

SERVICE REPORT

Preventive Maintenance

For

Continuous Emission Monitoring System (CEMS)



EGCO COGENERATION CO., LTD



January, 2023 ^{1st}

JID2300041

BY:

PETRO-INSTRUMENTS CORP.,LTD

**PETRO-INSTRUMENTS CORP., LTD.**

7/409 Soi Vibhavadi-Rangsit 36, Vibhavadi-Rangsit Rd., Chatuchak, Chatuchak
Bangkok 10900 Thailand
Tel.:(+66) 2939 5711 (12 Lines), (+66) 2513 2333 (12 Lines), Fax. : (+66) 939

DOC. NUMBER

SERVICE REPORT

REPORT DATE

EQUIPMENT: CEMs	SERIAL NUMBER / TAG NUMBER -	BRAND / MANUFACTURER ABB
CUSTOMER NAME: Egco cogeneration	LACATION: Rayong	JOB NUMBER / REQUESTED NUMBER JID2300041

REASON FOR VISIT

- Preventive maintenance CEMs unit 11, 12.

FOUND FAILURE & CORRECTIVE ACTION DETAILS

- Operation checked of the gas analyzer all units.
- Checked diagnostic of the gas analyzer all units.
- Checked the sample gas cooler all unit was normal operation.
- Checked the sample gas feed all unit was normal operation.
- Checked the automatic condensate drain was normal operation.
- Checked the sample flow and by pass flow were kept in set point.
- Validate zero and span gas for the gas analyzer was normal response.
- Calibration zero and span gas for the gas analyzer by feed gas direct to the sample gas cooler.

Standard gas CO supply by PICO

WORK CONCLUSION

<input checked="" type="checkbox"/> COMPLETED		<input type="checkbox"/> IN COMPLETED	PARTS REPLACEMENT		
<input checked="" type="checkbox"/> CHARGE	<input type="checkbox"/> NO CHARGE		PARTS NAME	P/N	QTY.
<input type="checkbox"/> SERVICE FEE	<input type="checkbox"/> PROJECT WARRANTY	<input type="checkbox"/> TAKE TO OFFICE			
<input type="checkbox"/> TRAVELLING	<input type="checkbox"/> SERVICE WARRANTY	<input type="checkbox"/> WAIT FOR PARTS			
<input type="checkbox"/> SPARE PARTS	<input type="checkbox"/> PARTS WARRANTY	<input type="checkbox"/> IN PROCESS			
<input type="checkbox"/> OTHER	<input checked="" type="checkbox"/> SERVICE CONTRACT	<input type="checkbox"/> OTHER			

TIME SPENT (HOURS)

YEAR	2023								TOTAL HOURS	TRAVELING DETAILS	
MONTH	1									TRAVEL BY	
DATE	10								6	FROM	Pico
SERVICE TIME	6								-	TO	Rayong
OVERTIME	-								4	TOTAL ROUND TRIP	1
TRAVELING TIME	4								10	DISTANCE (KM.)	360
TOTAL HOURS	10										

SERVICE CREW

NAME		NAME	
1. Mr. Phuwanai N.		3.	
2.		4.	

CUSTOMER'S NAME 2674. Nintara 2901	CUSTOMER'S SIGNATURE 	DATE 13-1-2023
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UNIT 1A



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http : // www.pico.co.th E-mail-address : combustion@pico.co.th

SERVICE REPORT

Job No. :	JID2300041	Customer name :	EGCO COGENERATION
Equipment :	CEMS	Unit name :	1SAA-IRK-1A
Manufacturer :	ABB	Location :	Rayong
Model :	URAS 26	Contact name :	K. Pipat Udom
Serial No. :	3.345753.3	Telephone :	038-637-051-57 #9241
Working date :	10-January-2023	Fax. :	081-862-4780
Traveling hour :	4 Hr.	Email address :	Pipat.udo@egco.com
Mileage :	360 km.	Working Hour :	2 Hr.

SCOPE OF WORK	Preventive maintenance continuous emission monitoring system unit 1SAA-IRK-1A.
PHYSICAL & FUNCTION CHECK	<p>Sampling system.</p> <ul style="list-style-type: none"> - Checked the heated line was normal condition. - Checked the sample gas cooler was normal operation. - Checked the automatic condensate drain was normal operation. - Checked the acid filter was clean. - Checked the sample gas feed unit was normal operation. - Checked the filter membrane was clean. - Checked the sample flow and bypass flow were kept in set point. - Checked the condensate alarm for cut-off pump was normal operation. <p>Gas analyzer</p> <ul style="list-style-type: none"> - Diagnostics checked of the gas analyzer before calibration found were normal condition such as temperature, pressure. - Validate zero and span for the gas analyzer found normal responding.
CORRECT ACTION	<p>Gas analyzer</p> <ul style="list-style-type: none"> - Performed zero and span calibration for the gas analyzer by feed standard gas direct to the sample gas cooler. - Diagnostics checked of the gas analyzer after calibrations were normal condition.
PART REPLACEMENT	- No part replacement.
RECOMMENDATION	-

Internal information: ID Warranty.

Gas analyzer (Uras26) : 1360

Gas cooler (SCC-C) : 7703

Gas feed unit (SCC-F) : 7705

NO_x Converter : 7707

Sampling system 1A : 4156



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CHECK BY :	Mr. Phuwanai	DATE :	10-January-2023
APPROVE BY:	Mr. Nadthapong	DATE:	13-January-2023
CUSTOMER SIGN :		DATE :	



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GENERAL CHECK

UNIT NAME :	1SAA-IRK-1A	LOCATION :	HRSG 11
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ITEM	DESCRIPTION	SET-POINT VALUE	STATUS/VALUE		REMARK
			BEFORE	AFTER	
	Inside cabinet				
1	Temperature in Cabinet	20-25 °C	20.7 °C	24.7 °C	
2	Air conditioner	Operate	OK	OK	
3	Humidity in Cabinet	-	53 %	44 %	
4	Sample gas cooler temperature	3.0 °C	3.0 °C	3.0 °C	
5	Automatic Condensate Drain	Drain	Drain	Drain	
6	Flexible tube	Normal	Normal	Normal	
7	Acid filter	Clean	Clean	Clean	
8	Sample gas feed pump operate	Run	Run	Run	
9	Condensate filter	Clean	Clean	Clean	
10	Condensate monitor	Normal	Normal	Normal	
11	Sample flow	60 l/h	61 l/h	60 l/h	
12	Bypass flow	60 l/h	60 l/h	60 l/h	
13	Disposable filter unit.	Clean	Clean	Clean	
14	Span gas NO cylinder	> 300 psi	1,600 psi	1,600 psi	
15	Span gas CO cylinder	> 300 psi	1,300 psi	1,300 psi	
	On stack				
16	Heated sample probe	Hot	Hot	Hot	
17	Filter probe	Clean	Clean	Clean	
18	Heated line Main	140 °C	137.7 °C	137.7 °C	
19	Heated line Bypass	140 °C	137.7 °C	137.7 °C	

CHECK BY :

Mr. Phuwanai

DATE :

10-January-2023



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ANALYZER TEST REPORT

ANALYZER TYPE :	GAS ANALYZER	MENUFACTURER :	ABB
MODEL :	URAS 26	SERIAL NO. :	3.345753.3
UNIT NAME :	1SAA-IRK-1A	LOCATION :	HRSG 11

Standard gas concentration

Parameter	Concentration	Start date	Expire date	Cylinder No.
CO	164.6 ppm	28-Dec-2017	28-Dec-2025	CC703275
NO	82.5 ppm	27-Oct-2021	27-Oct-2025	D878359

Use ambient air for calibrate span point O₂ 20.95 Vol%.

MEASUREMENT RESULT BEFORE CALIBRATE						
Parameter	Measurement Value		Status Reactive Calibration Drifts		Offset&Amplify Acceptance	Note
	Reading	Analog (mA)	Offset (%)	Amplify (%)		
CO 0 - 200 ppm	15.0	5.20	1%	-7%	±30%	Passed
CO@7% 0 - 200 ppm	43.6	-	-	-		
NO _x 0 - 250 ppm	27.5	5.76	3%	0%		Passed
NO _x @7% 0 - 250 ppm	79.9	-	-	-		
O ₂ 0 - 25 Vol%	16.15	14.34	0%	4%		Passed

VALIDATION RESULT												
Parameter			Zero				Span				% Error Acceptance	Note
			Ideal	Actual	Drift	% Error	Ideal	Actual	Drift	% Error		
CO	0 - 200	ppm	0.0	0.1	0.10	-0.05	164.6	164.5	-0.10	0.05	±5.0 %	Passed
NO	0 - 250	ppm	0.0	-0.3	-0.30	0.12	82.5	82.1	-0.40	0.16	±2.5 %	Passed
O ₂	0 - 25	Vol%	0.00	0.02	0.02	-0.02	20.95	20.90	-0.05	0.05	±0.5 %	Passed

CALIBRATION RESULT												
Parameter			Zero				Span				% Error Acceptance	Note
			Ideal	Actual	Drift	% Error	Ideal	Actual	Drift	% Error		
CO	0 - 200	ppm	0.0	0.0	0.00	0.00	164.6	164.6	0.00	0.00	±5.0 %	Passed
NO	0 - 250	ppm	0.0	0.0	0.00	0.00	82.5	82.5	0.00	0.00	±2.5 %	Passed
O ₂	0 - 25	Vol%	0.00	0.00	0.00	0.00	20.95	20.95	0.00	0.00	±0.5 %	Passed

MEASUREMENT RESULT AFTER CALIBRATE						
Parameter	Measurement Value		Status Reactive Calibration Drifts		Offset&Amplify Acceptance	Note
	Reading	Analog (mA)	Offset (%)	Amplify (%)		
CO 0 - 200 ppm	12.0	4.96	1%	-7%	±30%	Passed
CO@7% 0 - 200 ppm	34.9	-	-	-		
NO _x 0 - 250 ppm	38.1	6.44	0%	2%		Passed
NO _x @7% 0 - 250 ppm	100.9	-	-	-		
O ₂ 0 - 25 Vol%	15.68	14.04	0%	0%		Passed

* % Error Calculate from percent of range.

CHECK BY :	Mr. Phuwanai
DATE :	10-January-2023

UNIT 1B



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SERVICE REPORT

Job No. :	JID2300041	Customer name :	EGCO COGENERATION
Equipment :	CEMS	Unit name :	1SAA-IRK-1B
Manufacturer :	ABB	Location :	Rayong
Model :	URAS 26	Contact name :	K. Pipat Udom
Serial No. :	3.387669.9	Telephone :	038-637-051-57 #9241
Working date :	10-January-2023	Fax. :	081-862-4780
Traveling hour :	4 Hr.	Email address :	Pipat.udo@egco.com
Mileage :	360 km.	Working Hour :	2 Hr.

SCOPE OF WORK	Preventive maintenance continuous emission monitoring system unit 1SAA-IRK-1B.
PHYSICAL & FUNCTION CHECK	<p><u>Sampling system.</u></p> <ul style="list-style-type: none"> - Checked the heated line was normal condition. - Checked the sample gas cooler was normal operation. - Checked the automatic condensate drain was normal operation. - Checked the acid filter was clean. - Checked the sample gas feed unit was normal operation. - Checked the filter membrane was clean. - Checked the sample flow and bypass flow were kept in set point. - Checked the condensate alarm for cut-off pump was normal operation. <p><u>Gas analyzer</u></p> <ul style="list-style-type: none"> - Diagnostics checked of the gas analyzer before calibration found were normal condition. - Validate zero and span for the gas analyzer was normal responding.
CORRECT ACTION	<p><u>Gas analyzer</u></p> <ul style="list-style-type: none"> - Performed zero and span calibration for the gas analyzer by feed standard gas direct to the sample gas cooler. - Diagnostics checked of the gas analyzer after calibrations were normal condition.
PART REPLACEMENT	- No part replacement.
RECOMMENDATION	-

Internal information: ID Warranty.

Sampling system 1B	: 4157
Gas analyzer (Uras26)	: 4723
Gas cooler (SCC-C)	: 7704
Gas feed unit (SCC-F)	: 7706
NOx Converter	: 7708



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CHECK BY :	Mr. Phuwanai	DATE :	10-January-2023
APPROVE BY:	Mr. Nadthapong	DATE:	13-January-2023
CUSTOMER SIGN :		DATE :	



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GENERAL CHECK

UNIT NAME :	1SAA-IRK-1B	LOCATION :	HRS 12
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ITEM	DESCRIPTION	SET-POINT VALUE	STATUS/VALUE		REMARK
			BEFORE	AFTER	
	Inside cabinet				
1	Temperature in Cabinet	20-25 °C	24.3 °C	25.1 °C	
2	Air conditioner	Operate	OK	OK	
3	Humidity in Cabinet	-	38 %	58 %	
4	Sample gas cooler temperature	3.0 °C	3.0 °C	3.0 °C	
5	Automatic Condensate Drain	Drain	Drain	Drain	
6	Flexible tube	Normal	Normal	Normal	
7	Acid filter	Clean	Clean	Clean	
8	Sample gas feed pump operate	Run	Run	Run	
9	Condensate filter	Clean	Clean	Clean	
10	Condensate monitor	Normal	Normal	Normal	
11	Sample flow	60 l/h	60 l/h	60 l/h	
12	Bypass flow	≈20 l/h	20 l/h	20 l/h	
13	Disposable filter unit.	Clean	Clean	Clean	
14	Span gas NO cylinder	> 300 psi	1,600 psi	1,600 psi	
15	Span gas CO cylinder	> 300 psi	1,300 psi	1,300 psi	
	On stack				
16	Heated sample probe	Hot	Hot	Hot	
17	Filter probe	Clean	Clean	Clean	
18	Heated line Main	140 °C	139.4 °C	139.3 °C	
19	Heated line Bypass	140 °C	139.4 °C	139.3 °C	

CHECK BY : Mr. Phuwanai

DATE : 10-January-2023



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ANALYZER TEST REPORT

ANALYZER TYPE :	GAS ANALYZER	MENUFACTURER :	ABB
MODEL :	URAS 26	SERIAL NO. :	3.387669.9
UNIT NAME :	1SAA-IRK-1B	LOCATION :	HRS 12

Standard gas concentration

Parameter	Concentration	Start date	Expire date	Cylinder No.
CO	164.6 ppm	28-Dec-2017	28-Dec-2025	CC703275
NO	82.5 ppm	27-Oct-2022	27-Oct-2025	D878359

Use ambient air for calibrate span point O₂ 20.95 Vol%.

