Preecha Hlahib

Approved by :
Approved Signatory

(/) Pormthippa Tameyakul
(/) Malee Bulkruea
(/) Suwit Imjai

Issue Date : 2 June 2022

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3: Equipment: Calibration and Testing

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Equipment : Autoclave
Condition As-Received : Used Item
Reference : 2205-0764OC-2

Cert. No.: 22TM681
Page.: 2 of 3

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT03 according to direct measurement method with Data Acquisition which connected with Thermocouple Type T

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44060450	22LM46	28 Mar 2023

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

3. This certification is traceable to the International System of Unit.

4. This result of calibration covers laboratory autoclaves for the sterilization of goods and material which could be infected with organisms categorized as Hazard Group 1, 2 and 3**

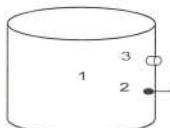
(** = Categorization of pathogens according to hazard and categories of containment, second edition, 1990)

It does not cover autoclaves for use with material infect with organisms in Hazard Group 4, for which complete containment and sterilization of infected condensate is considered to be essential.

This result of calibration does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical or veterinary purposes which are directly concerned with patient care, or those used for fabrics subjected to sterilization which are required to be dry at the end of cycle.

Result of Calibration :- (°) Without Adjustment

Function of UUC* : Temperature Source



	Environmental		
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	27	56	220
Finished of Calibration	27	59	221

Position	Description	Ref. Std. ID No.:
1 =	Center of chamber	22-14TC-01
2 =	Temperature sensor	22-14TC-02
3 =	Exhaust port	22-14TC-03

เอกสารไม่ควบคุม



Equipment : Autoclave
Condition As-Received : Used Item
Reference : 2205-0764OC-2

Cert. No.: 22TM681
Page.: 3 of 3

Result of Calibration :- (°) Without Adjustment

Operating parameter Set : Temperature = 115.0 °C
Sterilization period = 15 minute

UUC* Setting (°C)	UUC* Reading (°C)	Position	Average* Standard Reading (°C)	Stability (± °C)	Pressure Reading (MPa)	Uncertainty (± °C)	Coverage Factor k
115.0	115.0	1	115.553	0.4	0.08	0.82	2
		2	115.582				
		3	115.325				

Operating parameter Set : Temperature = 121 °C
Sterilization period = 30 minute

UUC* Setting (°C)	UUC* Reading (°C)	Position	Average* Standard Reading (°C)	Stability (± °C)	Pressure Reading (MPa)	Uncertainty (± °C)	Coverage Factor k
121.0	121.0	1	121.484	0.21	1.1	0.75	2
		2	121.581				
		3	121.311				

Average* : The average of 30 values in each position.

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity.

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 %.

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List of Instruments Certification for Water Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Water									
1	pH Meter	pH	Horiba	LAQUA-PH210 HA1F0002	Technology Promotion Association (Thailand-Japan)	21CH1607	19 Nov 21	18 Nov 22	-
2	DO Meter	DO	Horiba	LAQUA-DO210 HE1D0010	Technology Promotion Association (Thailand-Japan)	21TM250	19 Nov 21	18 Nov 22	-
3	Conductivity Meter	Conductivity	Horiba	LAQUA-EC210 HC0J0014	Technology Promotion Association (Thailand-Japan)	21CH1621	23 Nov 21	22 Nov 22	-



Cert.No.: 21CH1607
Page.: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Horiba
Model : LAQUA-PH210
Serial No. : HA1F0002
ID No. : UAE.EFM.200/2564(EFM.pH.08/64)
Condition As-Received: Used Item
Received Date : 18 November 2021
Calibration Date : 19 November 2021
Reference : 2111-0736WSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260
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)
- CP-CH8 by comparison with standard thermometer
Calibrated by : Warakorn Lernagatrakul
Approved by : Malee Butkruea
() Malee Butkruea
() Sathip Meangmai
() Warakorn Lernagatrakul
Issue Date : 25 November 2021

The Uncertainties are for a confidence probability of approximately 95%

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Cert.No.: 21CH1607
Page.: 2 of 3

Condition of this calibration result

- Reference Standard Instrument : -

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	21E2682	25 Aug 2022
2) Ref. Standard Thermometer	4982054	110RC044	2111201	26 Oct 2022

This certification is traceable to the International System of Unit maintained at:-
- Traceable to National Institute of Metrology (Thailand), NiMT
- 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	761016	02 Aug 2023
pH 6.982	CPA chem	761017	02 Aug 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)(7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (± mV)	Coverage factor k
			mV	pH		
pH Meter S/N : HA1F0002	4.00	177.48	177.4	4.01	0.058	2.00
	7.00	0.00	-0.2	7.02	0.058	2.00
	10.00	-177.48	-177.6	10.01	0.058	2.00

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Cert.No.: 21CH1607
Page.: 3 of 3

Calibration Results

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4.7)(7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor k
pH Electrode S/N: 991E0471	4.008	4.01	172	0.0071	2.00
	6.982	6.98	-4	0.011	2.00
	6.982	6.98	-4	0.011	2.00
	10.015	10.01	-181	0.011	2.05

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9652
- Serial No. : 991E0471
Dimension of probe;
- Length : 103 mm.
- Diameter : 16 mm.
- Immersion Depth : 90 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor k
25.0	25.002	25.0	-0.002	0.13	2.00
30.0	30.004	30.0	-0.004	0.13	2.00
35.0	35.003	35.0	-0.003	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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 %.

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Cert.No.: 21TW250
Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : Horiba
Model : LAQUA-DO210
Serial No. : HE1D0010
ID No. : UAE.EFM.208/2564(EFM.DO.10/64)
Received Date : 18 November 2021
Test Date : 19 November 2021
Reference : 2111-0736WSC-11
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260
Laboratory Condition : Temperature (25 ± 5) °C
Humidity (50 ± 20) %
In - house method : CP-CH9
by Comparison Technique with Azide Modification Method
Tested by : Walalak Sirithuan
Approved by : Malee Butkruea
() Malee Butkruea
() Sathip Meangmai
() Warakorn Lernagatrakul
Issue Date : 25 November 2021

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Cert.No.: 21TW250
Page.: 2 of 2

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 9K1B0023

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.16	8.15	0.0055

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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CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-3000-27 FAX: 0-2719-9484



Cert. No.: 21LM21
Page.: 1 of 2

Certificate of Calibration

Equipment : DO Meter with Sensor
Manufacturer : Horiba
Model : LAQUA-DO210
Serial No. : HE1D0010
ID No. : UAE.EFM.208/2564(EFM.DO.10/64)
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : TPA On Site Calibration Laboratory
Received Order : 18 November 2021
Calibrated Date : 26 November 2021
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V
Calibrated by : Malee Butkruea
Approved by :
() Pornthippa Tameyakul
(✓) Suwit Imjai

Issue Date : 2 December 2021

The Uncertainties are for a confidence probability of approximately 95%

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Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2111-0736WSC-12

Cert. No.: 21LM21
Page.: 2 of 2

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Digital Thermometer	1523	2188080	2111273	22 Nov 2022

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

3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N : 9K1B0023

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
25.0	60	25.006	25.1	0.094	0.16	2.00
30.0	60	29.996	30.0	0.004	0.16	2.00
35.0	60	35.007	35.1	0.093	0.16	2.00

UUC* : Unit Under Calibration

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 %.

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CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-3000-27 FAX: 0-2719-9484



Cert.No.: 21CH1621
Page.: 1 of 3

Certificate of Calibration

Equipment : Conductivity Meter
Manufacturer : Horiba
Model : LAQUA-EC210
Serial No. : HCOJ0014
ID No. : UAE.EFM.205/2564(EFM.SCT.10/64)
Condition As-Received : Used Item
Received Date : 18 November 2021
Calibration Date : 23 November 2021
Reference : 2111-0736WSC-6
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In-house method :
- CP-CH6 by direct measurement
with certified reference material (CRM)
- CP-CH8 by comparison with standard thermometer
Walalak Sirinthean
Calibrated by :
Approved by :
(✓) Malee Butkruea
() Sathip Meangmai
() Warakorn Lernagatrakul
Issue Date : 25 November 2021

The Uncertainties are for a confidence probability of approximately 95%

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Cert.No.: 21CH1621

Page.: 2 of 3

Condition of this result of calibration

1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Certificate No.	Due date
1) Thermometer	9549224	130RC003	21I451	15 Apr 2022
2) Ref. Std Thermometer	4982054	110RC044	21I1201	26 Oct 2022

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

- Traceable to National Institute of Metrology (Thailand), NIMT

2. Certified Reference Materials :-

- Conductivity calibration solution, CPA chem Ltd., The measurement results are traceable to SI through CPA chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Conductivity Solution	Manufacturer	Lot No.	Exp. date
1413.0 μ S/cm	CPA Chem	761021	02 Aug 2022
12.8806 mS/cm	CPA Chem	754037	28 June 2022

- Control Conductivity calibration solution temperature by Water bath (25 \pm 0.1) $^{\circ}$ C

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

Calibration results**Function : Conductivity Measurement**(*) After Adjustment at 1413.0 μ S/cm

Conductivity Electrode Serial No.: 9B0H0061

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (\pm)	Coverage factor k
1413.0 μ S/cm	1312 μ S/cm	1412 μ S/cm	9.2 μ S/cm	2.00
12.8806 mS/cm	11.67 mS/cm	12.79 mS/cm	0.086 mS/cm	2.00

Remark - UUC* = Unit Under Calibration

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Cert.No.: 21CH1621

Page.: 3 of 3

Calibration Results**Function : Temperature Measurement**

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9383

- Serial No. 9B0HC0061

Dimension of probe;

- Length : 113 mm.

- Diameter : 10 mm.

- Immersion Depth : 90 mm.

Calibration Point ($^{\circ}$ C)	Standard Temperature ($^{\circ}$ C)	UUC* Reading ($^{\circ}$ C)	Error ($^{\circ}$ C)	Uncertainty of Measurement (\pm $^{\circ}$ C)	Coverage factor k
25.0	24.999	24.9	-0.099	0.13	2.00
30.0	29.999	29.9	-0.099	0.13	2.00
35.0	34.998	34.9	-0.098	0.13	2.00

Remark : - UUC* = Unit Under CalibrationThe reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k , providing a level of confidence of approximately 95 %.

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เอกสารไม่ควบคุม

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Stack									
1	Pre-Test Console	Total Suspended Particulate Methanethiol Dimethyl Sulfide Chloride	Apex Instruments, USA.	XC-572-V 0803018	Envi Equipment Service Co., Ltd.	E21-0817	24 Aug 21	23 Aug 22	-
2	Pre-Test Console	Total Suspended Particulate Methanethiol Dimethyl Sulfide Chloride	Apex Instruments, USA.	XC-572-V 0807047	Envi Equipment Service Co., Ltd.	E21-0813	19 Aug 21	18 Aug 22	-
3	Flue gas Analyzer	Sulphur Dioxide Oxide of Nitrogen as Nitrogen Dioxide Carbon Monoxide	Testo	Testo 350 60899617	Entech Industrial Sulation Co., Ltd.	G 640549	31 Aug 21	30 Aug 22	-
4	Flue gas Analyzer	Sulphur Dioxide Oxide of Nitrogen as Nitrogen Dioxide Carbon Monoxide	Testo	Testo 350 61658806	Entech Industrial Sulation Co., Ltd.	G 640630	30 Sep 21	29 Sep 22	-

CERTIFICATE OF CALIBRATION

Customer : United Analyst and Engineering Consultant Co., Ltd.
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260
Description of Equipment : Console meter
Manufacturer : Apex Instrument
Model Number : XC-572-V
Serial Number : 0803018
ID/Control No. : -
Environment Conditions : Temperature (25 ± 2) °C
: Humidity (50 ± 15) % RH
Cal. Date : 24/8/2021
Issue Date : 24/8/2021

Calibration Method or Calibration Procedure Used

US EPA Method (United State Environmental Protection Agency)

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

Result of Calibration

This certificate may not be reproduced other than in full except with prior Written approval of the Technical Manager, Envi Equipment Service Co., Ltd.
Service Company Limited.

These reported uncertainties of measurement are expanded by a coverage factor of k=2, providing a 95% confidence level.



Calibrated by : Mr. Sanya Sangnil

Approved by : (Mr. Mann Fuekchod)
Technical Manager

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METHOD 5 CONSOLE CALIBRATION USING REFERENCE WET GAS METER W-NK-2.5-B-Z No.547425 5-POINT METRIC UNIT

Meter Console Information		Calibration Conditions		Factors/Conversions	
Console Model Number	XC-572-V	Date	Time	24/8/2021	11:30 AM
Console Serial Number	0803018	Calibration Reference No.	-		
DGM Model Number	SK25EX	Barometric Pressure	761.00	mm Hg	
DGM Serial Number	00002780	Calibration Meter Gamma	0.999		
		Std Temp	293	K	
		Std Press	760	mm Hg	
		K _i	0.386		
		Console Leak Check	PASS		

Calibration Data											
Run Time		Metering Console				Calibration Meter					
Elapsed	DGM Orifice	Volume	Volume	Outlet Temp	Outlet Temp	Volume	Volume	Outlet Temp	Outlet Temp		
(Q)	(P _o)	(V _{in})	(V _{out})	(t _{in})	(t _{out})	(V _{in})	(V _{out})	(t _{in})	(t _{out})		
min	mm H ₂ O	m ³	m ³	°C	°C	m ³	m ³	°C	°C		
12.80	13.0	582.0100	582.1500	26	26	25.26650	25.40756	26	26		
12.85	13.0	582.1500	582.2900	26	26	25.40756	25.54916	26	26		
8.73	26.0	582.2970	582.4370	26	26	25.56074	25.70184	26	26		
8.73	26.0	582.4370	582.5770	27	27	25.70184	25.84216	26	26		
14.37	40.0	582.5830	582.8630	27	27	25.84806	26.12710	26	26		
14.33	40.0	582.8630	583.1430	27	27	26.12710	26.40500	26	26		
10.43	70.0	583.1580	583.4380	27	27	26.41974	26.69684	25	25		
10.42	70.0	583.4380	583.7180	28	28	26.69684	26.97274	25	25		
9.15	90.0	583.7360	584.0160	29	29	26.98612	27.26132	25	25		
9.13	90.0	584.0160	584.2960	30	30	27.26132	27.53592	25	25		



เอกสารไม่ควบคุม

Meter Console Information		Calibration Conditions		Factors/Conversions	
Console Model Number	XC-572-V	Date	Time	24/8/2021	11:30 AM
Console Serial Number	0803018	Calibration Reference No.	-		
DGM Model Number	SK25EX	Barometric Pressure	761.00	mm Hg	
DGM Serial Number	00002780	Calibration Meter Gamma	0.999		
		Std Temp	293	K	
		Std Press	760	mm Hg	
		K _i	0.386		
		Console Leak Check	PASS		

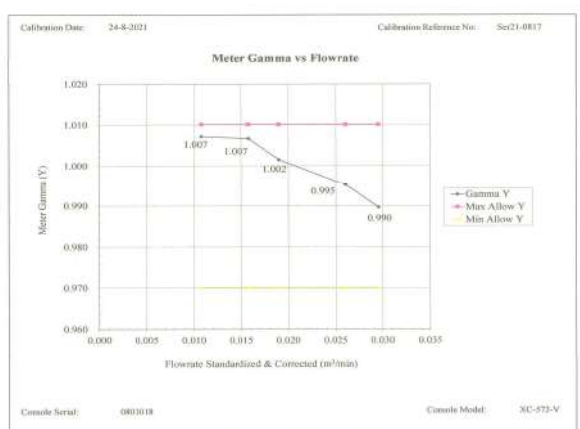
Calibration Data									
Standardized Data		Results							
		Dry Gas Meter				Flowrate			
Dry Gas Meter	Calibration Meter	Value	Variation	Std & Corr	Flowrate	Value	Variation	Std & Corr	Variation
(V _{std})	(Q _{std})	(V _{std})	(Q _{std})	(Y)	(ΔY)	(Q _{std})	(ΔH _g)	(ΔH _g)	(ΔH _g)
m ³	m ³ /min	m ³	m ³ /min			m ³ /min	mm H ₂ O		
0.138	0.011	0.138	0.011	1.005	0.015	0.011	49.413	1.849	
0.138	0.011	0.139	0.011	1.009	0.019	0.011	49.420	1.857	
0.138	0.016	0.138	0.016	1.004	0.014	0.016	46.095	-1.469	
0.138	0.016	0.138	0.016	0.999	0.009	0.016	46.609	-0.955	
0.276	0.019	0.274	0.019	0.992	0.002	0.019	49.202	1.638	
0.276	0.019	0.272	0.019	0.988	-0.002	0.019	49.377	1.813	
0.278	0.027	0.273	0.026	0.982	-0.008	0.026	46.160	-1.404	
0.278	0.027	0.271	0.026	0.978	-0.012	0.026	46.414	-1.150	
0.278	0.030	0.271	0.030	0.973	-0.017	0.030	46.456	-1.107	
0.278	0.030	0.270	0.030	0.971	-0.019	0.030	46.490	-1.074	
		0.990	Y Average				47.563	ΔH _g Average	

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



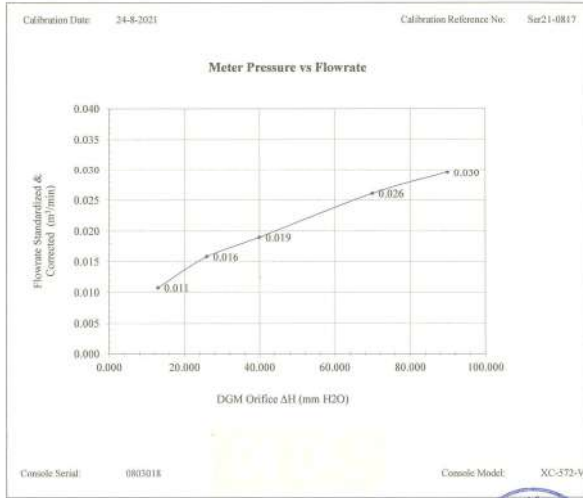
เอกสารไม่ควบคุม

Meter Console Information		Calibration Conditions		Factors/Conversions	
Console Model Number	XC-572-V	Date	Time	24/8/2021	11:30 AM
Console Serial Number	0803018	Calibration Reference No.	-		
DGM Model Number	SK25EX	Barometric Pressure	761.00	mm Hg	
DGM Serial Number	00002780	Calibration Meter Gamma	0.999		
		Std Temp	293	K	
		Std Press	760	mm Hg	
		K _i	0.386		
		Console Leak Check	PASS		



เอกสารไม่ควบคุม

Meter Console Information		Calibration Conditions		Factors/Conversions	
Console Model Number	XC-572-V	Date	Time	24/8/2021	11:30 AM
Console Serial Number	0803018	Calibration Reference No.	-		
DGM Model Number	SK25EX	Barometric Pressure	761.00	mm Hg	
DGM Serial Number	00002780	Calibration Meter Gamma	0.999		
		Std Temp	293	K	
		Std Press	760	mm Hg	
		K ₁	0.386		
		Console Leak Check	PASS		



เอกสารไม่ควบคุม

THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information		Calibration Conditions	
Console Model Number	XC-572-V	Date	Time
Console Serial Number	0803018	24/8/2021	01:30 PM
DGM Model Number	SK25EX	Calibration Reference No.	-
DGM Serial Number	00002780	Reference Thermometer	DIGICON
Meter Box Model Number	JENCO 765 KF	Serial Number	I83169105
Meter Box Serial Number	JC 17060		

Results	
Console Thermocouple Simulator	
Channel and test point	Meter Box Channel Temperature Reading (°C)
	-18.0 25.0 38.0 93.0 149.0 260.0 371.0 482.0 593.0 816.0 1038.0
Stack	-17.0 24.0 37.0 93.0 149.0 260.0 372.0 483.0 594.0 817.0 1039.0
Aux	-17.0 24.0 37.0 93.0 150.0
Probe	-17.0 24.0 37.0 93.0 150.0
Filter	-17.0 24.0 37.0 93.0 149.0
Oven	- - - - -
Exit	-17.0 24.0 37.0

Tolerance Range	
Stack	± 1.50% Absolute
Probe	± 3.0 °C
Filter	± 3.0 °C
Meter	± 3.0 °C
Exit	± 2.0 °C



เอกสารไม่ควบคุม

Envi Equipment Service Co., Ltd.
110/254 Moo 5, Tumbon Bang Rak Phatthana, Amphur Bang Bua Thong, Nonthaburi 11110
Tel. 098 362 9152, 089 478 7885
E-mail: sales@envi-ees.com

Certificate No. : E21-0813
Page : 1 of 6

CERTIFICATE OF CALIBRATION

Customer	: United Analyst and Engineering Consultant Co., Ltd.
Address	: 81 Soi Udumak 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Description of Equipment	: Console meter
Manufacturer	: Apex Instrument
Model Number	: XC-572-V
Serial Number	: 0807047
ID/Control No.	: -
Environment Conditions	: Temperature (25 ± 2) °C Humidity (50 ± 15) % RH
Cal. Date	: 19/08/2021
Issue Date	: 19/08/2021

Calibration Method or Calibration Procedure Used

US EPA Method (United State Environmental Protection Agency)

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

Result of Calibration

This certificate may not be reproduced other than in full except with prior Written approval of the Technical Manager, Envi Equipment Service Company Limited.