MEASUREMENT RESULT BEFORE CALIBRATE						
Parameter	Measurement Value		Status Reactive Calibration Drifts		Offset&Amplify Acceptance	Note
	Reading	Analog (mA)	Offset (%)	Amplify (%)		
CO 0 - 200 ppm	1.5	4.12	-1%	-1%	±30%	Passed
CO@7% 0 - 200 ppm	3.3	-	-	-		
NO _x 0 - 250 ppm	34.5	6.21	2%	0%		Passed
NO _x @7% 0 - 250 ppm	76.2	-	-	-		
O ₂ 0 - 25 Vol%	14.63	13.36	0%	3%		Passed

VALIDATION RESULT												
Parameter			Zero				Span				% Error Acceptance	Note
			Ideal	Actual	Drift	% Error	Ideal	Actual	Drift	% Error		
CO	0 - 200	ppm	0.0	-0.1	-0.10	0.05	164.6	164.8	0.20	-0.10	±5.0 %	Passed
NO	0 - 250	ppm	0.0	0.1	0.10	-0.04	82.5	81.9	-0.60	0.24	±2.5 %	Passed
O ₂	0 - 25	Vol%	0.00	0.02	0.02	-0.02	20.95	20.92	-0.03	0.03	±0.5 %	Passed

CALIBRATION RESULT												
Parameter			Zero				Span				% Error Acceptance	Note
			Ideal	Actual	Drift	% Error	Ideal	Actual	Drift	% Error		
CO	0 - 200	ppm	0.0	0.0	0.00	0.00	164.6	164.6	0.00	0.00	±5.0 %	Passed
NO	0 - 250	ppm	0.0	0.0	0.00	0.00	82.5	82.5	0.00	0.00	±2.5 %	Passed
O ₂	0 - 25	Vol%	0.00	0.00	0.00	0.00	20.95	20.95	0.00	0.00	±0.5 %	Passed

MEASUREMENT RESULT AFTER CALIBRATE						
Parameter	Measurement Value		Status Reactive Calibration Drifts		Offset&Amplify Acceptance	Note
	Reading	Analog (mA)	Offset (%)	Amplify (%)		
CO 0 - 200 ppm	2.7	4.22	-1%	-1%	±30%	Passed
CO@7% 0 - 200 ppm	7.0	-	-	-		
NO _x 0 - 250 ppm	37.3	6.39	1%	0%		Passed
NO _x @7% 0 - 250 ppm	96.4	-	-	-		
O ₂ 0 - 25 Vol%	15.55	13.95	0%	0%		Passed

* % Error Calculate from percent of range.

CHECK BY : Mr. Phuwanai

DATE : 10-January-2023

CERTIFICATE OF STANDARD GAS

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E02NI99E15A3300	Reference Number:	82-401076401-1
Cylinder Number:	CC703275	Cylinder Volume:	144.3 CF
Laboratory:	124 - Riverton (SAP) - NJ	Cylinder Pressure:	2015 PSIG
PGVP Number:	B52017	Valve Outlet:	350
Gas Code:	CO,BALN	Certification Date:	Dec 28, 2017

Expiration Date: Dec 28, 2025

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, 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 volume/volume basis unless otherwise noted.

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

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON MONOXIDE	160.0 PPM	164.6 PPM	G1	+/- 0.9% NIST Traceable	12/28/2017
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	12062228	CC365471	97.56 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	May 25, 2018

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AHR0801933 CO	FTIR	Dec 08, 2017

Triad Data Available Upon Request

NOTES:PO# 5217005382

This calibration std. has been certified in accordance with the May 2012 EPA Traceability Protocol, Document EPA-600/R-12/531. All testing processes and measurements conform to the requirements of ISO/IEC 17025 and to Airgas ISO 9001:2000 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. 2000.02


Approved for Release

Certificate Of Analysis

Special Gases Mixture

Customer Details

Name: ECGO ENGINEERING AND SERVICE
 Address: 222 Moo. 8, A. Mabkha, A. King Aumphur
 Nikhom Pattana, Rayong 21180
 Customer Tag No.:

Certificate Details

Number:	3218/22	Date of Issue:	27-Oct-2022	Expiry date:	27-Oct-2025
Material Details					
Production Order:	90174084	Material Code:	431600-SV-44	Cylinder No.:	D878359
Gas content:	1.25 M ³	Filling pressure:	130.0 bar	Valve:	CGA 660 SS
Cylinder Owner:	LINDE	Cylinder Material:	Spectra seal	Cylinder Size:	10 L

Laboratory Report

Analytical Result

Component	Normal Concentration	Analysis Result ¹	Uncertainty ²	Method of Analysis ³	Assay Date
Nitric Oxide	85.0 ppm	82.5 ppm	± 1% relative	(6) I-PB-352	19-Oct & 26-Oct-22
Other NOx impurity In Nitrogen		Less than 4.1 ppm			

Reference Standard used in Assay

Reference Standard	Cylinder number	Concentration	Expiry date:
Nitric Oxide In Nitrogen	1228205G	50.87 ± 0.25 ppm	6-May-2023

Analytical Instruments used in Assay

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
FTIR Spectrometers Nicolet iS50	FTIR-NO	1-Oct-2022

Recommend usage condition

Minimum utilization: 5% of actual content or before expire date whichever comes first.
 Storage condition: Keep in well ventilation and secure area.

Comments

When reordering, please quote the material number

Note:

- All results expressed in this report are on mole/mole basis, unless otherwise specified. The Assay of this Standard has been performed in accordance with the EPA Traceability Protocol EPA-600/R-12/531 for the Assay and Certification of Gaseous Calibration Standards using procedure G1
- The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The measurement of this material is traceable to the SI through the reference gas standard which is traceable to Swiss National Standard of Mass or other recognised national metrology institutes.
- (1) Gas Chromatography, (2) Paramagnetic Oxygen Analyzer, (3) Electrochemical Oxygen Analyzer, (4) Electrochemical Moisture Analyzer, (5) Total Hydrocarbon Analyzer, (6) Other - Specified

Sukanya Parinyasoonorn
 Signatory for and on behalf of Linde (Thailand) Co., Ltd.

PB-002/F006

บริษัท ลินด์ (ประเทศไทย) จำกัด (มหาชน)

เบอร์โทรศัพท์: 0107537000/785

ชั้น 15 ถนนนาภาวอโร 2/3 หมู่ 14 ถนนนาภาวอโร กม. 6.5 ตำบลนาภาวอโร

อำเภอสี จ.สมุทรปราการ 10540 โทรศัพท์ (66) 2338-6100 โทรสาร (66) 2338-6333

โรงงานนาภาวอโร: 105 หมู่ 5 ต.นาภาวอโร อ.นาภาวอโร จ.สมุทรปราการ 24180

โทรศัพท์ (66) 38.570-479-93

โทรสาร (66) 38.570-323

Linde (Thailand) Public Company Limited Iss:K/2, 15 Oct 2021

PLC Registration no 0107537000/785

15th Floor, Bangna Tower A, 2/3 Moo 14, Bangna Trad KM. 6.5 Road, Bangkaew

Bangplee, Samutprakarn 10540, Tel (66) 2338-6100 Fax (66) 2338-6333

Wellgrow Plant : 105 Moo 5, T.Bangsamak, A.Bangpakong, Chachoengsao 24180

Thailand, Tel (66) 38.570-479-93

Fax (66) 38.570-323

PREVENTIVE MAINTENANCE PLAN

SCHEDULE PLAN FOR PREVENTIVE MAINTENANCE CEMS																
Item	Part name	P/N	Interval	Q'ty	Unit	2023										
						1	2	3	4	5	6	7	8	9	10	11
						Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	PM Schedule		1 M			X	X	X	X	X	X	X	X	X	X	X
	Sampling probe															
1	Ceramic filter	IT0001141	1 Y	2	pc				X							
2	Set of gaskets FPM	IT0001152	1 Y	2	set				X							
	Sample gas cooler SCC-C															
3	sealing GL25-12mm (SCC-C)	IT0001830	1 Y	2	pc				X							
4	sealing GL18-8mm (SCC-C)	IT0001831	1 Y	4	pc				X							
5	Driver complete	IT0001823	1 Y	2	pc				X							
6	Flexible tube	IT0001931	3 M	1	Pack	X			X			X			X	
	Acid filter unit															
7	Filter element for acid filter	IT0000732	-	4	pc	Up to condition										
8	O-ring 56 x 3, FPM	IT0000777	1 Y	2	pc				X							
	Gas feed unit SCC-F															
9	Spare parts set (for diaphragm pump)	IT0000716	1 Y	2	set							X				
10	O-ring 60x3.5mm , FPM70	IT0000800	1 Y	2	pc							X				
11	Filter membrane	IT0001128	-	1	Pack	Up to condition										
	Gas analyzer															
13	Oxygen sensor	IT0000702	1 Y	2	pc	Up to condition										
14	Disposable filter unit	IT0001136	3	4	pc	Up to condition										
15	Viton tube FPM-70-SW 4x1.5	IT0000741	1 Y	4	Meter			X								

- ☒ กำหนดการเข้าปฏิบัติงานการบำรุงรักษาเชิงป้องกันตามแผน
☒ กำหนดการเปลี่ยนวัสดุสิ้นเปลืองตามแผนแต่ละรายการ

SERVICE REPORT

Preventive Maintenance

For

Continuous Emission Monitoring System (CEMS)



EGCO COGENERATION CO., LTD



February, 2023^{2nd}

JID2300041-001

BY:

PETRO-INSTRUMENTS CORP.,LTD

**PETRO-INSTRUMENTS CORP., LTD.**

7/409 Soi Vibhavadi-Rangsit 36, Vibhavadi-Rangsit Rd., Chatuchak, Chatuchak Bangkok 10900 Thailand

Tel.:(+66) 2939 5711 (12 Lines), (+66) 2513 2333 (12 Lines), Fax. : (+66) 939

DOC. NUMBER

SERVICE REPORT

REPORT DATE

EQUIPMENT: CEMs	SERIAL NUMBER / TAG NUMBER -	BRAND / MANUFACTURER ABB
CUSTOMER NAME: Egco cogeneration	LACATION: Rayong	JOB NUMBER / REQUESTED NUMBER JID2300041-001

REASON FOR VISIT

- Preventive maintenance CEMs unit 11, 12.

FOUND FAILURE & CORRECTIVE ACTION DETAILS

- Operation checked of the gas analyzer all units.
- Checked diagnostic of the gas analyzer all units.
- Checked the sample gas cooler all unit was normal operation.
- Checked the sample gas feed all unit was normal operation.
- Checked the automatic condensate drain was normal operation.
- Checked the sample flow and by pass flow were kept in set point.
- Validate zero and span gas for the gas analyzer was normal response.
- Calibration zero and span gas for the gas analyzer by feed gas direct to the sample gas cooler.

Standard gas CO supply by PICO

WORK CONCLUSION

<input checked="" type="checkbox"/> COMPLETED		<input type="checkbox"/> IN COMPLETED	PARTS REPLACEMENT		
<input checked="" type="checkbox"/> CHARGE	<input type="checkbox"/> NO CHARGE		PARTS NAME	P/N	QTY.
<input type="checkbox"/> SERVICE FEE	<input type="checkbox"/> PROJECT WARRANTY	<input type="checkbox"/> TAKE TO OFFICE			
<input type="checkbox"/> TRAVELLING	<input type="checkbox"/> SERVICE WARRANTY	<input type="checkbox"/> WAIT FOR PARTS			
<input type="checkbox"/> SPARE PARTS	<input type="checkbox"/> PARTS WARRANTY	<input type="checkbox"/> IN PROCESS			
<input type="checkbox"/> OTHER	<input checked="" type="checkbox"/> SERVICE CONTRACT	<input type="checkbox"/> OTHER			

TIME SPENT (HOURS)

YEAR	2023								TOTAL HOURS	TRAVELING DETAILS	
MONTH	2									TRAVEL BY	
DATE	9								6	FROM	Pico
SERVICE TIME	6								-	TO	Rayong
OVERTIME	-								4	TOTAL ROUND TRIP	1
TRAVELING TIME	4								10	DISTANCE (KM.)	360
TOTAL HOURS	10										

SERVICE CREW

NAME		NAME	
1. Mr. Phuwanai N.		3.	
2.		4.	

CUSTOMER'S NAME Mr. Nitsak 999	CUSTOMER'S SIGNATURE 	DATE 9/12/2023
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UNIT 1A



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http : // www.pico.co.th E-mail-address : combustion@pico.co.th

SERVICE REPORT

Job No. :	JID2300041-001	Customer name :	EGCO COGENERATION
Equipment :	CEMS	Unit name :	1SAA-IRK-1A
Manufacturer :	ABB	Location :	Rayong
Model :	URAS 26	Contact name :	K. Pipat Udom
Serial No. :	3.345753.3	Telephone :	038-637-051-57 #9241
Working date :	9-February-2023	Fax. :	081-862-4780
Traveling hour :	4 Hr.	Email address :	Pipat.udo@egco.com
Mileage :	360 km.	Working Hour :	2 Hr.

SCOPE OF WORK	Preventive maintenance continuous emission monitoring system unit 1SAA-IRK-1A.
PHYSICAL & FUNCTION CHECK	<p>Sampling system.</p> <ul style="list-style-type: none"> - Checked the heated line was normal condition. - Checked the sample gas cooler was normal operation. - Checked the automatic condensate drain was normal operation. - Checked the acid filter was clean. - Checked the sample gas feed unit was normal operation. - Checked the filter membrane was clean. - Checked the sample flow and bypass flow were kept in set point. - Checked the condensate alarm for cut-off pump was normal operation. <p>Gas analyzer</p> <ul style="list-style-type: none"> - Diagnostics checked of the gas analyzer before calibration found were normal condition such as temperature, pressure. - Validate zero and span for the gas analyzer found normal responding.
CORRECT ACTION	<p>Gas analyzer</p> <ul style="list-style-type: none"> - Performed zero and span calibration for the gas analyzer by feed standard gas direct to the sample gas cooler. - Diagnostics checked of the gas analyzer after calibrations were normal condition.
PART REPLACEMENT	- No part replacement.
RECOMMENDATION	-

Internal information: ID Warranty.

Gas analyzer (Uras26) : 1360

Gas cooler (SCC-C) : 7703

Gas feed unit (SCC-F) : 7705

NO_x Converter : 7707

Sampling system 1A : 4156



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http : // www.pico.co.th E-mail-address : combustion@pico.co.th

CHECK BY :	Mr. Phuwanai	DATE :	9-February-2023
APPROVE BY:	Mr. Nadthapong	DATE:	13-February-2023
CUSTOMER SIGN :		DATE :	



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GENERAL CHECK

UNIT NAME :	1SAA-IRK-1A	LOCATION :	HRSG 11
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ITEM	DESCRIPTION	SET-POINT VALUE	STATUS/VALUE		REMARK
			BEFORE	AFTER	
	Inside cabinet				
1	Temperature in Cabinet	20-25 °C	20.7 °C	24.7 °C	
2	Air conditioner	Operate	OK	OK	
3	Humidity in Cabinet	-	53 %	44 %	
4	Sample gas cooler temperature	3.0 °C	3.0 °C	3.0 °C	
5	Automatic Condensate Drain	Drain	Drain	Drain	
6	Flexible tube	Normal	Normal	Normal	
7	Acid filter	Clean	Clean	Clean	
8	Sample gas feed pump operate	Run	Run	Run	
9	Condensate filter	Clean	Clean	Clean	
10	Condensate monitor	Normal	Normal	Normal	
11	Sample flow	60 l/h	61 l/h	60 l/h	
12	Bypass flow	60 l/h	60 l/h	60 l/h	
13	Disposable filter unit.	Clean	Clean	Clean	
14	Span gas NO cylinder	> 300 psi	1,600 psi	1,600 psi	
15	Span gas CO cylinder	> 300 psi	1,300 psi	1,300 psi	
	On stack				
16	Heated sample probe	Hot	Hot	Hot	
17	Filter probe	Clean	Clean	Clean	
18	Heated line Main	140 °C	137.7 °C	137.7 °C	
19	Heated line Bypass	140 °C	137.7 °C	137.7 °C	

CHECK BY :

Mr. Phuwanai

DATE :

9-February-2023



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http : // www.pico.co.th E-mail-address : combustion@pico.co.th

ANALYZER TEST REPORT

ANALYZER TYPE :	GAS ANALYZER	MANUFACTURER :	ABB
MODEL :	URAS 26	SERIAL NO. :	3.345753.3
UNIT NAME :	1SAA-IRK-1A	LOCATION :	HRSG 11

Standard gas concentration

Parameter	Concentration	Start date	Expire date	Cylinder No.
CO	164.6 ppm	28-Dec-2017	28-Dec-2025	CC703275
NO	82.5 ppm	27-Oct-2021	27-Oct-2025	D878359

Use ambient air for calibrate span point O₂ 20.95 Vol%.

MEASUREMENT RESULT BEFORE CALIBRATE						
Parameter	Measurement Value		Status Reactive Calibration Drifts		Offset&Amplify Acceptance	Note
	Reading	Analog (mA)	Offset (%)	Amplify (%)		
CO 0 - 200 ppm	0.6	4.05	1%	-7%	±30%	Passed
CO@7% 0 - 200 ppm	1.2	-	-	-		
NO _x 0 - 250 ppm	43.4	6.78	2%	23%		Passed
NO _x @7% 0 - 250 ppm	88.0	-	-	-		
O ₂ 0 - 25 Vol%	14.07	13.00	0%	3%		Passed

VALIDATION RESULT										
Parameter	Zero				Span				% Error Acceptance	Note
	Ideal	Actual	Drift	% Error	Ideal	Actual	Drift	% Error		
CO 0 - 200 ppm	0.0	0.0	0.00	0.00	164.6	164.5	-0.10	0.05	±5.0 %	Passed
NO 0 - 250 ppm	0.0	-0.2	-0.20	0.08	82.5	82.2	-0.30	0.12	±2.5 %	Passed
O ₂ 0 - 25 Vol%	0.00	0.02	0.02	-0.02	20.95	20.90	-0.05	0.05	±0.5 %	Passed

CALIBRATION RESULT										
Parameter	Zero				Span				% Error Acceptance	Note
	Ideal	Actual	Drift	% Error	Ideal	Actual	Drift	% Error		
CO 0 - 200 ppm	0.0	0.0	0.00	0.00	164.6	164.6	0.00	0.00	±5.0 %	Passed
NO 0 - 250 ppm	0.0	0.0	0.00	0.00	82.5	82.5	0.00	0.00	±2.5 %	Passed
O ₂ 0 - 25 Vol%	0.00	0.00	0.00	0.00	20.95	20.95	0.00	0.00	±0.5 %	Passed

MEASUREMENT RESULT AFTER CALIBRATE						
Parameter	Measurement Value		Status Reactive Calibration Drifts		Offset&Amplify Acceptance	Note
	Reading	Analog (mA)	Offset (%)	Amplify (%)		
CO 0 - 200 ppm	0.6	4.05	1%	-7%	±30%	Passed
CO@7% 0 - 200 ppm	1.2	-	-	-		-
NO _x 0 - 250 ppm	57.1	7.65	0%	4%		Passed
NO _x @7% 0 - 250 ppm	125.8	-	-	-		-
O ₂ 0 - 25 Vol%	14.62	13.36	0%	0%		Passed

* % Error Calculate from percent of range.

CHECK BY : Mr. Phuwanai
DATE : 9-February-2023

UNIT 1B



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SERVICE REPORT

Job No. :	JID2300041-001	Customer name :	EGCO COGENERATION
Equipment :	CEMS	Unit name :	1SAA-IRK-1B
Manufacturer :	ABB	Location :	Rayong
Model :	URAS 26	Contact name :	K. Pipat Udom
Serial No. :	3.387669.9	Telephone :	038-637-051-57 #9241
Working date :	9-February-2023	Fax. :	081-862-4780
Traveling hour :	4 Hr.	Email address :	Pipat.udo@egco.com
Mileage :	360 km.	Working Hour :	2 Hr.

SCOPE OF WORK	Preventive maintenance continuous emission monitoring system unit 1SAA-IRK-1B.
PHYSICAL & FUNCTION CHECK	<p><u>Sampling system.</u></p> <ul style="list-style-type: none"> - Checked the heated line was normal condition. - Checked the sample gas cooler was normal operation. - Checked the automatic condensate drain was normal operation. - Checked the acid filter was clean. - Checked the sample gas feed unit was normal operation. - Checked the filter membrane was clean. - Checked the sample flow and bypass flow were kept in set point. - Checked the condensate alarm for cut-off pump was normal operation. <p><u>Gas analyzer</u></p> <ul style="list-style-type: none"> - Diagnostics checked of the gas analyzer before calibration found were normal condition. - Validate zero and span for the gas analyzer was normal responding.
CORRECT ACTION	<p><u>Gas analyzer</u></p> <ul style="list-style-type: none"> - Performed zero and span calibration for the gas analyzer by feed standard gas direct to the sample gas cooler. - Diagnostics checked of the gas analyzer after calibrations were normal condition.
PART REPLACEMENT	- No part replacement.
RECOMMENDATION	-

Internal information: ID Warranty.

Sampling system 1B : 4157
 Gas analyzer (Uras26) : 4723
 Gas cooler (SCC-C) : 7704
 Gas feed unit (SCC-F) : 7706
 NOx Converter : 7708



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http : // www.pico.co.th E-mail-address : combustion@pico.co.th

CHECK BY :	Mr. Phuwanai	DATE :	9-February-2023
APPROVE BY:	Mr. Nadthapong	DATE:	13-February-2023
CUSTOMER SIGN :		DATE :	



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GENERAL CHECK

UNIT NAME :	1SAA-IRK-1B	LOCATION :	HRS 12
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ITEM	DESCRIPTION	SET-POINT VALUE	STATUS/VALUE		REMARK
			BEFORE	AFTER	
	Inside cabinet				
1	Temperature in Cabinet	20-25 °C	24.3 °C	25.1 °C	
2	Air conditioner	Operate	OK	OK	
3	Humidity in Cabinet	-	38 %	58 %	
4	Sample gas cooler temperature	3.0 °C	3.0 °C	3.0 °C	
5	Automatic Condensate Drain	Drain	Drain	Drain	
6	Flexible tube	Normal	Normal	Normal	
7	Acid filter	Clean	Clean	Clean	
8	Sample gas feed pump operate	Run	Run	Run	
9	Condensate filter	Clean	Clean	Clean	
10	Condensate monitor	Normal	Normal	Normal	
11	Sample flow	60 l/h	60 l/h	60 l/h	
12	Bypass flow	≈20 l/h	20 l/h	20 l/h	
13	Disposable filter unit.	Clean	Clean	Clean	
14	Span gas NO cylinder	> 300 psi	1,600 psi	1,600 psi	
15	Span gas CO cylinder	> 300 psi	1,300 psi	1,300 psi	
	On stack				
16	Heated sample probe	Hot	Hot	Hot	
17	Filter probe	Clean	Clean	Clean	
18	Heated line Main	140 °C	139.4 °C	139.3 °C	
19	Heated line Bypass	140 °C	139.4 °C	139.3 °C	

CHECK BY : Mr. Phuwanai

DATE : 9-February-2023



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http : // www.pico.co.th E-mail-address : combustion@pico.co.th

ANALYZER TEST REPORT

ANALYZER TYPE :	GAS ANALYZER	MENUFACTURER :	ABB
MODEL :	URAS 26	SERIAL NO. :	3.387669.9
UNIT NAME :	1SAA-IRK-1B	LOCATION :	HRSO 12

Standard gas concentration

Parameter	Concentration	Start date	Expire date	Cylinder No.
CO	164.6 ppm	28-Dec-2017	28-Dec-2025	CC703275
NO	82.5 ppm	27-Oct-2022	27-Oct-2025	D878359

Use ambient air for calibrate span point O₂ 20.95 Vol%.

MEASUREMENT RESULT BEFORE CALIBRATE						
Parameter	Measurement Value		Status Reactive Calibration Drifts		Offset&Amplify Acceptance	Note
	Reading	Analog (mA)	Offset (%)	Amplify (%)		
CO 0 - 200 ppm	0.2	4.02	-1%	-1%	±30%	Passed
CO@7% 0 - 200 ppm	3.8	-	-	-		
NO _x 0 - 250 ppm	0.1	4.01	2%	10%		Passed
NO _x @7% 0 - 250 ppm	1.9	-	-	-		
O ₂ 0 - 25 Vol%	20.22	16.94	0%	3%		Passed

VALIDATION RESULT										
Parameter	Zero				Span				% Error Acceptance	Note
	Ideal	Actual	Drift	% Error	Ideal	Actual	Drift	% Error		
CO 0 - 200 ppm	0.0	-0.1	-0.10	0.05	164.6	164.8	0.20	-0.10	±5.0 %	Passed
NO 0 - 250 ppm	0.0	0.1	0.10	-0.04	82.5	81.9	-0.60	0.24	±2.5 %	Passed
O ₂ 0 - 25 Vol%	0.00	0.02	0.02	-0.02	20.95	20.92	-0.03	0.03	±0.5 %	Passed

CALIBRATION RESULT										
Parameter	Zero				Span				% Error Acceptance	Note
	Ideal	Actual	Drift	% Error	Ideal	Actual	Drift	% Error		
CO 0 - 200 ppm	0.0	0.0	0.00	0.00	164.6	164.6	0.00	0.00	±5.0 %	Passed
NO 0 - 250 ppm	0.0	0.0	0.00	0.00	82.5	82.5	0.00	0.00	±2.5 %	Passed
O ₂ 0 - 25 Vol%	0.00	0.00	0.00	0.00	20.95	20.95	0.00	0.00	±0.5 %	Passed

MEASUREMENT RESULT AFTER CALIBRATE						
Parameter	Measurement Value		Status Reactive Calibration Drifts		Offset&Amplify Acceptance	Note
	Reading	Analog (mA)	Offset (%)	Amplify (%)		
CO 0 - 200 ppm	0.0	4.00	-1%	-1%	±30%	Passed
CO@7% 0 - 200 ppm	0.0	-	-	-		
NO _x 0 - 250 ppm	0.0	4.00	0%	6%		Passed
NO _x @7% 0 - 250 ppm	0.0	-	-	-		
O ₂ 0 - 25 Vol%	20.96	17.41	0%	0%		Passed

* % Error Calculate from percent of range.

CHECK BY : Mr. Phuwanai
DATE : 9-February-2023

CERTIFICATE OF STANDARD GAS

Certificate Of Analysis

Special Gases Mixture

Customer Details

Name:	Address:	Customer Tag No.:
EGCO ENGINEERING AND SERVICE	222 Moo. 8, A. Mabkha, A. King Aumphur Nikhom Pattana, Rayong 21180	

Certificate Details

Number:	3218/22	Date of Issue:	27-Oct-2022	Expiry date:	27-Oct-2025
Material Details					
Production Order:	90174084	Material Code:	431600-SV-44	Cylinder No.:	D878359
Gas content:	1.25 M ³	Filling pressure:	130.0 bar	Valve:	CGA 660 SS
Cylinder Owner:	LINDE	Cylinder Material:	Spectra seal	Cylinder Size:	10 L

Laboratory Report**Analytical Result**

Component	Normal Concentration	Analysis Result ¹	Uncertainty ²	Method of Analysis ³	Assay Date
Nitric Oxide	85.0 ppm	82.5 ppm	± 1% relative	(6) I-PB-352	19-Oct & 26-Oct-22
Other NOx impurity In Nitrogen		Less than 4.1 ppm			

Reference Standard used in Assay

Reference Standard	Cylinder number	Concentration	Expiry date:
Nitric Oxide In Nitrogen	1228205G	50.87 ± 0.25 ppm	6-May-2023

Analytical Instruments used in Assay

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
FTIR Spectrometers Nicolet iS50	FTIR-NO	1-Oct-2022

Recommend usage condition

Minimum utilization: 5% of actual content or before expire date whichever comes first.

Storage condition: Keep in well ventilation and secure area.

Comments

When reordering, please quote the material number

Note:

1. All results expressed in this report are on mole/mole basis, unless otherwise specified. The Assay of this Standard has been performed in accordance with the EPA Traceability Protocol EPA-600/R-12/531 for the Assay and Certification of Gaseous Calibration Standards using procedure G1
2. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The measurement of this material is traceable to the SI through the reference gas standard which is traceable to Swiss National Standard of Mass or other recognised national metrology institutes.
3. (1) Gas Chromatography, (2) Paramagnetic Oxygen Analyzer, (3) Electrochemical Oxygen Analyzer, (4) Electrochemical Moisture Analyzer, (5) Total Hydrocarbon Analyzer, (6) Other - Specified

BPC - GT HRS6
CO

Airgas Specialty Gases
Airgas USA, LLC
600 Union Landing Road
Cinnaminson, NJ 08077-0000
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E02NI99E15A3300 Reference Number: 82-401076401-1
Cylinder Number: CC703275 Cylinder Volume: 144.3 CF
Laboratory: 124 - Riverton (SAP) - NJ Cylinder Pressure: 2015 PSIG
PGVP Number: B52017 Valve Outlet: 350
Gas Code: CO, BALN Certification Date: Dec 28, 2017

Expiration Date: Dec 28, 2025

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, 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 volume/volume basis unless otherwise noted.