These reported uncertainties of measurement are expanded by a coverage factor of k=2, providing a 95% confidence level.



Calibrated by : Mr. Sanya Sangnil

Approved by :
(Mr. Mana Fuekhu) Technical Manager

เอกสารไม่ควบคุม

Certificate No. : E21-0813
Page : 2 of 6

**METHOD 5 CONSOLE CALIBRATION
USING REFERENCE WET GAS METER W-NK-2.5-B-Z No.547425
5-POINT METRIC UNIT**

Meter Console Information		Calibration Conditions		Factors/Conversions	
Console Model Number	XC-572-V	Date	Time	19/8/2021	01:00 PM
Console Serial Number	0807047	Calibration Reference No.	-		
DGM Model Number	SK25EX	Barometric Pressure	761.00	mm Hg	
DGM Serial Number	00003580	Calibration Meter Gamma	0.999		
		Std Temp	293	K	
		Std Press	760	mm Hg	
		K ₁	0.386		
		Console Leak Check	PASS		

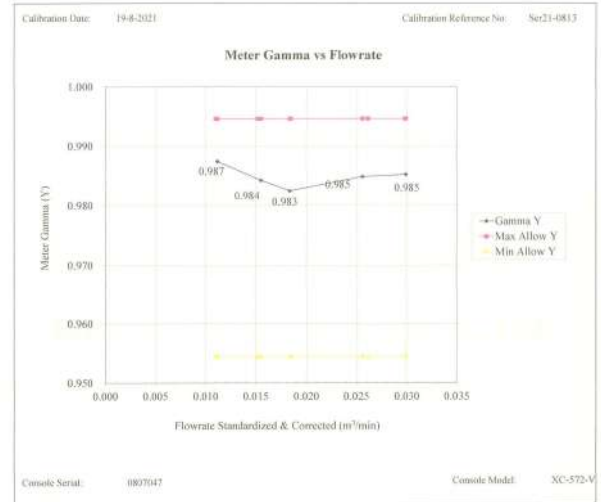
Run Time		Metering Console				Calibration Meter			
Elapsed (Q)	(P _{at})	DGM Orifice DH	Volume Initial (V _{in})	Volume Final (V _{out})	Outlet Temp Initial (t _{in})	Outlet Temp Final (t _{out})	Volume Initial (V _{in})	Volume Final (V _{out})	Outlet Temp Initial (t _{in})
min	mm H ₂ O	m ³	m ³	°C	°C	m ³	m ³	°C	°C
12.17	13.0	3.3600	3.5000	23	23	23.01236	23.15126	26	26
12.30	13.0	3.5000	3.6400	23	23	23.15126	23.28948	26	26
8.72	26.0	3.6400	3.7800	24	24	23.29826	23.43644	26	26
8.88	26.0	3.7800	3.9200	24	24	23.43644	23.57434	26	26
14.83	40.0	3.9200	4.2150	25	25	23.58012	23.83818	26	26
14.67	40.0	4.2150	4.4950	25	25	23.83818	24.13456	26	26
10.37	70.0	4.5080	4.7880	25	25	24.14158	24.41250	26	26
10.13	70.0	4.7880	5.0680	26	26	24.41250	24.68290	26	26
8.90	90.0	5.0750	5.3550	27	27	24.68856	24.96012	26	26
8.88	90.0	5.3550	5.6350	27	27	24.96012	25.23050	26	26

เอกสารไม่ควบคุม

METHOD 5 CONSOLE CALIBRATION
USING REFERENCE WET GAS METER W-NK-2.5-B-Z No.547425
5-POINT METRIC UNIT

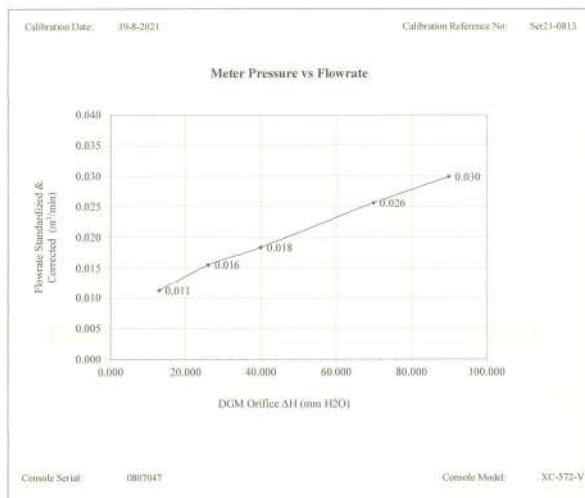
Calibration Data									
Results									
Standardized Data				Dry Gas Meter					
Dry Gas Meter		Calibration Meter		Calibration Factor		Flowrate			
(V _{wet})	(Q _{wet})	(V _{std})	(Q _{std})	Value	Variation	Std & Corr	.0212 m ³ /min	Variation	
(m ³)	(m ³ /min)	(m ³)	(m ³ /min)	(Y)	(ΔY)	(Q _{actual})	(ΔH _g)	(ΔH _g)	
0.138	0.011	0.136	0.011	0.990	0.015	0.011	46.043	-2.056	
0.138	0.011	0.135	0.011	0.985	0.010	0.011	47.522	-0.577	
0.138	0.016	0.135	0.016	0.984	0.009	0.016	47.880	-0.219	
0.138	0.016	0.135	0.015	0.982	0.007	0.015	49.931	1.832	
0.276	0.019	0.273	0.018	0.988	0.014	0.018	52.821	4.722	
0.276	0.019	0.271	0.018	0.982	0.008	0.018	52.270	-4.171	
0.277	0.027	0.266	0.026	0.960	-0.014	0.026	47.835	-0.264	
0.277	0.027	0.265	0.026	0.958	-0.016	0.026	45.881	-2.217	
0.277	0.031	0.266	0.030	0.961	-0.014	0.030	45.290	-2.809	
0.277	0.031	0.265	0.030	0.956	-0.018	0.030	45.515	-2.583	
				0.975	Y Average			-48.099	ΔH _g Average

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



เอกสารไม่ควบคุม

เอกสารไม่ควบคุม



เอกสารไม่ควบคุม

THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information				Calibration Conditions			
Console Model Number	XC-572-V			Date	Time	19/8/2021	03:00 PM
Console Serial Number	0807047			Calibration Reference No.			
DGM Model Number	SK25EX			Reference Thermometer			
DGM Serial Number	00003580			Serial Number			
Meter Box Model Number	JENCO 765 KF			183169105			
Meter Box Serial Number	JC 17073						

Results									
Console Thermocouple Simulator									
Channel and test point	Meter Box Channel Temperature Reading (°C)								
	-18.0	25.0	38.0	93.0	149.0	260.0	371.0	482.0	593.0
Stack	-17.0	24.0	37.0	93.0	149.0	259.0	371.0	482.0	594.0
Aux	-17.0	24.0	37.0	93.0	149.0				
Probe	-18.0	24.0	37.0	93.0	149.0				
Filter	-18.0	24.0	37.0	93.0	149.0				
Oven	-	-	-	-	-				
Exit	-18.0	24.0	37.0						

Tolerance Range				Meter	
Stack	± 1.50%	Absolute		± 3.0 °C	
Probe	± 3.0 °C			± 2.0 °C	
Filter	± 3.0 °C				

เอกสารไม่ควบคุม

Certificate No: G 640118
Date of issue : 04-Mar-21

Instrument description : Flue gas Analyzer
Instrument model : Testo 350 New
Instrument serial no. : 60899617
ID no. or control no. : UAE.EFM. 007/2560
Manufacturer : testo AG
Probe description : -
Probe model : -
Probe serial : -
Customer name : United Analyst and Engineering Consultant Co., Ltd.
Customer address : 81 Soi Udomsak 41, Sukhumvit Rd., Bangkok, Phrakhanong, Bangkok 10260

Total pages of certificate : 3 Pages
Receiving no. : L-210518
Receiving date : 22-Feb-21
Parameter of calibration : Gas Calibration(Oxygen 2.501, 10.00, 21.00 %Vol, Carbon Monoxide 80.23, 301.4, 1002 ppm, Nitric Oxide 10.04, 150.2, 320.9 ppm, Sulphur Dioxide 50.28, 100.5, 600.0 ppm, Nitrogen Dioxide 10.20, 80.37, 200.8 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, Toongsongkhong, Laksi, Bangkok 10210

Calibration procedure 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.
This calibration certificate documents are traceability to national standards, which realize measurement according to the International System of Units (SI).

Date of calibration : 01-Mar-21


Mr. Kwanchai Khamdoung
Calibration Technician


Mrs. Nongluck Wongtettee
Technical Manager

FM-CL-09-C Rev.B

Page 1 of 3

Issued Date 26/02/16

เอกสารไม่ควบคุม

Certificate No.: G 640118

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O ₂) 2.501 % Vol	2431/19	Linde	16-Jul-23
Oxygen (O ₂) 10.00 % Vol	2453/19	Linde	18-Jul-23
Oxygen (O ₂) 21.00 % Vol	2426/19	Linde	16-Jul-23
Carbon monoxide (CO) 80.23 ppm	2196/19	Linde	15-Jul-21
Carbon monoxide (CO) 301.4 ppm	2397/19	Linde	16-Jul-21
Carbon monoxide (CO) 1002 ppm	2424/19	Linde	17-Jul-21
Nitric Oxide (NO) 10.04 ppm	2448/19	Linde	17-Jul-21
Nitric Oxide (NO) 150.2 ppm	2309/19	Linde	07-Jul-21
Nitric Oxide (NO) 320.9 ppm	2433/19	Linde	16-Jul-21
Sulphur Dioxide (SO ₂) 50.28 ppm	2410/19	Linde	23-Jul-21
Sulphur Dioxide (SO ₂) 100.5 ppm	2400/19	Linde	18-Jul-21
Sulphur Dioxide (SO ₂) 600.0 ppm	2398/19	Linde	16-Jul-21
Nitrogen Dioxide (NO ₂) 10.20 ppm	2929/19	Linde	27-Aug-21
Nitrogen Dioxide (NO ₂) 80.37 ppm	2379/19	Linde	14-Jul-21
Nitrogen Dioxide (NO ₂) 200.8 ppm	2347/19	Linde	10-Jul-21

Measured room conditions

Temperature : 23 °C Humidity : 46.5 %RH Pressure : 1015.1 mbar

Calibration conditions

Gas Temperature : 23 °C Flow rate : 1,100 ml/min Gas pressure : 1021.6 mbar

Calibration Results Before Adjustment (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O ₂ (%Vol)	2.501	2.46	-0.041	0.20
O ₂ (%Vol)	10.00	9.92	-0.08	0.40
O ₂ (%Vol)	21.00	21.17	0.17	0.80
CO (ppm)	80.23	66	-14.23	2.8
CO (ppm)	301.4	247	-54.4	11
CO (ppm)	1002	836	-166	34
NO (ppm)	10.04	7	-3.04	3.0
NO (ppm)	150.2	158	-0.2	5.0
NO (ppm)	320.9	312	-8.9	10
SO ₂ (ppm)	50.28	51	0.72	5.0
SO ₂ (ppm)	100.5	101	0.5	5.0
SO ₂ (ppm)	600.0	606	6.0	14
NO ₂ (ppm)	10.20	9.1	-1.10	1.5
NO ₂ (ppm)	80.37	72.4	-7.97	5.0
NO ₂ (ppm)	200.8	189.2	-11.6	5.0

FM-CL-09-C Rev.B

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Issued Date 26/02/16

เอกสารไม่ควบคุม

Certificate No.: G 640118

Calibration Results After Adjustment (Table 3)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O ₂ (%Vol)	2.501	2.46	-0.041	0.20
O ₂ (%Vol)	10.00	9.92	-0.08	0.40
O ₂ (%Vol)	21.00	21.17	0.17	0.80
CO (ppm)	80.23	79	-1.23	2.8
CO (ppm)	301.4	299	-2.4	11
CO (ppm)	1002	1004	2	34
NO (ppm)	10.04	7	-3.04	3.0
NO (ppm)	150.2	150	-0.2	5.0
NO (ppm)	320.9	312	-8.9	10
SO ₂ (ppm)	50.28	51	0.72	5.0
SO ₂ (ppm)	100.5	101	0.5	5.0
SO ₂ (ppm)	600.0	606	6.0	14
NO ₂ (ppm)	10.20	11.2	1.00	1.5
NO ₂ (ppm)	80.37	81.2	0.83	5.0
NO ₂ (ppm)	200.8	201.9	1.1	5.0

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

Instrument description : Flue gas Analyzer
Instrument model : Testo 350 New
Instrument serial no. : 61658806
ID no. or control no. : UAE.EFM.122/2562
Manufacturer : testo AG
Probe description : -
Probe model : -
Probe serial : -
Customer name : United Analyst and Engineering Consultant Co., Ltd.
Customer address : 81 Soi Udomsak 41, Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260

Total pages of certificate : 3 Pages
Receiving no. : L-211058
Receiving date : 22-Apr-21
Parameter of calibration : Gas Calibration(Oxygen 2.501, 10.00, 21.00 %Vol, Carbon Monoxide 80.23, 301.4, 1002 ppm, Nitric Oxide 10.04, 150.2, 320.9 ppm, Sulphur Dioxide 50.28, 100.5, 600.0 ppm, Nitrogen Dioxide 10.20, 80.37, 200.8 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, Toongsongkhong, Laksi, Bangkok 10210

Calibration procedure 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.
This calibration certificate documents are traceability to national standards, which realize measurement according to the International System of Units (SI).

Date of calibration : 26-Apr-21


Mr. Kwanchai Khamdoung
Calibration Technician


Mrs. Nongluck Wongtettee
Technical Manager

FM-CL-09-C Rev.B

Page 3 of 3

Issued Date 26/02/16

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O ₂) 2.501 % Vol	2431/19	Linde	16-Jul-23
Oxygen (O ₂) 10.00 % Vol	2453/19	Linde	18-Jul-23
Oxygen (O ₂) 21.00 % Vol	2426/19	Linde	16-Jul-23
Carbon monoxide (CO) 80.23 ppm	2396/19	Linde	15-Jul-21
Carbon monoxide (CO) 301.4 ppm	2397/19	Linde	16-Jul-21
Carbon monoxide (CO) 1002 ppm	2424/19	Linde	17-Jul-21
Nitric Oxide (NO) 10.04 ppm	2448/19	Linde	17-Jul-21
Nitric Oxide (NO) 150.2 ppm	2309/19	Linde	07-Jul-21
Nitric Oxide (NO) 320.9 ppm	2453/19	Linde	16-Jul-21
Sulphur Dioxide (SO ₂) 50.28 ppm	2410/19	Linde	21-Jul-21
Sulphur Dioxide (SO ₂) 100.9 ppm	4942/20	Linde	20-Nov-22
Sulphur Dioxide (SO ₂) 600.0 ppm	2398/19	Linde	16-Jul-21
Nitrogen Dioxide (NO ₂) 10.20 ppm	2929/19	Linde	27-Aug-21
Nitrogen Dioxide (NO ₂) 80.37 ppm	2379/19	Linde	14-Jul-21
Nitrogen Dioxide (NO ₂) 200.8 ppm	2347/19	Linde	10-Jul-21

Measured room conditions

Temperature : 23.8 °C Humidity : 46.5 %RH Pressure : 1017.5 mbar

Calibration conditions

Gas Temperature : 23 °C Flow rate : 1,200 ml/min Gas pressure : 1021.6 mbar

Calibration Results Before Adjustment (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O ₂ (%Vol)	2.501	2.46	-0.041	0.20
O ₂ (%Vol)	10.00	9.87	-0.13	0.40
O ₂ (%Vol)	21.00	21.12	0.12	0.80
CO (ppm)	80.23	83	2.77	2.8
CO (ppm)	301.4	307	5.6	11
CO (ppm)	1002	1029	27	34
NO (ppm)	10.04	3	-7.04	3.0
NO (ppm)	150.2	144	-6.2	5.0
NO (ppm)	320.9	301	-19.9	10
SO ₂ (ppm)	50.28	51	0.72	5.0
SO ₂ (ppm)	100.9	102	1.1	5.0
SO ₂ (ppm)	600.0	603	3.0	14
NO ₂ (ppm)	10.20	11.0	0.80	1.5
NO ₂ (ppm)	80.37	81.4	1.03	5.0
NO ₂ (ppm)	200.8	202.3	1.5	5.0

Calibration Results After Adjustment (Table 3)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O ₂ (%Vol)	2.501	2.46	-0.041	0.20
O ₂ (%Vol)	10.00	9.87	-0.13	0.40
O ₂ (%Vol)	21.00	21.12	0.12	0.80
CO (ppm)	80.23	83	2.77	2.8
CO (ppm)	301.4	307	5.6	11
CO (ppm)	1002	1029	27	34
NO (ppm)	10.04	3	-7.04	3.0
NO (ppm)	150.2	144	-6.2	5.0
NO (ppm)	320.9	301	-19.9	10
SO ₂ (ppm)	50.28	51	0.72	5.0
SO ₂ (ppm)	100.9	102	1.1	5.0
SO ₂ (ppm)	600.0	603	3.0	14
NO ₂ (ppm)	10.20	11.0	0.80	1.5
NO ₂ (ppm)	80.37	81.4	1.03	5.0
NO ₂ (ppm)	200.8	202.3	1.5	5.0

Remark : 1 cm³/mol = 1 %vol , 1 µmol/mol = 1 ppm.

End of Report

ภาคผนวก ฉ

หนังสืออนุญาตขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท อินทิเกรตเต็ด รีเสิร์ช เซ็นเตอร์ จำกัด

ที่ อก ๐๓๑๐(๓)/ ๖๕๒



กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ เขตราชเทวี
กรุงเทพมหานคร ๑๐๔๐๐

๑๓ มกราคม ๒๕๖๓

เรื่อง ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน และเปลี่ยนแปลงชื่อห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท อินทิเกรตเต็ด รีเสิร์ช เซ็นเตอร์ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุหนังสืออนุญาตขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

ลงวันที่ ๒๑ ตุลาคม ๒๕๖๒

สิ่งที่ส่งมาด้วย เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท อินทิเกรตเต็ด รีเสิร์ช เซ็นเตอร์ จำกัด จำนวน ๒ แผ่น

ตามหนังสือที่อ้างถึง บริษัท อินทิเกรตเต็ด รีเสิร์ช เซ็นเตอร์ จำกัด ขอต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน และขอเปลี่ยนแปลงชื่อบริษัทของห้องปฏิบัติการวิเคราะห์เลขทะเบียน ว-๑๙๙ สถานที่ตั้งเลขที่ ๑๒๒ หมู่ที่ ๒ ตำบลท่าตูม อำเภอศรีมหาโพธิ จังหวัดปราจีนบุรี ต่อกรมโรงงานอุตสาหกรรม นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นให้เปลี่ยนแปลงชื่อบริษัท จากบริษัท ดี.เอ.รีเสิร์ช เซ็นเตอร์ จำกัด เป็น บริษัท อินทิเกรตเต็ด รีเสิร์ช เซ็นเตอร์ จำกัด และต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน โดยมีองค์ประกอบดังนี้

ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์

- | | | |
|------------------------|---------------|--------------|
| ๑) นางสาวทิทยา นันทมีน | ทะเบียนเลขที่ | ว-๑๙๙-ค-๖๔๙๓ |
| ๒) นางวีราภรณ์ ผลเจริญ | ทะเบียนเลขที่ | ว-๑๙๙-ค-๘๔๙๖ |

ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์

- | | | |
|---------------------------|---------------|--------------|
| ๑) นายชัยณรงค์ อินรินทร์ | ทะเบียนเลขที่ | ว-๑๙๙-จ-๕๖๘๕ |
| ๒) นางสาวอนันตพร งามสง่า | ทะเบียนเลขที่ | ว-๑๙๙-จ-๕๖๘๖ |
| ๓) นางสาวหนึ่งฤทัย อบมาลี | ทะเบียนเลขที่ | ว-๑๙๙-จ-๖๔๙๕ |
| ๔) นางสาวแววตา คำสา | ทะเบียนเลขที่ | ว-๑๙๙-จ-๖๔๙๗ |
| ๕) นายจักรีชัย อินทะ | ทะเบียนเลขที่ | ว-๑๙๙-จ-๘๔๙๗ |
| ๖) นางสาวชนนิภาณต์ แสนสุข | ทะเบียนเลขที่ | ว-๑๙๙-จ-๘๔๙๘ |
| ๗) นายกิตติพงษ์ คำกั้ง | ทะเบียนเลขที่ | ว-๑๙๙-จ-๘๔๙๙ |

ค. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนให้วิเคราะห์ในน้ำเสีย จำนวน ๒๒ รายการ และน้ำใต้ดิน จำนวน ๑๒ รายการ รวมทั้งสิ้นจำนวน ๓๔ รายการ ตามสิ่งที่ส่งมาด้วย

-๒-

หนังสือฉบับนี้จะหมดอายุในวันที่ ๑๘ พฤศจิกายน ๒๕๖๕ หากประสงค์จะต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออายุพร้อมเอกสารประกอบคำขอต่อกรมโรงงานอุตสาหกรรมภายใน ๓๐ วัน ก่อนวันสิ้นอายุของหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ซึ่งคำขอต่ออายุดังกล่าวขอรับได้ที่กรมโรงงานอุตสาหกรรม

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ


(นางจินดา เดชะครินทร์)
ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน
ปฏิบัติการตามหนังสือกรมโรงงานอุตสาหกรรม

กองวิจัยและเตือนภัยมลพิษโรงงาน
ศูนย์วิจัยและเตือนภัยมลพิษโรงงานภาคตะวันออก
โทร. ๐ ๓๘๐๕ ๗๒๖๑-๓
โทรสาร ๐ ๓๘๐๕ ๗๒๖๓

หนังสือ...