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

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON MONOXIDE	160.0 PPM	164.6 PPM	G1	+/- 0.9% NIST Traceable	12/28/2017
NITROGEN	Balance				
CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	12062228	CC365471	97.56 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	May 25, 2018
ANALYTICAL EQUIPMENT					
Instrument/Make/Model		Analytical Principle		Last Multipoint Calibration	
Nicolet 6700 AHR0801933 CO		FTIR		Dec 08, 2017	

Triad Data Available Upon Request

NOTES: PO# 5217005382

This calibration std. has been certified in accordance with the May 2012 EPA Traceability Protocol, Document EPA-600/R-12/531. All testing processes and measurements conform to the requirements of ISO/IEC 17025 and to Airgas ISO 9001:2000 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. 2000.02


Approved for Release

PREVENTIVE MAINTENANCE PLAN

SCHEDULE PLAN FOR PREVENTIVE MAINTENANCE CEMS																
Item	Part name	P/N	Interval	Qty	Unit	2023										
						1	2	3	4	5	6	7	8	9	10	11
						Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	PM Schedule		1 M			X	X	X	X	X	X	X	X	X	X	X
	Sampling probe															
1	Ceramic filter	IT0001141	1 Y	2	pc				X							
2	Set of gaskets FPM	IT0001152	1 Y	2	set				X							
	Sample gas cooler SCC-C															
3	sealing GL25-12mm (SCC-C)	IT0001830	1 Y	2	pc				X							
4	sealing GL18-8mm (SCC-C)	IT0001831	1 Y	4	pc				X							
5	Driver complete	IT0001823	1 Y	2	pc				X							
6	Flexible tube	IT0001931	3 M	1	Pack	X			X			X			X	
	Acid filter unit															
7	Filter element for acid filter	IT0000732	-	4	pc	Up to condition										
8	O-ring 56 x 3, FPM	IT0000777	1 Y	2	pc				X							
	Gas feed unit SCC-F															
9	Spare parts set (for diaphragm pump)	IT0000716	1 Y	2	set							X				
10	O-ring 60x3,5mm , FPM70	IT0000800	1 Y	2	pc							X				
11	Filter membrane	IT0001128	-	1	Pack	Up to condition										
	Gas analyzer															
13	Oxygen sensor	IT0000702	1 Y	2	pc	Up to condition										
14	Disposable filter unit	IT0001136	3	4	pc	Up to condition										
15	Viton tube FPM-70-SW 4x1.5	IT0000741	1 Y	4	Meter			X								

X	กำหนดการเข้าปฏิบัติงานการบำรุงรักษาเชิงป้องกันตามแผน
X	กำหนดการเปลี่ยนวัสดุสิ้นเปลืองตามแผนแต่ละรายการ

SERVICE REPORT

Preventive Maintenance

For

Continuous Emission Monitoring System (CEMS)



EGCO COGENERATION CO., LTD



March, 2023^{3rd}

JID2300041-002

BY:

PETRO-INSTRUMENTS CORP.,LTD

**PETRO-INSTRUMENTS CORP., LTD.**7/409 Soi Vibhavadi-Rangsit 36, Vibhavadi-Rangsit Rd., Chatuchak, Chatuchak
Bangkok 10900 Thailand

Tel.:(+66) 2939 5711 (12 Lines), (+66) 2513 2333 (12 Lines), Fax. : (+66) 939

DOC. NUMBER

SERVICE REPORT

REPORT DATE

EQUIPMENT:	SERIAL NUMBER / TAG NUMBER	BRAND / MANUFACTURER
CEMs	-	ABB
CUSTOMER NAME:	LACATION:	JOB NUMBER / REQUESTED NUMBER
Egco cogeneration	Rayong	JID2300041-002

REASON FOR VISIT

- Preventive maintenance CEMs unit 11, 12.

FOUND FAILURE & CORRECTIVE ACTION DETAILS

- Operation checked of the gas analyzer all units.
- Checked diagnostic of the gas analyzer all units.
- Checked the sample gas cooler all unit was normal operation.
- Checked the sample gas feed all unit was normal operation.
- Checked the automatic condensate drain was normal operation.
- Checked the sample flow and by pass flow were kept in set point.
- Validate zero and span gas for the gas analyzer was normal response.
- Calibration zero and span gas for the gas analyzer by feed gas direct to the sample gas cooler.

Standard gas CO supply by PICO

WORK CONCLUSION

<input checked="" type="checkbox"/> COMPLETED		<input type="checkbox"/> IN COMPLETED	PARTS REPLACEMENT		
<input checked="" type="checkbox"/> CHARGE	<input type="checkbox"/> NO CHARGE		PARTS NAME	P/N	QTY.
<input type="checkbox"/> SERVICE FEE	<input type="checkbox"/> PROJECT WARRANTY	<input type="checkbox"/> TAKE TO OFFICE			
<input type="checkbox"/> TRAVELLING	<input type="checkbox"/> SERVICE WARRANTY	<input type="checkbox"/> WAIT FOR PARTS			
<input type="checkbox"/> SPARE PARTS	<input type="checkbox"/> PARTS WARRANTY	<input type="checkbox"/> IN PROCESS			
<input type="checkbox"/> OTHER	<input checked="" type="checkbox"/> SERVICE CONTRACT	<input type="checkbox"/> OTHER			

TIME SPENT (HOURS)

YEAR	2023									TRAVELING DETAILS	
MONTH	3										
DATE	10									TRAVEL BY	
SERVICE TIME	6							6		FROM	Pico
OVERTIME	-							-		TO	Rayong
TRAVELING TIME	4							4		TOTAL ROUND TRIP	1
TOTAL HOURS	10							10		DISTANCE (KM.)	360

SERVICE CREW

NAME		NAME	
1. Mr. Pirin K.		3.	
2.		4.	

CUSTOMER'S NAME	CUSTOMER'S SIGNATURE	DATE
2674. นพิตาน ๑๑๑		13/3/2023

UNIT 1A



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http : // www.pico.co.th E-mail-address : combustion@pico.co.th

SERVICE REPORT

Job No. :	JID2300041-002	Customer name :	EGCO COGENERATION
Equipment :	CEMS	Unit name :	1SAA-IRK-1A
Manufacturer :	ABB	Location :	Rayong
Model :	URAS 26	Contact name :	K. Pipat Udom
Serial No. :	3.345753.3	Telephone :	038-637-051-57 #9241
Working date :	10-March-2023	Fax. :	081-862-4780
Traveling hour :	4 Hr.	Email address :	Pipat.udo@egco.com
Mileage :	360 km.	Working Hour :	2 Hr.

SCOPE OF WORK	Preventive maintenance continuous emission monitoring system unit 1SAA-IRK-1A.
PHYSICAL & FUNCTION CHECK	<p><u>Sampling system.</u></p> <ul style="list-style-type: none"> - Checked the heated line was normal condition. - Checked the sample gas cooler was normal operation. - Checked the automatic condensate drain was normal operation. - Checked the acid filter was clean. - Checked the sample gas feed unit was normal operation. - Checked the filter membrane was clean. - Checked the sample flow and bypass flow were kept in set point. - Checked the condensate alarm for cut-off pump was normal operation. <p><u>Gas analyzer</u></p> <ul style="list-style-type: none"> - Diagnostics checked of the gas analyzer before calibration found were normal condition such as temperature, pressure. - Validate zero and span for the gas analyzer found normal responding.
CORRECT ACTION	<p><u>Gas analyzer</u></p> <ul style="list-style-type: none"> - Performed zero and span calibration for the gas analyzer by feed standard gas direct to the sample gas cooler. - Diagnostics checked of the gas analyzer after calibrations were normal condition.
PART REPLACEMENT	- No part replacement.
RECOMMENDATION	-

Internal information: ID Warranty.

Gas analyzer (Uras26) : 1360
 Gas cooler (SCC-C) : 7703
 Gas feed unit (SCC-F) : 7705
 NO_x Converter : 7707
 Sampling system 1A : 4156



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http : // www.pico.co.th E-mail-address : combustion@pico.co.th

CHECK BY :	Mr. Pirin	DATE :	10-March-2023
APPROVE BY:	Mr. Nadthapong	DATE:	13-March-2023
CUSTOMER SIGN :		DATE :	



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GENERAL CHECK

UNIT NAME :	1SAA-IRK-1A	LOCATION :	HRSG 11
-------------	-------------	------------	---------

ITEM	DESCRIPTION	SET-POINT VALUE	STATUS/VALUE		REMARK
			BEFORE	AFTER	
	Inside cabinet				
1	Temperature in Cabinet	20-25 °C	20.7 °C	24.7 °C	
2	Air conditioner	Operate	OK	OK	
3	Humidity in Cabinet	-	53 %	44 %	
4	Sample gas cooler temperature	3.0 °C	3.0 °C	3.0 °C	
5	Automatic Condensate Drain	Drain	Drain	Drain	
6	Flexible tube	Normal	Normal	Normal	
7	Acid filter	Clean	Clean	Clean	
8	Sample gas feed pump operate	Run	Run	Run	
9	Condensate filter	Clean	Clean	Clean	
10	Condensate monitor	Normal	Normal	Normal	
11	Sample flow	60 l/h	61 l/h	60 l/h	
12	Bypass flow	60 l/h	60 l/h	60 l/h	
13	Disposable filter unit.	Clean	Clean	Clean	
14	Span gas NO cylinder	> 300 psi	1,400 psi	1,400 psi	
15	Span gas CO cylinder	> 300 psi	1,300 psi	1,300 psi	
	On stack				
16	Heated sample probe	Hot	Hot	Hot	
17	Filter probe	Clean	Clean	Clean	
18	Heated line Main	140 °C	137.7 °C	137.7 °C	
19	Heated line Bypass	140 °C	137.7 °C	137.7 °C	

CHECK BY :

Mr. Pirin

DATE :

10-March-2023



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ANALYZER TEST REPORT

ANALYZER TYPE :	GAS ANALYZER	MENUFACTURER :	ABB
MODEL :	URAS 26	SERIAL NO. :	3.345753.3
UNIT NAME :	1SAA-IRK-1A	LOCATION :	HRSG 11

Standard gas concentration

Parameter	Concentration	Start date	Expire date	Cylinder No.
CO	164.6 ppm	28-Dec-2017	28-Dec-2025	CC703275
NO	82.5 ppm	27-Oct-2021	27-Oct-2025	D878359

Use ambient air for calibrate span point O₂ 20.95 Vol%.

MEASUREMENT RESULT BEFORE CALIBRATE						
Parameter	Measurement Value		Status Reactive Calibration Drifts		Offset&Amplify Acceptance	Note
	Reading	Analog (mA)	Offset (%)	Amplify (%)		
CO 0 - 200 ppm	1.2	4.10	-1%	-1%	±30%	Passed
CO@7% 0 - 200 ppm	2.5	-	-	-		
NO _x 0 - 250 ppm	41.1	6.63	2%	6%		Passed
NO _x @7% 0 - 250 ppm	85.2	-	-	-		
O ₂ 0 - 25 Vol%	14.22	13.10	0%	3%		Passed

VALIDATION RESULT												
Parameter			Zero				Span				% Error Acceptance	Note
			Ideal	Actual	Drift	% Error	Ideal	Actual	Drift	% Error		
CO	0 - 200	ppm	0.0	0.2	0.20	-0.10	164.6	164.5	-0.10	0.05	±5.0 %	Passed
NO	0 - 250	ppm	0.0	-0.3	-0.30	0.12	82.5	82.2	-0.30	0.12	±2.5 %	Passed
O ₂	0 - 25	Vol%	0.00	0.02	0.02	-0.02	20.95	20.90	-0.05	0.05	±0.5 %	Passed

CALIBRATION RESULT												
Parameter			Zero				Span				% Error Acceptance	Note
			Ideal	Actual	Drift	% Error	Ideal	Actual	Drift	% Error		
CO	0 - 200	ppm	0.0	0.0	0.00	0.00	164.6	164.6	0.00	0.00	±5.0 %	Passed
NO	0 - 250	ppm	0.0	0.0	0.00	0.00	82.5	82.5	0.00	0.00	±2.5 %	Passed
O ₂	0 - 25	Vol%	0.00	0.00	0.00	0.00	20.95	20.95	0.00	0.00	±0.5 %	Passed

MEASUREMENT RESULT AFTER CALIBRATE						
Parameter	Measurement Value		Status Reactive Calibration Drifts		Offset&Amplify Acceptance	Note
	Reading	Analog (mA)	Offset (%)	Amplify (%)		
CO 0 - 200 ppm	1.2	4.10	0%	0%	±30%	Passed
CO@7% 0 - 200 ppm	2.5	-	-	-		-
NO _x 0 - 250 ppm	44.8	6.87	0%	0%		Passed
NO _x @7% 0 - 250 ppm	93.8	-	-	-		-
O ₂ 0 - 25 Vol%	14.29	13.15	0%	3%		Passed

* % Error Calculate from percent of range.

CHECK BY :	Mr. Pirin
DATE :	10-March-2023

UNIT 1B



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SERVICE REPORT

Job No. :	JID2300041-002	Customer name :	EGCO COGENERATION
Equipment :	CEMS	Unit name :	1SAA-IRK-1B
Manufacturer :	ABB	Location :	Rayong
Model :	URAS 26	Contact name :	K. Pipat Udom
Serial No. :	3.387669.9	Telephone :	038-637-051-57 #9241
Working date :	10-March-2023	Fax. :	081-862-4780
Traveling hour :	4 Hr.	Email address :	Pipat.udo@egco.com
Mileage :	360 km.	Working Hour :	2 Hr.

SCOPE OF WORK	Preventive maintenance continuous emission monitoring system unit 1SAA-IRK-1B.
PHYSICAL & FUNCTION CHECK	<p><u>Sampling system.</u></p> <ul style="list-style-type: none"> - Checked the heated line was normal condition. - Checked the sample gas cooler was normal operation. - Checked the automatic condensate drain was normal operation. - Checked the acid filter was clean. - Checked the sample gas feed unit was normal operation. - Checked the filter membrane was clean. - Checked the sample flow and bypass flow were kept in set point. - Checked the condensate alarm for cut-off pump was normal operation. <p><u>Gas analyzer</u></p> <ul style="list-style-type: none"> - Diagnostics checked of the gas analyzer before calibration found were normal condition. - Validate zero and span for the gas analyzer was normal responding.
CORRECT ACTION	<p><u>Gas analyzer</u></p> <ul style="list-style-type: none"> - Performed zero and span calibration for the gas analyzer by feed standard gas direct to the sample gas cooler. - Diagnostics checked of the gas analyzer after calibrations were normal condition.
PART REPLACEMENT	- No part replacement.
RECOMMENDATION	-

Internal information: ID Warranty.

Sampling system 1B : 4157

Gas analyzer (Uras26) : 4723

Gas cooler (SCC-C) : 7704

Gas feed unit (SCC-F) : 7706

NO_x Converter : 7708



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http : // www.pico.co.th E-mail-address : combustion@pico.co.th

CHECK BY :	Mr. Pirin	DATE :	10-March-2023
APPROVE BY:	Mr. Nadthapong	DATE:	13-March-2023
CUSTOMER SIGN :		DATE :	



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GENERAL CHECK

UNIT NAME :	1SAA-IRK-1B	LOCATION :	HRSG 12
-------------	-------------	------------	---------

ITEM	DESCRIPTION	SET-POINT VALUE	STATUS/VALUE		REMARK
			BEFORE	AFTER	
	Inside cabinet				
1	Temperature in Cabinet	20-25 °C	24.3 °C	25.1 °C	
2	Air conditioner	Operate	OK	OK	
3	Humidity in Cabinet	-	38 %	58 %	
4	Sample gas cooler temperature	3.0 °C	3.0 °C	3.0 °C	
5	Automatic Condensate Drain	Drain	Drain	Drain	
6	Flexible tube	Normal	Normal	Normal	
7	Acid filter	Clean	Clean	Clean	
8	Sample gas feed pump operate	Run	Run	Run	
9	Condensate filter	Clean	Clean	Clean	
10	Condensate monitor	Normal	Normal	Normal	
11	Sample flow	60 l/h	60 l/h	60 l/h	
12	Bypass flow	≈20 l/h	20 l/h	20 l/h	
13	Disposable filter unit.	Clean	Clean	Clean	
14	Span gas NO cylinder	> 300 psi	1,400 psi	1,400 psi	
15	Span gas CO cylinder	> 300 psi	1,300 psi	1,300 psi	
	On stack				
16	Heated sample probe	Hot	Hot	Hot	
17	Filter probe	Clean	Clean	Clean	
18	Heated line Main	140 °C	139.4 °C	139.3 °C	
19	Heated line Bypass	140 °C	139.4 °C	139.3 °C	

CHECK BY :

Mr. Pirin

DATE :

10-March-2023



PETRO - INSTRUMENTS CORP., LTD.