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท อินทีเกรเท็ด รีเสิร์ช เซ็นเตอร์ จำกัด

เลขทะเบียน ๖-๑๙๙


ที่ อก ๐๓๑๐(๓)/ ๒๕๖๒

ลงวันที่ ๑๓ มกราคม ๒๕๖๓

ขอขยายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๓๔ รายการ

น้ำเสีย จำนวน 22 รายการ

ลำดับที่	ชนิดสารมลพิษ	วิธีวิเคราะห์
1	Arsenic	Digestion, Inductively Coupled Plasma Method
2	Barium	Digestion, Inductively Coupled Plasma Method
3	Biochemical Oxygen Demand	5-Day BOD Test, Azide Modification Method
4	Cadmium	Digestion, Inductively Coupled Plasma Method
5	Chemical Oxygen Demand	Closed Reflux, Colorimetric Method
6	Color	ADMI Weighted - Ordinate Spectrophotometric Method
7	Copper	Digestion, Inductively Coupled Plasma Method
8	Free Chlorine	Iodometric Method
9	Hexavalent Chromium	Filtration, Colorimetric Method
10	Lead	Digestion, Inductively Coupled Plasma Method
11	Manganese	Digestion, Inductively Coupled Plasma Method
12	Nickle	Digestion, Inductively Coupled Plasma Method
13	Oil and Grease	Liquid-Liquid, Partition-Gravimetric Method
14	pH	Electrometric Method
15	Selenium	Digestion, Inductively Coupled Plasma Method
16	Sulfide	ZnS Precipitation, Iodometric Method
17	Temperature	Laboratory and Field Method
18	Total Chromium	Digestion, Inductively Coupled Plasma Method
19	Total Dissolved Solids	Dried at 180 °C
20	Total Suspended Solids	Dried at 103-105 °C
21	Trivalent Chromium	Digestion, Inductively Coupled Plasma Method Filtration, Colorimetric Method, Calculation
22	Zinc	Digestion, Inductively Coupled Plasma Method


 (นางสาววิชุดา สัมฤทธิ์ผล)
 นักวิทยาศาสตร์ชำนาญการ ทำหน้าที่แทน
 ผู้อำนวยการศูนย์วิจัยและเตือนภัยมลพิษโรงงานภาคตะวันออก

Arsenic...


-2-

น้ำใต้ดิน จำนวน 12 รายการ

ลำดับที่	ชนิดสารมลพิษ	วิธีวิเคราะห์
1	Arsenic	Digestion, Inductively Coupled Plasma Method
2	Barium	Digestion, Inductively Coupled Plasma Method
3	Cadmium	Digestion, Inductively Coupled Plasma Method
4	Chromium	Digestion, Inductively Coupled Plasma Method
5	Hexavalent Chromium	Filtration, Colorimetric Method
6	Lead	Digestion, Inductively Coupled Plasma Method
7	Manganese	Digestion, Inductively Coupled Plasma Method
8	Nickel	Digestion, Inductively Coupled Plasma Method
9	pH	Electrometric Method
10	Selenium	Digestion, Inductively Coupled Plasma Method
11	Trivalent Chromium	Inductively Coupled Plasma Method; Filtration, Colorimetric Method; Calculation
12	Zinc	Digestion, Inductively Coupled Plasma Method

เอกสารอ้างอิง

APHA, AWWA, WEF. Standard Methods for the Examination of Water and Wastewater. 23rd ed. Washington, DC : APHA, 2017


 (นางสาววิชุดา สัมฤทธิ์ผล)
 นักวิทยาศาสตร์ชำนาญการ ทำหน้าที่แทน
 ผู้อำนวยการศูนย์วิจัยและเตือนภัยมลพิษโรงงานภาคตะวันออก

บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด



ที่ อก ๐๓๐(๑)/ ๑๘๗ ๕

กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๐ ๙ กุมภาพันธ์ ๒๕๖๕

เรื่อง ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท ยูโนเดค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และขอขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๒๗ ธันวาคม ๒๕๖๔

- สิ่งที่ส่งมาด้วย ๑. รายชื่อผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๔๐ ราย
๒. รายชื่อเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๐๖ ราย
๓. ขอบข่ายสามารถให้บริการได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม

ตามหนังสือที่ยังอ้างถึง บริษัท ยูโนเดค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด
ขอต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๑๕๕ สถานที่ตั้งเลขที่ ๓
ซอยสุขุมวิท ๔๑ ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร ต่อกรมโรงงานอุตสาหกรรม นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้ความเห็น ยูโนเดค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง
คอนซัลแตนท์ จำกัด ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน โดยมีองค์ประกอบดังนี้
ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๔๐ ราย ตามสิ่งที่ส่งมาด้วย ๑
ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๐๖ ราย ตามสิ่งที่ส่งมาด้วย ๒
ค. ขอบข่ายสามารถให้บริการได้รับขึ้นทะเบียนวิเคราะห์ในน้ำเสีย น้ำดื่ม อากาศเสีย สิ่งปฏิกูล
หรือวัสดุที่ไม่ใช่แล้ว และดิน ตามสิ่งที่ส่งมาด้วย ๓

หนังสือฉบับนี้จะหมดอายุในวันที่ ๒ กุมภาพันธ์ ๒๕๖๕ หากประสงค์จะต่ออายุหนังสือ
รับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออายุพร้อมเอกสารประกอบคำขอต่อ
กรมโรงงานอุตสาหกรรมภายใน ๓๐ วัน ก่อนวันสิ้นสุดอายุของหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
ทั้งนี้ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ทั้งผ่านเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ที่แนบ
หนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(นางจินดา เชนะคันทรี่)
ผู้อำนวยการกองวิจัยและพัฒนาบริการโรงงาน
ปฏิบัติการทางเทคนิคกรมโรงงานอุตสาหกรรม



ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์

กองวิจัยและพัฒนาบริการโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๕๓๐ ๖๓๒๖ ต่อ ๒๐๓๓-๕

โทรสาร ๐ ๒๕๓๐ ๖๓๒๖ ต่อ ๒๐๓๓-๕

ไปรษณีย์อิเล็กทรอนิกส์ saraban@dwf.go.th

สิ่งที่ส่งมาด้วย ๑

เอกสารแนบท้ายหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
บริษัท ยูโนเดค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด เลขทะเบียน ๖-๑๕๕
ที่ อก ๐๓๐(๑)/ ๑๘๗ ๕ ลงวันที่ ๐๙ กุมภาพันธ์ ๒๕๖๕

ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๔๐ ราย

๑) นางสาวกชกรวรรณ กัชรวิตรกุล	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๐๑
๒) นายณรงค์ ชินพาสี	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๐๒
๓) นางสาวนันทิดา บุญโสม	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๐๓
๔) นางปิยะพัชร สุทธิมนัสวงษ์	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๐๔
๕) นางมานิดา แสงโสม	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๐๕
๖) นางสาวเบญจวรรณ วีระโยทัย	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๐๖
๗) นายธนพรรัตน์ วงศ์อนุรักษชัย	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๐๗
๘) นางสาวฉวีวรรณ บุญลา	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๐๘
๙) นายสุวิทย์ จอดนอก	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๐๙
๑๐) นางสาวโชติกา สมบูรณ์	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๑๐
๑๑) นางสาวบุษกร เลิศกาญจน์	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๑๑
๑๒) นางสาววิไลลักษณ์ ศรีสุข	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๑๒
๑๓) นางสาวปวีณา จรัสใจพิเศษ	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๑๓
๑๔) นายศิลา บรรจงรัก	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๑๔
๑๕) นายปฏิกรณ์ คณะนา	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๑๕
๑๖) นายธีรวัฒน์ ชามัง	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๑๖
๑๗) นางสาวศิริพร ศรีประสิทธิ์	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๑๗
๑๘) นางสาวลลิตา วิจิตร	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๑๘
๑๙) นางสาวนพวรรณ สุราษฎร์	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๑๙
๒๐) นายบุรุษ พานิชย์เลิศคำไพ	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๒๐
๒๑) นายณัฐวัฒน์ แสงสวัสดิ์	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๒๑
๒๒) นายเอกกรีน ปะกะนันท์	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๒๒
๒๓) นางสาวนิศากร ศรีสกุลสิทธิ์	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๒๓
๒๔) นางสาวจตุพร จันทร์ ทำสะอาด	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๒๔
๒๕) นางสาวสุวรรณา คงทอง	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๒๕
๒๖) นางสาววรรณ ทัดสองชั้น	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๒๖
๒๗) นายวิรุทธ โภกแก้ว	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๒๗
๒๘) นายวิรุทธ เทพคุณ	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๒๘
๒๙) นายอนุศาสน์ สวัสดิ์	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๒๙
๓๐) นายกรวิทย์ เขียวศรีสกุล	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๓๐
๓๑) นางสาวอริกา รังศรีรัตน์	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๓๑
๓๒) นางสาวนภสรวรรณ คงคำ	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๓๒
๓๓) นายสุทธิธรรมา อนุชันทน์	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๓๓
๓๔) นางสาวทัศนีย์ อ่อนคำ	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๓๔
๓๕) นางสาวพิมพ์พรหม สมบูรณ์ธรรม	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๓๕

(นางจินดา เชนะคันทรี่)
ผู้อำนวยการกองวิจัยและพัฒนาบริการโรงงาน
ปฏิบัติการทางเทคนิคกรมโรงงานอุตสาหกรรม

๓๖) นายณัฐวุฒิ...

-๒-

เอกสารแนบท้ายหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
บริษัท ยูโนเดค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด เลขทะเบียน ๖-๑๕๕
ที่ อก ๐๓๐(๑)/ ๑๘๗ ๕ ลงวันที่ ๐๙ กุมภาพันธ์ ๒๕๖๕

ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๐๖ ราย

๑) นายสุทัศน์ พันสีห์	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๐๑
๒) นางสาวธรรมา แก้วชื่นนอก	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๐๒
๓) นายพัชรินทร์ เจริญผล	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๐๓
๔) นางสาววิไลลักษณ์ เกตุสง	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๐๔
๕) นายสมชาติ อุทุมรัตน์	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๐๕
๖) นางสาวปรมาภรณ์ ทองแก้ว	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๐๖
๗) นางสาวกัญญา สมพงษ์	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๐๗
๘) นายธรรกร เทพทอง	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๐๘
๙) นางสาวอรวิรัตน์ พุทธา	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๐๙
๑๐) นางสาววรรณ สายบุญเรือน	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๑๐
๑๑) นายฤกษ์พงษ์ นามทิพย์	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๑๑
๑๒) นางสาวอรอนงค์ อ่อนคง	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๑๒
๑๓) นายกิตติศักดิ์ ทรงจำรัส	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๑๓
๑๔) นางสาวอักษรินทร์ บุญคง	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๑๔
๑๕) นางสาวพรพิมล นวนทอง	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๑๕
๑๖) นายวิชญ์ สุวรรณราช	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๑๖
๑๗) นายอภิรักษ์ ทุ่งทำ	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๑๗
๑๘) นายณณิต ปานจิติ	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๑๘
๑๙) นายเทพ อนุพิรุทธิ์	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๑๙
๒๐) นางสาวกัญญา โยธา	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๒๐
๒๑) นางสาวภาวิณี สุทธิ	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๒๑
๒๒) นางสาวชนัญญา อภิสิทธิ์ปภา	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๒๒
๒๓) นายศิริพงษ์ จงสูงเกียรติ	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๒๓
๒๔) นางสาวสุภาวดี อินยาคีรี	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๒๔
๒๕) นายพงศ์เทพ เหล่าเพชร	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๒๕
๒๖) นายขวัญชัย พันทุก	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๒๖
๒๗) นางสาวพัชริดา ศิริพิศาล	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๒๗
๒๘) นางสาวณิกานต์ เสือคำจันทร์	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๒๘
๒๙) นายกานต์พงศ์ บุญทอง	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๒๙
๓๐) นางสาวสุภาวดี เจริญชัยสมบัติ	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๓๐
๓๑) นายณพนธ์ จอ	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๓๑
๓๒) นายพิชิตพงษ์ ปัญญาศิลป์	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๓๒
๓๓) นายปรีดา ไชยกุล	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๓๓
๓๔) นายชัชวาลย์ เลื่อนทอง	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๓๔
๓๕) นายปิยะณัฐ ศรีภูโง่น	ทะเบียนเลขที่ ๖-๑๕๕-๕-๐๐๓๕

(นางจินดา เชนะคันทรี่)
ผู้อำนวยการกองวิจัยและพัฒนาบริการโรงงาน
ปฏิบัติการทางเทคนิคกรมโรงงานอุตสาหกรรม

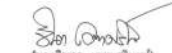
๓๖) นายณัฐวุฒิ...

๓๖) นายสมสันต์ ฐิตะธรรมรัตน์
๓๗) นายกันนิกร วัชรโส
๓๘) นายจักรพันธ์ ภูมรินทร์
๓๙) นายปิยธิดา กลมเกลียว
๔๐) นายธีรวัฒน์ นาคโพธิ์ศรี
๔๑) นายธีรเมธ สุขศรี
๔๒) นายบุญฤทธิ์ ก้อนสิน
๔๓) นายพรพจน์ ไกลสกุล
๔๔) นายอชิตะ แสงจันทร์
๔๕) นายณัฐพงษ์ เมืองชัย
๔๖) นายนิธ เลิศประเสริฐ
๔๗) นางสาวนิภากร จันทร์เขตต์
๔๘) นายสุทธพงษ์ อีระสุข
๔๙) นายรณภพ ภูตะกูลพัฒนา
๕๐) นางสาวศิริวรรณ ขอนพา
๕๑) นายสมพงษ์ สกุลไทย
๕๒) นายสุวิทย์ นิธิจิตฺตราช
๕๓) นายอชิตาฐิต ยนต์ศิริ
๕๔) นายเอกวุฒิ เสนอใจ
๕๕) นายสุทัศน์ บุญเลี้ยง
๕๖) นายธนเดช หวานสนา
๕๗) นายพิพัฒน์ สันตกุล
๕๘) นายอภิสิทธิ์ ศรีคมแก้ว
๕๙) นายภูวดล มงคลสูง
๖๐) นายอุทัย แก้วราษฎร์
๖๑) นางสาววรินทร์ สานนท์
๖๒) นายภูกร รินวงศ์
๖๓) นายศุภกิจสิทธิ์ เกตุสิง
๖๔) นางสาวศิริพร อภัยรัตน์
๖๕) นางสาวจินตสุภา เปลี่ยนศรี
๖๖) นางสาวนศรนาถ กลมบุญ
๖๗) นางสาวอริยา หวามย์
๖๘) นายจิรวัฒน์ สุขเกษม
๖๙) นายกิตติพงษ์ สอนชัยภูมิ
๗๐) นายจุฑาพร สวมเพชร
๗๑) นางสาวพชรภรณ์ แสงฟ้า
๗๒) นายรัตนชัย เหล่ามา

ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๓๖
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ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๔๑
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ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๔๙
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ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๕๑
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ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๕๕
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ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๕๗
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ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๕๙
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ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๖๑
ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๖๒
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ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๖๘
ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๖๙
ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๗๐
ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๗๑
ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๗๒

๗๓) นายอิทธิพงษ์ ศรีวิเศษ
๗๔) นางสาวกรณิการ์ ลำลิทา
๗๕) นายสุภากรณ์ พิมพ์ศรี
๗๖) นายพรชัย คู่ม่วง
๗๗) นางสาวศศิธร ใจยพาร
๗๘) นายธีรพงษ์ ศรีคำแหง
๗๙) นางสาวณัฐชา พรหมศิริ
๘๐) นางสาวสิริดาวัลย์ โพธิ์พันธ์
๘๑) นางสาวกมลวรรณ เข็มจันทร์
๘๒) นายณวัฒน์ จันทะคุณ
๘๓) นายธีรวัฒน์ ไชยชู
๘๔) นางสาวพรนิจา กลิ่นจูน
๘๕) นายณกสิทธิ์ ศรีพิมพ์
๘๖) นางสาวลลิกา จันทสุข
๘๗) นายสงกรานต์ นาสัยทอง
๘๘) นางสาวลาธิศา แสงเดียว
๘๙) นายศักดิ์สอน นุ่มนัม
๙๐) นายพรพงษ์ นพจันทร์
๙๑) นางสาวนภา มาตมาตาร
๙๒) นางสาวอรอนงค์ คุ้มพันธุ์ชัย
๙๓) นายวีระยุทธ สารวัตร
๙๔) นางสาววิธิตา วีระพันธุ์วัฒน์
๙๕) นายฤทธิพล พงศ์สารพร
๙๖) นายณัฐชัย พรหมอารักษ์
๙๗) นายชินพร พานแก้ว
๙๘) นายรัชชาพล โสภ
๙๙) นายธีรรัตน์ แสนงาม
๑๐๐) นางสาวอรอนงค์ อาราม
๑๐๑) นายอาทิตย์ อุดมผล
๑๐๒) นายปวรร บุญนาค
๑๐๓) นายอิทธิเดช ใจบุญ
๑๐๔) นายคณิติน พงษ์อัคราบุตร
๑๐๕) นางสาวสุภาวดี จันทร์ประทีป
๑๐๖) นายเสกสรรค์ เอกกลิ่นบัว

ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๗๓
ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๗๔
ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๗๕
ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๗๖
ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๗๗
ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๗๘
ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๗๙
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ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๘๓
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ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๑๐๖


(นางนงคา เลเชชนวิทย์)
ผู้อำนวยการกองวิจัยและพัฒนาสิ่งแวดล้อม
ปฎิบัติราชการแทนอธิบดีกรมควบคุมมลพิษ

๗๓) นายอิทธิพงษ์...


(นางนงคา เลเชชนวิทย์)
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สิ่งที่ส่งมาด้วย ๓

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกสาร
บริษัท ยูโนเทค แอนนาลิซิส แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด เลขทะเบียน ๖-๑๕๕
ที่ ๑๐ ๐๓๐(๑)/ ๑๕ ๗ ๕ ลงวันที่ ๑๔ กุมภาพันธ์ ๒๕๖๕

ขอขยายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๓๕๗ รายการ

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
1	Aldrin	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾
2	Arsenic	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ⁽¹⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽¹⁾ Digestion, Inductively Coupled Plasma Method ⁽¹⁾
3	Barium	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾
4	α-BHC	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾
5	β-BHC	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾
6	δ-BHC	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾
7	γ-BHC	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾
8	Biochemical Oxygen Demand	1) 5-Day BOD Test, Azide Modification Method ⁽¹⁾ 2) 5-Day BOD Test, Membrane Electrode Method ⁽¹⁾
9	Cadmium	1) Digestion, Direct Air-Acetylene Flame Method ⁽¹⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽¹⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽¹⁾
10	Chemical Oxygen Demand	1) Closed Reflux, Titrimetric Method ⁽¹⁾ 2) Closed Reflux, Colorimetric Method ⁽¹⁾ 3) Open Reflux, Titrimetric Method ⁽¹⁾
11	Chlordane	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾
12	Chromium	1) Digestion, Direct Air-Acetylene Flame Method ⁽¹⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽¹⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽¹⁾
13	Color	ADMI Weighted-Ordinate Spectrophotometric Method ⁽¹⁾
14	Copper	1) Digestion, Direct Air-Acetylene Flame Method ⁽¹⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽¹⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽¹⁾
15	Cyanide	1) Distillation, Colorimetric Method ⁽¹⁾ 2) Flow Injection Analysis Method ⁽¹⁾