บริษัท เพโทร-อินสตรูเมนต์ จำกัด

PETRO-INSTRUMENTS CORP., LTD.

7/409 ซ.วิภาวดีรังสิต 36 ถ.วิภาวดีรังสิต แขวงจตุจักร เขตจตุจักร กรุงเทพฯ 10900

7/409 Soi Vibhavadi-Rangsit 36 Vibhavadi-Rangsit Rd., Chatuchak, Bangkok 10900, Thailand

TEL: (662) 939 5711 (12 Lines), 513 2333 (12 Lines), 513 9575-9 FAX: (662) 939 4207

http : // www.pico.co.th E-mail-address : combustion@pico.co.th

ANALYZER TEST REPORT

ANALYZER TYPE :	GAS ANALYZER	MENUFACTURER :	ABB
MODEL :	URAS 26	SERIAL NO. :	3.387669.9
UNIT NAME :	1SAA-IRK-1B	LOCATION :	HRSO 12

Standard gas concentration

Parameter	Concentration	Start date	Expire date	Cylinder No.
CO	164.6 ppm	28-Dec-2017	28-Dec-2025	CC703275
NO	82.5 ppm	27-Oct-2022	27-Oct-2025	D878359

Use ambient air for calibrate span point O₂ 20.95 Vol%.

MEASUREMENT RESULT BEFORE CALIBRATE						
Parameter	Measurement Value		Status Reactive Calibration Drifts		Offset&Amplify Acceptance	Note
	Reading	Analog (mA)	Offset (%)	Amplify (%)		
CO 0 - 200 ppm	7.4	4.59	-1%	-1%	±30%	Passed
CO@7% 0 - 200 ppm	14.9	-	-	-		
NO _x 0 - 250 ppm	36.4	6.33	7%	24%		Passed
NO _x @7% 0 - 250 ppm	73.5	-	-	-		
O ₂ 0 - 25 Vol%	14.04	12.99	0%	4%		Passed

VALIDATION RESULT												
Parameter			Zero				Span				% Error Acceptance	Note
			Ideal	Actual	Drift	% Error	Ideal	Actual	Drift	% Error		
CO	0 - 200	ppm	0.0	-0.1	-0.10	0.05	164.6	164.8	0.20	-0.10	±5.0 %	Passed
NO	0 - 250	ppm	0.0	0.1	0.10	-0.04	82.5	81.9	-0.60	0.24	±2.5 %	Passed
O ₂	0 - 25	Vol%	0.00	0.02	0.02	-0.02	20.95	20.92	-0.03	0.03	±0.5 %	Passed

CALIBRATION RESULT											
Parameter		Zero				Span				% Error Acceptance	Note
		Ideal	Actual	Drift	% Error	Ideal	Actual	Drift	% Error		
CO	0 - 200 ppm	0.0	0.0	0.00	0.00	164.6	164.6	0.00	0.00	±5.0 %	Passed
NO	0 - 250 ppm	0.0	0.0	0.00	0.00	82.5	82.5	0.00	0.00	±2.5 %	Passed
O ₂	0 - 25 Vol%	0.00	0.00	0.00	0.00	20.95	20.95	0.00	0.00	±0.5 %	Passed

MEASUREMENT RESULT AFTER CALIBRATE						
Parameter	Measurement Value		Status Reactive Calibration Drifts		Offset&Amplify Acceptance	Note
	Reading	Analog (mA)	Offset (%)	Amplify (%)		
CO 0 - 200 ppm	10.6	4.85	-1%	-1%	±30%	Passed
CO@7% 0 - 200 ppm	20.9	-	-	-		
NO _x 0 - 250 ppm	33.8	6.16	0%	6%		Passed
NO _x @7% 0 - 250 ppm	66.7	-	-	-		
O ₂ 0 - 25 Vol%	13.88	12.88	3%	1%		Passed

* % Error Calculate from percent of range.

CHECK BY :	Mr. Pirin
DATE :	10-March-2023

CERTIFICATE OF STANDARD GAS

BPC - GT HRS6
CO

Airgas Specialty Gases
Airgas USA, LLC
600 Union Landing Road
Cinnaminson, NJ 08077-0000
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E02NI99E15A3300 Reference Number: 82-401076401-1
Cylinder Number: CC703275 Cylinder Volume: 144.3 CF
Laboratory: 124 - Riverton (SAP) - NJ Cylinder Pressure: 2015 PSIG
PGVP Number: B52017 Valve Outlet: 350
Gas Code: CO,BALN Certification Date: Dec 28, 2017

Expiration Date: Dec 28, 2025

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, 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 volume/volume basis unless otherwise noted.

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

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON MONOXIDE	160.0 PPM	164.6 PPM	G1	+/- 0.9% NIST Traceable	12/28/2017
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	12062228	CC365471	97.56 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	May 25, 2018

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AHR0801933 CO	FTIR	Dec 08, 2017

Trlad Data Available Upon Request

NOTES:PO# 5217005382

This calibration std. has been certified in accordance with the May 2012 EPA Traceability Protocol, Document EPA-600/R-12/531. All testing processes and measurements conform to the requirements of ISO/IEC 17025 and to Airgas ISO 9001:2000 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. 2000.02


Approved for Release

Certificate Of Analysis
Special Gases Mixture

Customer Details

Name: EGCO ENGINEERING AND SERVICE
Address: 222 Moo. 8, A. Mabkha, A. King Aumphur
Nikhom Pattana, Rayong 21180
Customer Tag No.:

Certificate Details

Number:	3218/22	Date of Issue:	27-Oct-2022	Expiry date:	27-Oct-2025
Material Details					
Production Order:	90174084	Material Code:	431600-SV-44	Cylinder No.:	D878359
Gas content:	1.25 M ³	Filling pressure:	130.0 bar	Valve:	CGA 660 SS
Cylinder Owner:	LINDE	Cylinder Material:	Spectra seal	Cylinder Size:	10 L

Laboratory Report

Analytical Result

Component	Normal Concentration	Analysis Result ¹	Uncertainty ²	Method of Analysis ³	Assay Date
Nitric Oxide	85.0 ppm	82.5 ppm	± 1% relative	(6) I-PB-352	19-Oct & 26-Oct-22
Other NOx impurity In Nitrogen		Less than 4.1 ppm			

Reference Standard used in Assay

Reference Standard	Cylinder number	Concentration	Expiry date:
Nitric Oxide In Nitrogen	1228205G	50.87 ± 0.25 ppm	6-May-2023

Analytical Instruments used in Assay

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
FTIR Spectrometers Nicolet i550	FTIR-NO	1-Oct-2022

Recommend usage condition

Minimum utilization: 5% of actual content or before expire date whichever comes first.
Storage condition: Keep in well ventilation and secure area.

Comments

When reordering, please quote the material number

Note:

1. All results expressed in this report are on mole/mole basis, unless otherwise specified. The Assay of this Standard has been performed in accordance with the EPA Traceability Protocol EPA-600/R-12/531 for the Assay and Certification of Gaseous Calibration Standards using procedure G1
2. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The measurement of this material is traceable to the SI through the reference gas standard which is traceable to Swiss National Standard of Mass or other recognised national metrology institutes.
3. (1) Gas Chromatography, (2) Paramagnetic Oxygen Analyzer, (3) Electrochemical Oxygen Analyzer, (4) Electrochemical Moisture Analyzer, (5) Total Hydrocarbon Analyzer, (6) Other - Specified

Sukanya Parinyasontorn
Signatory for and on behalf of Linde (Thailand) Co., Ltd.



PREVENTIVE MAINTENANCE PLAN

SCHEDULE PLAN FOR PREVENTIVE MAINTENANCE CEMS																
Item	Part name	P/N	Interval	Q'ty	Unit	2023										
						1	2	3	4	5	6	7	8	9	10	11
						Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	PM Schedule		1 M			X	X	X	X	X	X	X	X	X	X	X
	Sampling probe															
1	Ceramic filter	IT0001141	1 Y	2	pc				X							
2	Set of gaskets FPM	IT0001152	1 Y	2	set				X							
	Sample gas cooler SCC-C															
3	sealing GL25-12mm (SCC-C)	IT0001830	1 Y	2	pc				X							
4	sealing GL18-8mm (SCC-C)	IT0001831	1 Y	4	pc				X							
5	Driver complete	IT0001823	1 Y	2	pc				X							
6	Flexible tube	IT0001931	3 M	1	Pack	X			X			X			X	
	Acid filter unit															
7	Filter element for acid filter	IT0000732	-	4	pc	Up to condition										
8	O-ring 56 x 3, FPM	IT0000777	1 Y	2	pc				X							
	Gas feed unit SCC-F															
9	Spare parts set (for diaphragm pump)	IT0000716	1 Y	2	set							X				
10	O-ring 60x3,5mm , FPM70	IT0000800	1 Y	2	pc							X				
11	Filter membrane	IT0001128	-	1	Pack	Up to condition										
	Gas analyzer															
13	Oxygen sensor	IT0000702	1 Y	2	pc	Up to condition										
14	Disposable filter unit	IT0001136	3	4	pc	Up to condition										
15	Viton tube FPM-70-SW 4x1.5	IT0000741	1 Y	4	Meter			X								



กำหนดการเข้าปฏิบัติงานการบำรุงรักษาเชิงป้องกันตามแผน
กำหนดการเปลี่ยนวัสดุสิ้นเปลืองตามแผนแต่ละรายการ

SERVICE REPORT

Preventive Maintenance

For

Continuous Emission Monitoring System (CEMS)



EGCO COGENERATION CO., LTD



April, 2023^{4th}

JID2300041-003

BY:

PETRO-INSTRUMENTS CORP.,LTD

**PETRO-INSTRUMENTS CORP., LTD.**

7/409 Soi Vibhavadi-Rangsit 36, Vibhavadi-Rangsit Rd., Chatuchak, Chatuchak
Bangkok 10900 Thailand
Tel.:(+66) 2939 5711 (12 Lines), (+66) 2513 2333 (12 Lines), Fax. : (+66) 939

DOC. NUMBER

SERVICE REPORT

REPORT DATE

EQUIPMENT: CEMs	SERIAL NUMBER / TAG NUMBER -	BRAND / MANUFACTURER ABB
CUSTOMER NAME: Egco cogeneration	LACATION: Rayong	JOB NUMBER / REQUESTED NUMBER JID2300041-003

REASON FOR VISIT

- Preventive maintenance CEMs unit 11, 12.

FOUND FAILURE & CORRECTIVE ACTION DETAILS

- Operation checked of the gas analyzer all units.
- Checked diagnostic of the gas analyzer all units.
- Checked the sample gas cooler all unit was normal operation.
- Checked the sample gas feed all unit was normal operation.
- Checked the automatic condensate drain was normal operation.
- Checked the sample flow and by pass flow were kept in set point.
- Validate zero and span gas for the gas analyzer was normal response.
- Calibration zero and span gas for the gas analyzer by feed gas direct to the sample gas cooler.

Standard gas CO supply by PICO

WORK CONCLUSION

<input checked="" type="checkbox"/> COMPLETED		<input type="checkbox"/> IN COMPLETED	PARTS REPLACEMENT		
<input checked="" type="checkbox"/> CHARGE	<input type="checkbox"/> NO CHARGE		PARTS NAME	P/N	QTY.
<input type="checkbox"/> SERVICE FEE	<input type="checkbox"/> PROJECT WARRANTY	<input type="checkbox"/> TAKE TO OFFICE			
<input type="checkbox"/> TRAVELLING	<input type="checkbox"/> SERVICE WARRANTY	<input type="checkbox"/> WAIT FOR PARTS			
<input type="checkbox"/> SPARE PARTS	<input type="checkbox"/> PARTS WARRANTY	<input type="checkbox"/> IN PROCESS			
<input type="checkbox"/> OTHER	<input checked="" type="checkbox"/> SERVICE CONTRACT	<input type="checkbox"/> OTHER			

TIME SPENT (HOURS)

YEAR	2023								TOTAL HOURS	TRAVELING DETAILS	
MONTH	4									TRAVEL BY	
DATE	5								6	FROM	Pico
SERVICE TIME	6								-	TO	Rayong
OVERTIME	-								4	TOTAL ROUND TRIP	1
TRAVELING TIME	4								10	DISTANCE (KM.)	360
TOTAL HOURS	10										

SERVICE CREW

NAME		NAME	
1. Mr. Phuwanai N.		3.	
2.		4.	

CUSTOMER'S NAME 1555. 2110215 220	CUSTOMER'S SIGNATURE 	DATE 10/4/2023
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UNIT 1A



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SERVICE REPORT

Job No. :	JID2300041-003	Customer name :	EGCO COGENERATION
Equipment :	CEMS	Unit name :	1SAA-IRK-1B
Manufacturer :	ABB	Location :	Rayong
Model :	URAS 26	Contact name :	K. Pipat Udom
Serial No. :	3.387669.9	Telephone :	038-637-051-57 #9241
Working date :	5-April-2023	Fax. :	081-862-4780
Traveling hour :	4 Hr.	Email address :	Pipat.udo@egco.com
Mileage :	360 km.	Working Hour :	2 Hr.

SCOPE OF WORK	Preventive maintenance continuous emission monitoring system unit 1SAA-IRK-1B.
PHYSICAL & FUNCTION CHECK	<p>Sampling system.</p> <ul style="list-style-type: none"> - Checked the heated line was normal condition. - Checked the sample gas cooler was normal operation. - Checked the automatic condensate drain was normal operation. - Checked the acid filter was clean. - Checked the sample gas feed unit was normal operation. - Checked the filter membrane was clean. - Checked the sample flow and bypass flow were kept in set point. - Checked the condensate alarm for cut-off pump was normal operation. <p>Gas analyzer</p> <ul style="list-style-type: none"> - Diagnostics checked of the gas analyzer before calibration found were normal condition. - Validate zero and span for the gas analyzer was normal responding.
CORRECT ACTION	<p>Gas analyzer</p> <ul style="list-style-type: none"> - Performed zero and span calibration for the gas analyzer by feed standard gas direct to the sample gas cooler. - Diagnostics checked of the gas analyzer after calibrations were normal condition.
PART REPLACEMENT	- No part replacement.
RECOMMENDATION	-

Internal information: ID Warranty.