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
16	o,p'-DDT	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾
17	4,4'-DDD	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾
18	4,4'-DDE	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾
19	4,4'-DDT	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾
20	Dieldrin	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾
21	Endosulfan I	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾
22	Endosulfan II	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾
23	Endosulfan sulfate	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾
24	Endrin	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾
25	Endrin aldehyde	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾
26	Formaldehyde	Distillation, Colorimetric Method ⁽¹⁾
27	Free Chlorine	1) Iodometric Method ⁽¹⁾ 2) DPD Ferrous Titrimetric Method ⁽¹⁾
28	Heptachlor	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾
29	Heptachlor Epoxide	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾
30	Hexavalent Chromium	1) Colorimetric Method ⁽¹⁾ 2) Extraction, Direct Air-Acetylene Flame Method ⁽¹⁾
31	Lead	1) Digestion, Direct Air-Acetylene Flame Method ⁽¹⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽¹⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽¹⁾
32	Manganese	1) Digestion, Direct Air-Acetylene Flame Method ⁽¹⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽¹⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽¹⁾
33	Mercury	Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽¹⁾
34	Methoxychlor	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾
35	Nickel	1) Digestion, Direct Air-Acetylene Flame Method ⁽¹⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽¹⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽¹⁾

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
36	Oil & Grease	1) Liquid-Liquid, Partition-Gravimetric Method ⁽⁴⁾ 2) Soxhlet Extraction Method ⁽⁴⁾
37	pH	Electrometric Method ⁽²⁾
38	Phenols	1) Distillation, Chloroform Extraction Method ⁽⁴⁾ 2) Distillation, Direct Photometric Method ⁽⁴⁾
39	Selenium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
40	Sulfide	1) Iodometric Method ⁽⁴⁾ 2) Methylene Blue Method ⁽⁴⁾
41	Temperature	Laboratory and Field Methods ⁽⁴⁾
42	Total Dissolved Solids	Dried at 180 °C ⁽⁴⁾
43	Total Kjeldahl Nitrogen	Semi-Micro-Kjeldahl Method ⁽⁴⁾
44	Total Suspended Solids	Dried at 103-105 °C ⁽⁴⁾
45	Trivalent Chromium	1) Digestion, Direct Air-Acetylene Flame Method; Colorimetric Method; Calculation ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation ⁽⁴⁾
46	Zinc	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾

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ลำดับ	สารมลพิษ	วิธีวิเคราะห์
1	Acenaphthene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
2	Acetone	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
3	Aldrin	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ (2,4-D)

4 Anthracene...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
4	Anthracene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
5	Antimony	Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
6	Arsenic	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
7	Atrazine	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
8	Barium	1) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
9	Benz(a)anthracene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
10	Benzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
11	Benzo(b)fluoranthene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
12	Benzo(k)fluoranthene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
13	Benzoic acid	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
14	Benzo(a)pyrene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ (2,4-D)

15 Benzo(g,h,i)perylene...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
15	Benzo(g,h,i)perylene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
16	Beryllium	Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
17	Bis(2-chloroethyl)ether	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
18	Bis(2-ethylhexyl)phthalate	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
19	Bromodichloromethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
20	Bromoform	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
21	Butanol	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
22	Butyl benzyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
23	Cadmium	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
24	Carbazole	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
25	Carbon disulfide	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
26	Carbon tetrachloride	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
27	Chlordane	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
28	p-Chloroaniline	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
29	Chlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ (2,4-D)

30 Chlorodibromomethane...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
30	Chlorodibromomethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
31	Chloroform	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
32	2-Chlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
33	Chromium	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
34	Chromium (III)	1) Digestion, Direct Air-Acetylene Flame Method; Colorimetric Method; Calculation ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation ⁽⁴⁾
35	Chromium (VI)	1) Colorimetric Method ⁽⁴⁾ 2) Extraction, Air-Acetylene Flame Method ⁽⁴⁾
36	Chrysene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
37	Cyanide	Distillation, Colorimetric Method ⁽⁴⁾
38	2,4-D	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
39	DDD	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
40	DDE	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
41	DDT	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ (2,4-D)

42 Dibenzo(a,h)anthracene...

ลำดับ	สารเคมี	วิธีวิเคราะห์
42	Dibenz(a,h)anthracene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
43	Di-n-butyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
44	1,2-Dichlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
45	1,3-Dichlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
46	1,4-Dichlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
47	3,3'-Dichlorobenzidine	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
48	1,1-Dichloroethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
49	1,2-Dichloroethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
50	1,1-Dichloroethylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
51	cis-1,2-Dichloroethylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
52	trans-1,2-Dichloroethylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
53	2,4-Dichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
54	1,2-Dichloropropene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
55	1,3-Dichloropropane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
56	1,3-Dichloropropene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
57	Dieldrin	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ ^{(๕) (๖) (๗)}

58 Diethyl phthalate...

ลำดับ	สารเคมี	วิธีวิเคราะห์
58	Diethyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
59	2,4-Dimethylphenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
60	2,4-Dinitrophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
61	2,4-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
62	2,6-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
63	Di-n-Octyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
64	Endosulfan	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
65	Endrin	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
66	Ethylbenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
67	Fluoranthene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
68	Fluorene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
69	Heptachlor	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ ^{(๕) (๖) (๗)}

70 Heptachlor epoxide...

ลำดับ	สารเคมี	วิธีวิเคราะห์
70	Heptachlor epoxide	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
71	Hexachlorobenzene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
72	Hexachloro-1,3-butadiene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
73	n-Hexane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
74	α-HCH	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
75	β-HCH	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
76	γ-HCH	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
77	Hexachlorocyclopentadiene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
78	Hexachloroethane	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
79	Indeno(1,2,3-cd)pyrene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
80	Isophorone	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
81	Lead	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ ^{(๕) (๖) (๗)}


82 Manganese...

ลำดับ	สารเคมี	วิธีวิเคราะห์
82	Manganese	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
83	Mercury	Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽⁴⁾
84	Methanol	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
85	Methoxychlor	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
86	Methyl bromide	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
87	Methylene chloride	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
88	2-Methylphenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
89	2-Methylnaphthalene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
90	Methyl tert-butyl ether	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
91	Naphthalene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
92	Nickel	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
93	Nitrobenzene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
94	N-Nitrosodiphenylamine	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
95	N-Nitrosodi-n-propylamine	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ ^{(๕) (๖) (๗)}

96 Polychlorinated Biphenyls...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
96	Polychlorinated Biphenyls - PCB 1016 - PCB 1221 - PCB 1232 - PCB-1242 - PCB-1248 - PCB-1254 - PCB-1260	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
97	Pentachlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
98	pH	Electrometric Method ⁽⁴⁾
99	Phenanthrene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
100	Phenol	1) Distillation, Chloroform Extraction Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
101	Pyrene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
102	Selenium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
103	Silver	Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
104	Styrene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
105	1,1,2,2-Tetrachloroethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
106	Tetrachloroethylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
107	Toluene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ 


108 Toxaphene...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
108	Toxaphene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
109	TPH (C ₅ - C ₆)	1) Purge and Trap, Gas Chromatographic Method ^(11,21) 2) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(11,21)
110	TPH (C ₁₀ - C ₁₄)	Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(9,21)
111	TPH (C ₁₆ - C ₃₀)	Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(9,21)
112	1,2,4-Trichlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
113	1,1,1-Trichloroethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
114	1,1,2-Trichloroethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
115	Trichloroethylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
116	2,4,5-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
117	2,4,6-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
118	1,3,5-Trimethylbenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
119	Vanadium	Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
120	Vinyl acetate	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
121	Vinyl chloride	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
122	m-Xylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
123	o-Xylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ 

124 p-Xylene...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
124	p-Xylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
125	Xylene (Total)	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
126	Zinc	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾

จากาศเลี่ย (ปล่องระบาย) จำนวน 25 รายการ

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
1	Antimony	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾
2	Arsenic	1) Isokinetic Sampling, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ⁽⁵⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾
3	Cadmium	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ⁽⁵⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾
4	Carbon Monoxide	Instrumental Analyzer Method ⁽⁵⁾
5	Chlorine	Isokinetic Sampling, Ion Chromatographic Method ⁽⁵⁾
6	Chromium	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ⁽⁵⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾
7	Cobalt	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾
8	Copper	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ⁽⁵⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾
9	Cresol	Absorption Sampling, Gas Chromatographic Method ⁽⁵⁾ 

10 Dioxins/Furans...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
10	Dioxins/Furans	Isokinetic Sampling ⁽⁵⁾
11	Hydrogen Chloride	Isokinetic Sampling, Ion Chromatographic Method ⁽⁵⁾
12	Hydrogen Fluoride	Isokinetic Sampling, Ion Chromatographic Method ⁽⁵⁾
13	Hydrogen Sulfide	Absorption Sampling, Iodometric Method ⁽⁵⁾
14	Lead	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ⁽⁵⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾
15	Manganese	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ⁽⁵⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾
16	Mercury	Isokinetic Sampling, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽⁵⁾
17	Nickel	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ⁽⁵⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾
18	Opacity	Ringelmann's Method ⁽²⁾
19	Oxides of Nitrogen	1) Absorption Sampling, Phenoldisulfonic acid Method ⁽⁵⁾ 2) Instrumental Analyzer Method ⁽⁵⁾
20	Selenium	1) Isokinetic Sampling, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ⁽⁵⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾
21	Sulfur Dioxide	1) Absorption Sampling, Barium-Thorin Titrimetric Method ⁽⁵⁾ 2) Instrumental Analyzer Method ⁽⁵⁾
22	Sulfuric Acid	Isokinetic Sampling, Barium-Thorin Titrimetric Method ⁽⁵⁾
23	Total Suspended Particulate	Isokinetic Sampling, Gravimetric Method ⁽⁵⁾
24	Vanadium	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾
25	Xylene	1) Bag Sampling, Gas Chromatographic Method ⁽⁵⁾ 2) Adsorption Sampling, Gas Chromatographic Method ⁽⁵⁾ 

สิ่งบ่งชี้...

สิ่งปลูกสร้างวัสดุที่ไม่ใช้แล้ว จำนวน 35 รายการ

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
1	Aldrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
2	Antimony	Digestion, Inductively Coupled Plasma Method ^(7,13)
3	Arsenic	1) Waste Extraction, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(2,6,15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(7,15) 4) Digestion, Inductively Coupled Plasma Method ^(7,13)
4	Barium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
5	Beryllium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
6	Cadmium	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(2,6,14) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 4) Digestion, Inductively Coupled Plasma Method ^(7,13)
7	Chlordane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
8	Chromium	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(2,6,14) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13)

3) Digestion,...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
9	Chromium (III)	3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 4) Digestion, Inductively Coupled Plasma Method ^(7,13) 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method; Waste Extraction, Colorimetric Method; Calculation ^(2,6,14,16) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method; Waste Extraction, Colorimetric Method; Calculation ^(2,6,13,16) 3) Digestion, Flame Atomic Absorption Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation ^(7,8,14,16) 4) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation ^(7,8,13,16)
10	Chromium (VI)	1) Waste Extraction, Colorimetric Method ^(2,6,16) 2) Alkaline Digestion, Colorimetric Method ^(8,16)
11	Cobalt	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
12	Copper	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(2,6,14) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 4) Digestion, Inductively Coupled Plasma Method ^(7,13)
13	2,4-D	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
14	DDD	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)

15 DOE...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
15	DDE	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
16	DDT	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
17	Dieldrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
18	Endrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
19	Heptachlor	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
20	Lead	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(2,6,14) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 4) Digestion, Inductively Coupled Plasma Method ^(7,13)
21	Lindane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
22	Mercury	1) Waste Extraction, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ^(2,17) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13)

3) Digestion,...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
23	Methoxychlor	3) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽¹⁶⁾ 4) Digestion, Inductively Coupled Plasma Method ^(7,13) 5) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method ⁽¹⁸⁾ 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
24	Molybdenum	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
25	Nickel	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(2,6,14) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 4) Digestion, Inductively Coupled Plasma Method ^(7,13)
26	Polychlorinated Biphenyls - Aroclor 1016 - Aroclor 1221 - Aroclor 1232 - Aroclor 1242 - Aroclor 1248 - Aroclor 1254 - Aroclor 1260 - 2-Chlorobiphenyl - 2,3-Dichlorobiphenyl - 2,2',5'-Trichlorobiphenyl - 2,4',5'-Trichlorobiphenyl - 2,2',3,5'-Tetrachlorobiphenyl - 2,2',5,5'-Tetrachlorobiphenyl - 2,3',4,4'-Tetrachlorobiphenyl - 2,2',3,4,5'-Pentachlorobiphenyl	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)

- 2,2',4,5,5'...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
27	- 2,2',4,5,5'-Pentachlorobiphenyl - 2,3,3',4',6'-Pentachlorobiphenyl - 2,2',3,4,4',5'-Hexachlorobiphenyl - 2,2',3,4,5,5'-Hexachlorobiphenyl - 2,2',3,5,5',6'-Hexachlorobiphenyl - 2,2',4,4',5,5'-Hexachlorobiphenyl - 2,2',3,3',4,4',5'-Heptachlorobiphenyl - 2,2',3,4,4',5,5'-Heptachlorobiphenyl - 2,2',3,4',5,5',6'-Heptachlorobiphenyl - 2,2',3,3',4,4',5,5',6'-Nonachlorobiphenyl Pentachlorophenol	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(2,9,28) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) Electrometric Method ^(31,30)
28	pH	
29	Selenium	1) Waste Extraction, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(2,4,40) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(7,20) 4) Digestion, Inductively Coupled Plasma Method ^(7,13)

30 Silver...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
30	Silver	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13)
31	Thallium	2) Digestion, Inductively Coupled Plasma Method ^(7,13) 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13)
32	Toxaphene	2) Digestion, Inductively Coupled Plasma Method ^(7,13) 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
33	Trichloroethylene	1) Waste Extraction, Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(2,12,23) 2) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23)
34	Vanadium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
35	Zinc	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(2,6,14) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 4) Digestion, Inductively Coupled Plasma Method ^(7,13)

ดิน จำนวน 125 รายการ

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
1	Acenaphthene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
2	Acetone	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25) 2) (1) (2)

3 Aldrin...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
3	Aldrin	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
4	Anthracene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
5	Antimony	Digestion, Inductively Coupled Plasma Method ^(7,13)
6	Arsenic	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(7,13) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
7	Atrazine	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
8	Barium	Digestion, Inductively Coupled Plasma Method ^(7,13)
9	Benz(a)anthracene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
10	Benzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23)
11	Benzo(b)fluoranthene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
12	Benzo(k)fluoranthene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
13	Benzoic acid	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
14	Benzo(a)pyrene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)

15 Benzo(g,h,i)perylene...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
15	Benzo(g,h,i)perylene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
16	Beryllium	Digestion, Inductively Coupled Plasma Method ^(7,13)
17	Bis(2-chloroethyl)ether	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
18	Bis(2-ethylhexyl)phthalate	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
19	Bromodichloromethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23)
20	Bromoform	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23)
21	Butanol	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23)
22	Butyl benzyl phthalate	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
23	Cadmium	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
24	Carbazole	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
25	Carbon disulfide	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23)
26	Carbon tetrachloride	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23)
27	Chlordane	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
28	p-Chloroaniline	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
29	Chlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23)
30	Chlorodibromomethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23) 2) (1) (2)

31 Chloroform...

ลำดับ	สารเคมี	วิธีวิเคราะห์
31	Chloroform	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
32	2-Chlorophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
33	Chromium	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
34	Chromium (III)	1) Digestion, Flame Atomic Absorption Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation ^(7,8,14,16) 2) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation ^(7,8,14,16)
35	Chromium (VI)	Alkaline Digestion, Colorimetric Method ^(9,16)
36	Chrysene	1) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
37	Cyanide	Extraction, Distillation, Colorimetric Method ^(28,29,30)
38	2,4-D	Ultrasonic Extraction, Gas Chromatographic Method ⁽²⁷⁾
39	DDD	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
40	DDE	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
41	DDT	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
42	Dibenz(a,h)anthracene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,26) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)

43 Di-n-butyl phthalate...

ลำดับ	สารเคมี	วิธีวิเคราะห์
43	Di-n-butyl phthalate	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
44	1,2-Dichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
45	1,3-Dichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
46	1,4-Dichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
47	3,3'-Dichlorobenzidine	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
48	1,1-Dichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
49	1,2-Dichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
50	1,1-Dichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
51	cis-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
52	trans-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
53	2,4-Dichlorophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
54	1,2-Dichloropropane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
55	1,3-Dichloropropane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
56	1,3-Dichloropropene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
57	Dieldrin	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
58	Diethyl phthalate	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
59	2,4-Dimethylphenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)

60 2,4-Dinitrophenol...

ลำดับ	สารเคมี	วิธีวิเคราะห์
60	2,4-Dinitrophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
61	2,4-Dinitrotoluene	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
62	2,6-Dinitrotoluene	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
63	Di-n-Octyl phthalate	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
64	Endosulfan	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
65	Endrin	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
66	Ethylbenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
67	Fluoranthene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,26) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
68	Fluorene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,26) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
69	Heptachlor	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
70	Heptachlor epoxide	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)

71 Hexachlorobenzene...

ลำดับ	สารเคมี	วิธีวิเคราะห์
71	Hexachlorobenzene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
72	Hexachloro-1,3-butadiene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
73	n-Hexane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
74	α-HCH	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
75	β-HCH	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
76	γ-HCH	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
77	Hexachlorocyclopentadiene	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
78	Hexachloroethane	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
79	Indeno(1,2,3-cd)pyrene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,26) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
80	Isophorone	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
81	Lead	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
82	Manganese	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)

83 Mercury...

ลำดับ	สารเคมี	วิธีวิเคราะห์
83	Mercury	1) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽¹⁸⁾ 2) Digestion, Inductively Coupled Plasma Method ^(7,13) 3) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method ⁽⁹⁾
84	Methanol	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23)
85	Methoxychlor	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
86	Methyl bromide	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23)
87	Methylene chloride	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23)
88	2-Methylphenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
89	2-Methylnaphthalene	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
90	Methyl tert-butyl ether	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23)
91	Naphthalene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,26) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
92	Nickel	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
93	Nitrobenzene	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
94	N-Nitrosodiphenylamine	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
95	N-Nitrosodi-n-propylamine	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)

96 Polychlorinated Biphenyls...

ลำดับ	สารเคมี	วิธีวิเคราะห์
96	Polychlorinated Biphenyls - Aroclor 1016 - Aroclor 1221 - Aroclor 1232 - Aroclor 1242 - Aroclor 1248 - Aroclor 1254 - Aroclor 1260 Polychlorinated Biphenyls - 2-Chlorobiphenyl - 2,3-Dichlorobiphenyl - 2,2',5'-Trichlorobiphenyl - 2,4,5'-Trichlorobiphenyl - 2,2',3,5'-Tetrachlorobiphenyl - 2,2',5,5'-Tetrachlorobiphenyl - 2,3',4,4'-Tetrachlorobiphenyl - 2,2',3,4,5'-Pentachlorobiphenyl - 2,2',4,5,5'-Pentachlorobiphenyl - 2,3,3',4',6'-Pentachlorobiphenyl - 2,2',3,4,4',5'-Hexachlorobiphenyl - 2,2',3,4,5,5'-Hexachlorobiphenyl - 2,2',3,5,5',6'-Hexachlorobiphenyl - 2,2',4,4',5,5'-Hexachlorobiphenyl - 2,2',3,3',4,4',5'-Heptachlorobiphenyl - 2,2',3,4,4',5,5'-Heptachlorobiphenyl - 2,2',3,4,4',5',6'-Heptachlorobiphenyl	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,23) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) Ultrasonic Extraction, Gas Chromatographic Method ^(10,23)

- 2,2',3,4',5,5',6...

ลำดับ	สารเคมี	วิธีวิเคราะห์
97	- 2,2',3,4',5,5',6-Heptachlorobiphenyl - 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl Pentachlorophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
98	Phenanthrene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,26) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
99	Phenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
100	Pyrene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,26) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
101	Selenium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(7,22) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
102	Silver	Digestion, Inductively Coupled Plasma Method ^(7,13)
103	Styrene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23)
104	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23)
105	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23)
106	Toluene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23)
107	Toxaphene	Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
108	TPH (C ₉ -C ₁₃)	1) Purge and Trap, Gas Chromatographic Method ^(12,23) 2) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23)
109	TPH (C ₁₀ -C ₁₉)	Ultrasonic Extraction, Gas Chromatographic Method ^(10,21)
110	TPH (C ₁₀ -C ₁₃)	Ultrasonic Extraction, Gas Chromatographic Method ^(10,21)
111	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23)

112 1,1,1-Trichloroethane...

ลำดับ	สารเคมี	วิธีวิเคราะห์
112	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23)
113	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23)
114	Trichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23)
115	2,4,5-Trichlorophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
116	2,4,6-Trichlorophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
117	1,3,5-Trimethylbenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23)
118	Vanadium	Digestion, Inductively Coupled Plasma Method ^(7,13)
119	Vinyl acetate	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23)
120	Vinyl chloride	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23)
121	m-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23)
122	o-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23)
123	p-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23)
124	Xylene (Total)	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23)
125	Zinc	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)

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