Sampling system 1B	: 4157
Gas analyzer (Uras26)	: 4723
Gas cooler (SCC-C)	: 7704
Gas feed unit (SCC-F)	: 7706
NO _x Converter	: 7708



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CHECK BY :	Mr. Phuwana	DATE :	5-April-2023
APPROVE BY:	Mr. Nadthapong	DATE:	10-April-2023
CUSTOMER SIGN :		DATE :	



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GENERAL CHECK

UNIT NAME :	1SAA-IRK-1B	LOCATION :	HRS 12
-------------	-------------	------------	--------

ITEM	DESCRIPTION	SET-POINT VALUE	STATUS/VALUE		REMARK
			BEFORE	AFTER	
	Inside cabinet				
1	Temperature in Cabinet	20-25 °C	24.3 °C	25.1 °C	
2	Air conditioner	Operate	OK	OK	
3	Humidity in Cabinet	-	38 %	58 %	
4	Sample gas cooler temperature	3.0 °C	3.0 °C	3.0 °C	
5	Automatic Condensate Drain	Drain	Drain	Drain	
6	Flexible tube	Normal	Normal	Normal	
7	Acid filter	Clean	Clean	Clean	
8	Sample gas feed pump operate	Run	Run	Run	
9	Condensate filter	Clean	Clean	Clean	
10	Condensate monitor	Normal	Normal	Normal	
11	Sample flow	60 l/h	60 l/h	60 l/h	
12	Bypass flow	≈20 l/h	20 l/h	20 l/h	
13	Disposable filter unit.	Clean	Clean	Clean	
14	Span gas NO cylinder	> 300 psi	1,400 psi	1,400 psi	
15	Span gas CO cylinder	> 300 psi	1,300 psi	1,300 psi	
	On stack				
16	Heated sample probe	Hot	Hot	Hot	
17	Filter probe	Clean	Clean	Clean	
18	Heated line Main	140 °C	139.4 °C	139.3 °C	
19	Heated line Bypass	140 °C	139.4 °C	139.3 °C	

CHECK BY : Mr. Phuwanai

DATE : 5-April-2023



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ANALYZER TEST REPORT

ANALYZER TYPE :	GAS ANALYZER	MENUFACTURER :	ABB
MODEL :	URAS 26	SERIAL NO. :	3.387669.9
UNIT NAME :	1SAA-IRK-1B	LOCATION :	HRSO 12

Standard gas concentration

Parameter	Concentration	Start date	Expire date	Cylinder No.
CO	164.6 ppm	28-Dec-2017	28-Dec-2025	CC703275
NO	82.5 ppm	27-Oct-2022	27-Oct-2025	D878359

Use ambient air for calibrate span point O₂ 20.95 Vol%.

MEASUREMENT RESULT BEFORE CALIBRATE						
Parameter	Measurement Value		Status Reactive Calibration Drifts		Offset&Amplify Acceptance	Note
	Reading	Analog (mA)	Offset (%)	Amplify (%)		
CO 0 - 200 ppm	1.4	4.11	-1%	-2%	±30%	Passed
CO@7% 0 - 200 ppm	2.9	-	-	-		
NO _x 0 - 250 ppm	39.4	6.52	2%	-2%		Passed
NO _x @7% 0 - 250 ppm	80.8	-	-	-		
O ₂ 0 - 25 Vol%	14.15	13.06	0%	3%		Passed

VALIDATION RESULT												
Parameter			Zero				Span				% Error Acceptance	Note
			Ideal	Actual	Drift	% Error	Ideal	Actual	Drift	% Error		
CO	0 - 200	ppm	0.0	0.2	0.20	-0.10	164.6	164.8	0.20	-0.10	±5.0 %	Passed
NO	0 - 250	ppm	0.0	0.1	0.10	-0.04	82.5	81.9	-0.60	0.24	±2.5 %	Passed
O ₂	0 - 25	Vol%	0.00	0.00	0.00	0.00	20.95	20.92	-0.03	0.03	±0.5 %	Passed

CALIBRATION RESULT												
Parameter			Zero				Span				% Error Acceptance	Note
			Ideal	Actual	Drift	% Error	Ideal	Actual	Drift	% Error		
CO	0 - 200	ppm	0.0	0.0	0.00	0.00	164.6	164.6	0.00	0.00	±5.0 %	Passed
NO	0 - 250	ppm	0.0	0.0	0.00	0.00	82.5	82.5	0.00	0.00	±2.5 %	Passed
O ₂	0 - 25	Vol%	0.00	0.00	0.00	0.00	20.95	20.95	0.00	0.00	±0.5 %	Passed

MEASUREMENT RESULT AFTER CALIBRATE						
Parameter	Measurement Value		Status Reactive Calibration Drifts		Offset&Amplify Acceptance	Note
	Reading	Analog (mA)	Offset (%)	Amplify (%)		
CO 0 - 200 ppm	1.2	4.10	0%	-2%	±30%	Passed
CO@7% 0 - 200 ppm	2.7	-	-	-		
NO _x 0 - 250 ppm	39.8	6.55	0%	0%		Passed
NO _x @7% 0 - 250 ppm	88.4	-	-	-		
O ₂ 0 - 25 Vol%	14.67	13.39	0%	0%		Passed

* % Error Calculate from percent of range.

CHECK BY : Mr. Phuwanai

DATE : 5-April-2023

UNIT 1B



PETRO - INSTRUMENTS CORP., LTD.

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SERVICE REPORT

Job No. :	JID2300041-003	Customer name :	EGCO COGENERATION
Equipment :	CEMS	Unit name :	1SAA-IRK-1A
Manufacturer :	ABB	Location :	Rayong
Model :	URAS 26	Contact name :	K. Pipat Udom
Serial No. :	3.345753.3	Telephone :	038-637-051-57 #9241
Working date :	5-April-2023	Fax. :	081-862-4780
Traveling hour :	4 Hr.	Email address :	Pipat.udo@egco.com
Mileage :	360 km.	Working Hour :	2 Hr.

SCOPE OF WORK	Preventive maintenance continuous emission monitoring system unit 1SAA-IRK-1A.
PHYSICAL & FUNCTION CHECK	<p>Sampling system.</p> <ul style="list-style-type: none"> - Checked the heated line was normal condition. - Checked the sample gas cooler was normal operation. - Checked the automatic condensate drain was normal operation. - Checked the acid filter was clean. - Checked the sample gas feed unit was normal operation. - Checked the filter membrane was clean. - Checked the sample flow and bypass flow were kept in set point. - Checked the condensate alarm for cut-off pump was normal operation. <p>Gas analyzer</p> <ul style="list-style-type: none"> - Diagnostics checked of the gas analyzer before calibration found were normal condition such as temperature, pressure. - Validate zero and span for the gas analyzer found normal responding.
CORRECT ACTION	<p>Gas analyzer</p> <ul style="list-style-type: none"> - Performed zero and span calibration for the gas analyzer by feed standard gas direct to the sample gas cooler. - Diagnostics checked of the gas analyzer after calibrations were normal condition.
PART REPLACEMENT	- No part replacement.
RECOMMENDATION	-

Internal information: ID Warranty.

Gas analyzer (Uras26) : 1360

Gas cooler (SCC-C) : 7703

Gas feed unit (SCC-F) : 7705

NO_x Converter : 7707

Sampling system 1A : 4156



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PETRO-INSTRUMENTS CORP., LTD.

7/409 ซ.วิภาวดีรังสิต 36 ถ.วิภาวดีรังสิต แขวงจตุจักร เขตจตุจักร กรุงเทพฯ 10900

7/409 Soi Vibhavadi-Rangsit 36 Vibhavadi-Rangsit Rd., Chatuchak , Bangkok 10900, Thailand

TEL: (662) 939 5711 (12 Lines), 513 2333 (12 Lines), 513 9575-9 FAX: (662) 939 4207

http : // www.pico.co.th E-mail-address : combustion@pico.co.th

CHECK BY :	Mr. Phuwanai	DATE :	5-April-2023
APPROVE BY:	Mr. Nadthapong	DATE:	10-April-2023
CUSTOMER SIGN :		DATE :	



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GENERAL CHECK

UNIT NAME :	1SAA-IRK-1A	LOCATION :	HRSG 11
-------------	-------------	------------	---------

ITEM	DESCRIPTION	SET-POINT VALUE	STATUS/VALUE		REMARK
			BEFORE	AFTER	
	Inside cabinet				
1	Temperature in Cabinet	20-25 °C	20.7 °C	24.7 °C	
2	Air conditioner	Operate	OK	OK	
3	Humidity in Cabinet	-	34 %	49 %	
4	Sample gas cooler temperature	3.0 °C	3.0 °C	3.0 °C	
5	Automatic Condensate Drain	Drain	Drain	Drain	
6	Flexible tube	Normal	Normal	Normal	
7	Acid filter	Clean	Clean	Clean	
8	Sample gas feed pump operate	Run	Run	Run	
9	Condensate filter	Clean	Clean	Clean	
10	Condensate monitor	Normal	Normal	Normal	
11	Sample flow	60 l/h	61 l/h	60 l/h	
12	Bypass flow	60 l/h	60 l/h	60 l/h	
13	Disposable filter unit.	Clean	Clean	Clean	
14	Span gas NO cylinder	> 300 psi	1,400 psi	1,400 psi	
15	Span gas CO cylinder	> 300 psi	1,300 psi	1,300 psi	
	On stack				
16	Heated sample probe	Hot	Hot	Hot	
17	Filter probe	Clean	Clean	Clean	
18	Heated line Main	140 °C	139.7 °C	139.7 °C	
19	Heated line Bypass	140 °C	139.7 °C	139.7 °C	

CHECK BY :

Mr. Phuwanai

DATE :

5-April-2023



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ANALYZER TEST REPORT

ANALYZER TYPE :	GAS ANALYZER	MENUFACTURER :	ABB
MODEL :	URAS 26	SERIAL NO. :	3.345753.3
UNIT NAME :	1SAA-IRK-1A	LOCATION :	HRS 11

Standard gas concentration

Parameter	Concentration	Start date	Expire date	Cylinder No.
CO	164.6 ppm	28-Dec-2017	28-Dec-2025	CC703275
NO	82.5 ppm	27-Oct-2021	27-Oct-2025	D878359

Use ambient air for calibrate span point O₂ 20.95 Vol%.

MEASUREMENT RESULT BEFORE CALIBRATE						
Parameter	Measurement Value		Status Reactive Calibration Drifts		Offset&Amplify Acceptance	Note
	Reading	Analog (mA)	Offset (%)	Amplify (%)		
CO 0 - 200 ppm	1.4	4.11	1%	10%	±30%	Passed
CO@7% 0 - 200 ppm	2.7	-	-	-		
NO _x 0 - 250 ppm	39.2	6.51	2%	0%		Passed
NO _x @7% 0 - 250 ppm	74.7	-	-	-		
O ₂ 0 - 25 Vol%	13.63	12.72	3%	1%		Passed

VALIDATION RESULT												
Parameter			Zero				Span				% Error Acceptance	Note
			Ideal	Actual	Drift	% Error	Ideal	Actual	Drift	% Error		
CO	0 - 200	ppm	0.0	0.5	0.50	-0.25	164.6	164.5	-0.10	0.05	±5.0 %	Passed
NO	0 - 250	ppm	0.0	-0.3	-0.30	0.12	82.5	82.2	-0.30	0.12	±2.5 %	Passed
O ₂	0 - 25	Vol%	0.00	0.02	0.02	-0.02	20.95	20.90	-0.05	0.05	±0.5 %	Passed

CALIBRATION RESULT											
Parameter	Zero				Span				% Error Acceptance	Note	
	Ideal	Actual	Drift	% Error	Ideal	Actual	Drift	% Error			
CO 0 - 200 ppm	0.0	0.0	0.00	0.00	164.6	164.6	0.00	0.00	±5.0 %	Passed	
NO 0 - 250 ppm	0.0	0.0	0.00	0.00	82.5	82.5	0.00	0.00	±2.5 %	Passed	
O ₂ 0 - 25 Vol%	0.00	0.00	0.00	0.00	20.95	20.95	0.00	0.00	±0.5 %	Passed	

MEASUREMENT RESULT AFTER CALIBRATE						
Parameter	Measurement Value		Status Reactive Calibration Drifts		Offset&Amplify Acceptance	Note
	Reading	Analog (mA)	Offset (%)	Amplify (%)		
CO 0 - 200 ppm	0.9	4.07	0%	0%	±30%	Passed
CO@7% 0 - 200 ppm	1.7	-	-	-		
NO _x 0 - 250 ppm	54.1	7.46	0%	0%		Passed
NO _x @7% 0 - 250 ppm	118.1	-	-	-		
O ₂ 0 - 25 Vol%	14.56	13.32	0%	0%		Passed

* % Error Calculate from percent of range.

CHECK BY : Mr. Phuwanai

DATE : 5-April-2023

CERTIFICATE OF STANDARD GAS

Certificate Of Analysis

Special Gases Mixture

Customer Details

Name: EGCO ENGINEERING AND SERVICE Address: 222 Moo. 8, A. Mabkha, A. King Aumphur
Nikhom Pattana, Rayong 21180 Customer Tag No.:

Certificate Details

Number:	3218/22	Date of Issue:	27-Oct-2022	Expiry date:	27-Oct-2025
Material Details					
Production Order:	90174084	Material Code:	431600-SV-44	Cylinder No.:	D878359
Gas content:	1.25 M ³	Filling pressure:	130.0 bar	Valve:	CGA 660 SS
Cylinder Owner:	LINDE	Cylinder Material:	Spectra seal	Cylinder Size:	10 L

Laboratory Report**Analytical Result**

Component	Normal Concentration	Analysis Result ¹	Uncertainty ²	Method of Analysis ³	Assay Date
Nitric Oxide	85.0 ppm	82.5 ppm	± 1% relative	(6) I-PB-352	19-Oct & 26-Oct-22
Other NOx impurity In Nitrogen		Less than 4.1 ppm			

Reference Standard used in Assay

Reference Standard	Cylinder number	Concentration	Expiry date:
Nitric Oxide In Nitrogen	1228205G	50.87 ± 0.25 ppm	6-May-2023

Analytical Instruments used in Assay

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
FTIR Spectrometers Nicolet iS50	FTIR-NO	1-Oct-2022

Recommend usage condition

Minimum utilization: 5% of actual content or before expire date whichever comes first.
Storage condition: Keep in well ventilation and secure area.

Comments

When reordering, please quote the material number

Note:

- All results expressed in this report are on mole/mole basis, unless otherwise specified. The Assay of this Standard has been performed in accordance with the EPA Traceability Protocol EPA-600/R-12/531 for the Assay and Certification of Gaseous Calibration Standards using procedure G1
- The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The measurement of this material is traceable to the SI through the reference gas standard which is traceable to Swiss National Standard of Mass or other recognised national metrology institutes.
- (1) Gas Chromatography, (2) Paramagnetic Oxygen Analyzer, (3) Electrochemical Oxygen Analyzer, (4) Electrochemical Moisture Analyzer, (5) Total Hydrocarbon Analyzer, (6) Other - Specified

BPC - GT HRS6
CO

Airgas Specialty Gases
Airgas USA, LLC
600 Union Landing Road
Cinnaminson, NJ 08077-0000
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E02NI99E15A3300 Reference Number: 82-401076401-1
Cylinder Number: CC703275 Cylinder Volume: 144.3 CF
Laboratory: 124 - Riverton (SAP) - NJ Cylinder Pressure: 2015 PSIG
PGVP Number: B52017 Valve Outlet: 350
Gas Code: CO,BALN Certification Date: Dec 28, 2017

Expiration Date: Dec 28, 2025

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, 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 volume/volume basis unless otherwise noted.

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

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON MONOXIDE	160.0 PPM	164.6 PPM	G1	+/- 0.9% NIST Traceable	12/28/2017
NITROGEN	Balance				
CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	12062228	CC365471	97.56 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	May 25, 2018
ANALYTICAL EQUIPMENT					
Instrument/Make/Model		Analytical Principle		Last Multipoint Calibration	
Nicolet 6700 AHR0801933 CO		FTIR		Dec 08, 2017	

Triad Data Available Upon Request

NOTES: PO# 5217005382

This calibration std. has been certified in accordance with the May 2012 EPA Traceability Protocol, Document EPA-600/R-12/531. All testing processes and measurements conform to the requirements of ISO/IEC 17025 and to Airgas ISO 9001:2000 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. 2000.02


Approved for Release

PREVENTIVE MAINTENANCE PLAN

SCHEDULE PLAN FOR PREVENTIVE MAINTENANCE CEMS																
Item	Part name	P/N	Interval	Q'ty	Unit	2023										
						1	2	3	4	5	6	7	8	9	10	11
						Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	PM Schedule		1 M			X	X	X	X	X	X	X	X	X	X	X
	Sampling probe															
1	Ceramic filter	IT0001141	1 Y	2	pc				X							
2	Set of gaskets FPM	IT0001152	1 Y	2	set				X							
	Sample gas cooler SCC-C															
3	sealing GL25-12mm (SCC-C)	IT0001830	1 Y	2	pc				X							
4	sealing GL18-8mm (SCC-C)	IT0001831	1 Y	4	pc				X							
5	Driver complete	IT0001823	1 Y	2	pc				X							
6	Flexible tube	IT0001931	3 M	1	Pack	X			X			X			X	
	Acid filter unit															
7	Filter element for acid filter	IT0000732	-	4	pc	Up to condition										
8	O-ring 56 x 3, FPM	IT0000777	1 Y	2	pc				X							
	Gas feed unit SCC-F															
9	Spare parts set (for diaphragm pump)	IT0000716	1 Y	2	set							X				
10	O-ring 60x3,5mm , FPM70	IT0000800	1 Y	2	pc							X				
11	Filter membrane	IT0001128	-	1	Pack	Up to condition										
	Gas analyzer															
13	Oxygen sensor	IT0000702	1 Y	2	pc	Up to condition										
14	Disposable filter unit	IT0001136	3	4	pc	Up to condition										
15	Viton tube FPM-70-SW 4x1.5	IT0000741	1 Y	4	Meter			X								

X	กำหนดการเข้าปฏิบัติงานการบำรุงรักษาเชิงป้องกันตามแผน
X	กำหนดการเปลี่ยนวัสดุสิ้นเปลืองตามแผนแต่ละรายการ

SERVICE REPORT

Preventive Maintenance

For

Continuous Emission Monitoring System (CEMS)



EGCO COGENERATION CO., LTD



May, 2023^{5th}

JID2300041-004

BY:

PETRO-INSTRUMENTS CORP.,LTD

**PETRO-INSTRUMENTS CORP., LTD.**7/409 Soi Vibhavadi-Rangsit 36, Vibhavadi-Rangsit Rd., Chatuchak, Chatuchak
Bangkok 10900 Thailand

Tel.:(+66) 2939 5711 (12 Lines), (+66) 2513 2333 (12 Lines), Fax. : (+66) 939

DOC. NUMBER

SERVICE REPORT

REPORT DATE

EQUIPMENT: CEMs	SERIAL NUMBER / TAG NUMBER -	BRAND / MANUFACTURER ABB
CUSTOMER NAME: Egco cogeneration	LACATION: Rayong	JOB NUMBER / REQUESTED NUMBER JID2300041-004

REASON FOR VISIT

- Preventive maintenance CEMs unit 11, 12.

FOUND FAILURE & CORRECTIVE ACTION DETAILS

- Operation checked of the gas analyzer all units.
- Checked diagnostic of the gas analyzer all units.
- Checked the sample gas cooler all unit was normal operation.
- Checked the sample gas feed all unit was normal operation.
- Checked the automatic condensate drain was normal operation.
- Checked the sample flow and by pass flow were kept in set point.
- Validate zero and span gas for the gas analyzer was normal response.
- Calibration zero and span gas for the gas analyzer by feed gas direct to the sample gas cooler.

Standard gas CO supply by PICO

WORK CONCLUSION

<input checked="" type="checkbox"/> COMPLETED		<input type="checkbox"/> IN COMPLETED	PARTS REPLACEMENT		
<input checked="" type="checkbox"/> CHARGE	<input type="checkbox"/> NO CHARGE		PARTS NAME	P/N	QTY.
<input type="checkbox"/> SERVICE FEE	<input type="checkbox"/> PROJECT WARRANTY	<input type="checkbox"/> TAKE TO OFFICE			
<input type="checkbox"/> TRAVELLING	<input type="checkbox"/> SERVICE WARRANTY	<input type="checkbox"/> WAIT FOR PARTS			
<input type="checkbox"/> SPARE PARTS	<input type="checkbox"/> PARTS WARRANTY	<input type="checkbox"/> IN PROCESS			
<input type="checkbox"/> OTHER	<input checked="" type="checkbox"/> SERVICE CONTRACT	<input type="checkbox"/> OTHER			

TIME SPENT (HOURS)

YEAR	2023								TOTAL HOURS	TRAVELING DETAILS	
MONTH	5									TRAVEL BY	
DATE	9p								6	FROM	Pico
SERVICE TIME	6								-	TO	Rayong
OVERTIME	-								4	TOTAL ROUND TRIP	1
TRAVELING TIME	4								10	DISTANCE (KM.)	360

SERVICE CREW

NAME		NAME	
1. Mr. Phuwanai N.		3.	
2.		4.	

CUSTOMER'S NAME นาย. นพรัตน์ งาม	CUSTOMER'S SIGNATURE 	DATE 11-5-2023
-------------------------------------	--------------------------	-------------------

UNIT 1A



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SERVICE REPORT

Job No. :	JID2300041-004	Customer name :	EGCO COGENERATION
Equipment :	CEMS	Unit name :	1SAA-IRK-1A
Manufacturer :	ABB	Location :	Rayong
Model :	URAS 26	Contact name :	K. Pipat Udom
Serial No. :	3.345753.3	Telephone :	038-637-051-57 #9241
Working date :	9-May-2023	Fax. :	081-862-4780
Traveling hour :	4 Hr.	Email address :	Pipat.udo@egco.com
Mileage :	360 km.	Working Hour :	2 Hr.

SCOPE OF WORK	Preventive maintenance continuous emission monitoring system unit 1SAA-IRK-1A.
PHYSICAL & FUNCTION CHECK	<p>Sampling system.</p> <ul style="list-style-type: none"> - Checked the heated line was normal condition. - Checked the sample gas cooler was normal operation. - Checked the automatic condensate drain was normal operation. - Checked the acid filter was clean. - Checked the sample gas feed unit was normal operation. - Checked the filter membrane was clean. - Checked the sample flow and bypass flow were kept in set point. - Checked the condensate alarm for cut-off pump was normal operation. <p>Gas analyzer</p> <ul style="list-style-type: none"> - Diagnostics checked of the gas analyzer before calibration found were normal condition such as temperature, pressure. - Validate zero and span for the gas analyzer found normal responding.
CORRECT ACTION	<p>Gas analyzer</p> <ul style="list-style-type: none"> - Performed zero and span calibration for the gas analyzer by feed standard gas direct to the sample gas cooler. - Diagnostics checked of the gas analyzer after calibrations were normal condition.
PART REPLACEMENT	- No part replacement.
RECOMMENDATION	-

Internal information: ID Warranty.

Gas analyzer (Uras26) : 1360

Gas cooler (SCC-C) : 7703

Gas feed unit (SCC-F) : 7705

NO_x Converter : 7707

Sampling system 1A : 4156



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CHECK BY :	Mr. Phuwanai	DATE :	9-May-2023
APPROVE BY:	Mr. Nadthapong	DATE:	15-May-2023
CUSTOMER SIGN :		DATE :	



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GENERAL CHECK

UNIT NAME :	1SAA-IRK-1A	LOCATION :	HRSG 11
-------------	-------------	------------	---------

ITEM	DESCRIPTION	SET-POINT VALUE	STATUS/VALUE		REMARK
			BEFORE	AFTER	
	Inside cabinet				
1	Temperature in Cabinet	20-25 °C	20.7 °C	24.7 °C	
2	Air conditioner	Operate	OK	OK	
3	Humidity in Cabinet	-	34 %	40 %	
4	Sample gas cooler temperature	3.0 °C	3.0 °C	3.0 °C	
5	Automatic Condensate Drain	Drain	Drain	Drain	
6	Flexible tube	Normal	Normal	Normal	
7	Acid filter	Clean	Clean	Clean	
8	Sample gas feed pump operate	Run	Run	Run	
9	Condensate filter	Clean	Clean	Clean	
10	Condensate monitor	Normal	Normal	Normal	
11	Sample flow	60 l/h	61 l/h	60 l/h	
12	Bypass flow	60 l/h	60 l/h	60 l/h	
13	Disposable filter unit.	Clean	Clean	Clean	
14	Span gas NO cylinder	> 300 psi	1,300 psi	1,300 psi	
15	Span gas CO cylinder	> 300 psi	1,300 psi	1,300 psi	
	On stack				
16	Heated sample probe	Hot	Hot	Hot	
17	Filter probe	Clean	Clean	Clean	
18	Heated line Main	140 °C	139.7 °C	139.7 °C	
19	Heated line Bypass	140 °C	139.7 °C	139.7 °C	

CHECK BY : Mr. Phuwanai

DATE : 9-May-2023



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ANALYZER TEST REPORT

ANALYZER TYPE :	GAS ANALYZER	MANUFACTURER :	ABB
MODEL :	URAS 26	SERIAL NO. :	3.345753.3
UNIT NAME :	1SAA-IRK-1A	LOCATION :	HRSRG 11

Standard gas concentration

Parameter	Concentration	Start date	Expire date	Cylinder No.
CO	164.6 ppm	28-Dec-2017	28-Dec-2025	CC703275
NO	82.5 ppm	27-Oct-2021	27-Oct-2025	D878359

Use ambient air for calibrate span point O₂ 20.95 Vol%.

MEASUREMENT RESULT BEFORE CALIBRATE						
Parameter	Measurement Value		Status Reactive Calibration Drifts		Offset&Amplify Acceptance	Note
	Reading	Analog (mA)	Offset (%)	Amplify (%)		
CO 0 - 200 ppm	1.1	4.09	0%	0%	±30%	Passed
CO@7% 0 - 200 ppm	2.3	-	-	-		-
NO _x 0 - 250 ppm	40.8	6.61	3%	15%		Passed
NO _x @7% 0 - 250 ppm	83.8	-	-	-		-
O ₂ 0 - 25 Vol%	14.16	13.06	0%	3%		Passed

VALIDATION RESULT												
Parameter			Zero				Span				% Error Acceptance	Note
			Ideal	Actual	Drift	% Error	Ideal	Actual	Drift	% Error		
CO	0 - 200	ppm	0.0	0.2	0.20	-0.10	164.6	164.5	-0.10	0.05	±5.0 %	Passed
NO	0 - 250	ppm	0.0	-0.4	-0.40	0.16	82.5	82.2	-0.30	0.12	±2.5 %	Passed
O ₂	0 - 25	Vol%	0.00	0.02	0.02	-0.02	20.95	20.89	-0.06	0.06	±0.5 %	Passed

CALIBRATION RESULT												
Parameter			Zero				Span				% Error Acceptance	Note
			Ideal	Actual	Drift	% Error	Ideal	Actual	Drift	% Error		
CO	0 - 200	ppm	0.0	0.0	0.00	0.00	164.6	164.6	0.00	0.00	±5.0 %	Passed
NO	0 - 250	ppm	0.0	0.0	0.00	0.00	82.5	82.5	0.00	0.00	±2.5 %	Passed
O ₂	0 - 25	Vol%	0.00	0.00	0.00	0.00	20.95	20.95	0.00	0.00	±0.5 %	Passed

MEASUREMENT RESULT AFTER CALIBRATE						
Parameter	Measurement Value		Status Reactive Calibration Drifts		Offset&Amplify Acceptance	Note
	Reading	Analog (mA)	Offset (%)	Amplify (%)		
CO 0 - 200 ppm	0.8	4.06	0%	0%	±30%	Passed
CO@7% 0 - 200 ppm	1.6	-	-	-		-
NO _x 0 - 250 ppm	53.6	7.43	0%	0%		Passed
NO _x @7% 0 - 250 ppm	117.4	-	-	-		-
O ₂ 0 - 25 Vol%	14.58	13.33	0%	0%		Passed

* % Error Calculate from percent of range.

CHECK BY : Mr. Phuwanai

DATE : 9-May-2023

UNIT 1B



PETRO - INSTRUMENTS CORP., LTD.

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7/409 ซ.วิภาวดีรังสิต 36 ถ.วิภาวดีรังสิต แขวงจตุจักร เขตจตุจักร กรุงเทพฯ 10900

7/409 Soi Vibhavadi-Rangsit 36 Vibhavadi-Rangsit Rd., Chatuchak, Bangkok 10900, Thailand

TEL: (662) 939 5711 (12 Lines), 513 2333 (12 Lines), 513 9575-9 FAX: (662) 939 4207

http : // www.pico.co.th E-mail-address : combustion@pico.co.th

SERVICE REPORT

Job No. :	JID2300041-004	Customer name :	EGCO COGENERATION
Equipment :	CEMS	Unit name :	1SAA-IRK-1B
Manufacturer :	ABB	Location :	Rayong
Model :	URAS 26	Contact name :	K. Pipat Udom
Serial No. :	3.387669.9	Telephone :	038-637-051-57 #9241
Working date :	9-May-2023	Fax. :	081-862-4780
Traveling hour :	4 Hr.	Email address :	Pipat.udo@egco.com
Mileage :	360 km.	Working Hour :	2 Hr.

SCOPE OF WORK	Preventive maintenance continuous emission monitoring system unit 1SAA-IRK-1B.
PHYSICAL & FUNCTION CHECK	<p>Sampling system.</p> <ul style="list-style-type: none"> - Checked the heated line was normal condition. - Checked the sample gas cooler was normal operation. - Checked the automatic condensate drain was normal operation. - Checked the acid filter was clean. - Checked the sample gas feed unit was normal operation. - Checked the filter membrane was clean. - Checked the sample flow and bypass flow were kept in set point. - Checked the condensate alarm for cut-off pump was normal operation. <p>Gas analyzer</p> <ul style="list-style-type: none"> - Diagnostics checked of the gas analyzer before calibration found were normal condition. - Validate zero and span for the gas analyzer was normal responding.
CORRECT ACTION	<p>Gas analyzer</p> <ul style="list-style-type: none"> - Performed zero and span calibration for the gas analyzer by feed standard gas direct to the sample gas cooler. - Diagnostics checked of the gas analyzer after calibrations were normal condition.
PART REPLACEMENT	- No part replacement.
RECOMMENDATION	-

Internal information: ID Warranty.

Sampling system 1B : 4157

Gas analyzer (Uras26) : 4723

Gas cooler (SCC-C) : 7704

Gas feed unit (SCC-F) : 7706

NO_x Converter : 7708



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http : // www.pico.co.th E-mail-address : combustion@pico.co.th

CHECK BY :	Mr. Phuwanai	DATE :	9-May-2023
APPROVE BY:	Mr. Nadthapong	DATE:	15-May-2023
CUSTOMER SIGN :		DATE :	



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GENERAL CHECK

UNIT NAME :	1SAA-IRK-1B	LOCATION :	HRS 12
-------------	-------------	------------	--------

ITEM	DESCRIPTION	SET-POINT VALUE	STATUS/VALUE		REMARK
			BEFORE	AFTER	
	Inside cabinet				
1	Temperature in Cabinet	20-25 °C	24.3 °C	25.1 °C	
2	Air conditioner	Operate	OK	OK	
3	Humidity in Cabinet	-	43 %	48 %	
4	Sample gas cooler temperature	3.0 °C	3.0 °C	3.0 °C	
5	Automatic Condensate Drain	Drain	Drain	Drain	
6	Flexible tube	Normal	Normal	Normal	
7	Acid filter	Clean	Clean	Clean	
8	Sample gas feed pump operate	Run	Run	Run	
9	Condensate filter	Clean	Clean	Clean	
10	Condensate monitor	Normal	Normal	Normal	
11	Sample flow	60 l/h	60 l/h	60 l/h	
12	Bypass flow	≈20 l/h	20 l/h	20 l/h	
13	Disposable filter unit.	Clean	Clean	Clean	
14	Span gas NO cylinder	> 300 psi	1,300 psi	1,200 psi	
15	Span gas CO cylinder	> 300 psi	1,300 psi	1,300 psi	
	On stack				
16	Heated sample probe	Hot	Hot	Hot	
17	Filter probe	Clean	Clean	Clean	
18	Heated line Main	140 °C	139.4 °C	139.3 °C	
19	Heated line Bypass	140 °C	139.4 °C	139.3 °C	

CHECK BY : Mr. Phuwana

DATE : 9-May-2023



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http://www.pico.co.th E-mail-address: combustion@pico.co.th

ANALYZER TEST REPORT

ANALYZER TYPE :	GAS ANALYZER	MANUFACTURER :	ABB
MODEL :	URAS 26	SERIAL NO. :	3.387669.9
UNIT NAME :	1SAA-IRK-1B	LOCATION :	HRSG 12

Standard gas concentration

Parameter	Concentration	Start date	Expire date	Cylinder No.
CO	164.6 ppm	28-Dec-2017	28-Dec-2025	CC703275
NO	82.5 ppm	27-Oct-2022	27-Oct-2025	D878359

Use ambient air for calibrate span point O₂ 20.95 Vol%.

MEASUREMENT RESULT BEFORE CALIBRATE						
Parameter	Measurement Value		Status Reactive Calibration Drifts		Offset&Amplify Acceptance	Note
	Reading	Analog (mA)	Offset (%)	Amplify (%)		
CO 0 - 200 ppm	1.2	4.10	-1%	-2%	±30%	Passed
CO@7% 0 - 200 ppm	2.6	-	-	-		
NO _x 0 - 250 ppm	41.5	6.66	0%	0%		Passed
NO _x @7% 0 - 250 ppm	91.6	-	-	-		
O ₂ 0 - 25 Vol%	14.63	13.36	0%	0%		Passed

VALIDATION RESULT										
Parameter	Zero				Span				% Error Acceptance	Note
	Ideal	Actual	Drift	% Error	Ideal	Actual	Drift	% Error		
CO 0 - 200 ppm	0.0	0.2	0.20	-0.10	164.6	164.8	0.20	-0.10	±5.0 %	Passed
NO 0 - 250 ppm	0.0	0.1	0.10	-0.04	82.5	81.9	-0.60	0.24	±2.5 %	Passed
O ₂ 0 - 25 Vol%	0.00	0.02	0.02	-0.02	20.95	20.92	-0.03	0.03	±0.5 %	Passed

CALIBRATION RESULT										
Parameter	Zero				Span				% Error Acceptance	Note
	Ideal	Actual	Drift	% Error	Ideal	Actual	Drift	% Error		
CO 0 - 200 ppm	0.0	0.0	0.00	0.00	164.6	164.6	0.00	0.00	±5.0 %	Passed
NO 0 - 250 ppm	0.0	0.0	0.00	0.00	82.5	82.5	0.00	0.00	±2.5 %	Passed
O ₂ 0 - 25 Vol%	0.00	0.00	0.00	0.00	20.95	20.95	0.00	0.00	±0.5 %	Passed

MEASUREMENT RESULT AFTER CALIBRATE						
Parameter	Measurement Value		Status Reactive Calibration Drifts		Offset&Amplify Acceptance	Note
	Reading	Analog (mA)	Offset (%)	Amplify (%)		
CO 0 - 200 ppm	1.2	4.10	-1%	-3%	±30%	Passed
CO@7% 0 - 200 ppm	2.7	-	-	-		
NO _x 0 - 250 ppm	41.6	6.66	0%	-2%		Passed
NO _x @7% 0 - 250 ppm	93.1	-	-	-		
O ₂ 0 - 25 Vol%	14.72	13.42	0%	-1%		Passed

* % Error Calculate from percent of range.

CHECK BY : Mr. Phuwanai

DATE : 9-May-2023

CERTIFICATE OF STANDARD GAS

BPC - GT HRSg
CO

Airgas Specialty Gases
Airgas USA, LLC
600 Union Landing Road
Cinnaminson, NJ 08077-0000
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E02NI99E15A3300 Reference Number: 82-401076401-1
Cylinder Number: CC703275 Cylinder Volume: 144.3 CF
Laboratory: 124 - Riverton (SAP) - NJ Cylinder Pressure: 2015 PSIG
PGVP Number: B52017 Valve Outlet: 350
Gas Code: CO,BALN Certification Date: Dec 28, 2017

Expiration Date: Dec 28, 2025

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, 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 volume/volume basis unless otherwise noted.

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

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON MONOXIDE	160.0 PPM	164.6 PPM	G1	+/- 0.9% NIST Traceable	12/28/2017
NITROGEN	Balance				
CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	12062228	CC365471	97.56 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	May 25, 2018
ANALYTICAL EQUIPMENT					
Instrument/Make/Model		Analytical Principle		Last Multipoint Calibration	
Nicolet 6700 AHR0801933 CO		FTIR		Dec 08, 2017	

Triad Data Available Upon Request

NOTES: PO# 5217005382

This calibration std. has been certified in accordance with the May 2012 EPA Traceability Protocol, Document EPA-600/R-12/531. All testing processes and measurements conform to the requirements of ISO/IEC 17025 and to Airgas ISO 9001:2000 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. 2000.02

Approved for Release

Certificate Of Analysis
Special Gases Mixture

Customer Details

Name: EGCO ENGINEERING AND SERVICE
Address: 222 Moo. 8, A. Mabkha, A. King Aumphur
Nikhom Pattana, Rayong 21180
Customer Tag No.:

Certificate Details

Number:	3218/22	Date of Issue:	27-Oct-2022	Expiry date:	27-Oct-2025
Material Details					
Production Order:	90174084	Material Code:	431600-SV-44	Cylinder No.:	D878359
Gas content:	1.25 M ³	Filling pressure:	130.0 bar	Valve:	CGA 660 SS
Cylinder Owner:	LINDE	Cylinder Material:	Spectra seal	Cylinder Size:	10 L

Laboratory Report

Analytical Result

Component	Normal Concentration	Analysis Result ¹	Uncertainty ²	Method of Analysis ³	Assay Date
Nitric Oxide	85.0 ppm	82.5 ppm	± 1% relative	(6) I-PB-352	19-Oct & 26-Oct-22
Other NOx impurity In Nitrogen		Less than 4.1 ppm			

Reference Standard used in Assay

Reference Standard	Cylinder number	Concentration	Expiry date:
Nitric Oxide In Nitrogen	1228205G	50.87 ± 0.25 ppm	6-May-2023

Analytical Instruments used in Assay

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
FTIR Spectrometers Nicolet iS50	FTIR-NO	1-Oct-2022

Recommend usage condition

Minimum utilization: 5% of actual content or before expire date whichever comes first.
Storage condition: Keep in well ventilation and secure area.

Comments

When reordering, please quote the material number

Note:

1. All results expressed in this report are on mole/mole basis, unless otherwise specified. The Assay of this Standard has been performed in accordance with the EPA Traceability Protocol EPA-600/R-12/531 for the Assay and Certification of Gaseous Calibration Standards using procedure G1
2. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The measurement of this material is traceable to the SI through the reference gas standard which is traceable to Swiss National Standard of Mass or other recognised national metrology institutes.
3. (1) Gas Chromatography, (2) Paramagnetic Oxygen Analyzer, (3) Electrochemical Oxygen Analyzer, (4) Electrochemical Moisture Analyzer,
(5) Total Hydrocarbon Analyzer, (6) Other - Specified

Sukanya Parinyasontorn

Signatory for and on behalf of Linde (Thailand) Co., Ltd.

PB-002/F006

Linde (Thailand) Public Company Limited Iss:K/2, 15 Oct 2021

PLC Registration no. 0107537000785

15th Floor, Bangna Tower A, 2/3 Moo 14, Bangna Trad KM. 6.5 Road, Bangkaew

Bangplee, Samutprakarn 10540, Tel (66) 2338-6100 Fax (66) 2338-6333

Wellgrow Plant: 105 Moo 5, T.Bangsamak, A.Bangpakong, Chachoengsao 24180

Thailand, Tel (66) 38.570-479-93

Fax (66) 38.570-323

PREVENTIVE MAINTENANCE PLAN

SCHEDULE PLAN FOR PREVENTIVE MAINTENANCE CEMS															
Item	Part name	P/N	Interval	Qty	Unit	2023									
						1	2	3	4	5	6	7	8	9	10
						Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
	PM Schedule		1 M			X	X	X	X	X	X	X	X	X	X
	Sampling probe														
1	Ceramic filter	IT0001141	1 Y	2	pc				X						
2	Set of gaskets FPM	IT0001152	1 Y	2	set				X						
	Sample gas cooler SCC-C														
3	sealing GL25-12mm (SCC-C)	IT0001830	1 Y	2	pc				X						
4	sealing GL18-8mm (SCC-C)	IT0001831	1 Y	4	pc				X						
5	Driver complete	IT0001823	1 Y	2	pc				X						
6	Flexible tube	IT0001931	3 M	1	Pack	X			X			X		X	
	Acid filter unit														
7	Filter element for acid filter	IT0000732	-	4	pc	Up to condition									
8	O-ring 56 x 3, FPM	IT0000777	1 Y	2	pc				X						
	Gas feed unit SCC-F														
9	Spare parts set (for diaphragm pump)	IT0000716	1 Y	2	set							X			
10	O-ring 60x3,5mm , FPM70	IT0000800	1 Y	2	pc							X			
11	Filter membrane	IT0001128	-	1	Pack	Up to condition									
	Gas analyzer														
13	Oxygen sensor	IT0000702	1 Y	2	pc	Up to condition									
14	Disposable filter unit	IT0001136	3	4	pc	Up to condition									
15	Viton tube FPM-70-SW 4x1.5	IT0000741	1 Y	4	Meter			X							

X กำหนดการเข้าปฏิบัติงานการบำรุงรักษาเชิงป้องกันตามแผน
X กำหนดการเปลี่ยนวัสดุสิ้นเปลืองตามแผนแต่ละรายการ

SERVICE REPORT

Preventive Maintenance

For

Continuous Emission Monitoring System (CEMS)



EGCO COGENERATION CO., LTD



June, 2023^{6th}

JID2300041-005

BY:

PETRO-INSTRUMENTS CORP.,LTD

**PETRO-INSTRUMENTS CORP., LTD.**7/409 Soi Vibhavadi-Rangsit 36, Vibhavadi-Rangsit Rd., Chatuchak, Chatuchak
Bangkok 10900 Thailand

Tel.:(+66) 2939 5711 (12 Lines), (+66) 2513 2333 (12 Lines), Fax. : (+66) 939

SERVICE REPORT

DOC. NUMBER

REPORT DATE

EQUIPMENT: CEMs	SERIAL NUMBER / TAG NUMBER -	BRAND / MANUFACTURER ABB
CUSTOMER NAME: Egco cogeneration	LACATION: Rayong	JOB NUMBER / REQUESTED NUMBER JID2300041-005

REASON FOR VISIT

- Preventive maintenance CEMs unit 11, 12.

FOUND FAILURE & CORRECTIVE ACTION DETAILS

- Operation checked of the gas analyzer all units.
- Checked diagnostic of the gas analyzer all units.
- Checked the sample gas cooler all unit was normal operation.
- Checked the sample gas feed all unit was normal operation.
- Checked the automatic condensate drain was normal operation.
- Checked the sample flow and by pass flow were kept in set point.
- Validate zero and span gas for the gas analyzer was normal response.
- Calibration zero and span gas for the gas analyzer by feed gas direct to the sample gas cooler.

Standard gas CO supply by PICO

WORK CONCLUSION

<input checked="" type="checkbox"/> COMPLETED		<input type="checkbox"/> IN COMPLETED	PARTS REPLACEMENT		
<input checked="" type="checkbox"/> CHARGE	<input type="checkbox"/> NO CHARGE		PARTS NAME	P/N	QTY.
<input type="checkbox"/> SERVICE FEE	<input type="checkbox"/> PROJECT WARRANTY	<input type="checkbox"/> TAKE TO OFFICE			
<input type="checkbox"/> TRAVELLING	<input type="checkbox"/> SERVICE WARRANTY	<input type="checkbox"/> WAIT FOR PARTS			
<input type="checkbox"/> SPARE PARTS	<input type="checkbox"/> PARTS WARRANTY	<input type="checkbox"/> IN PROCESS			
<input type="checkbox"/> OTHER	<input checked="" type="checkbox"/> SERVICE CONTRACT	<input type="checkbox"/> OTHER			

TIME SPENT (HOURS)

YEAR	2023								TOTAL HOURS	TRAVELING DETAILS	
MONTH	6									TRAVEL BY	
DATE	7								6	FROM	Pico
SERVICE TIME	6								-	TO	Rayong
OVERTIME	-								4	TOTAL ROUND TRIP	1
TRAVELING TIME	4								10	DISTANCE (KM.)	360
TOTAL HOURS	10										

SERVICE CREW

NAME		NAME	
1. Mr. Phuwanai N.		3.	
2.		4.	

CUSTOMER'S NAME	CUSTOMER'S SIGNATURE	DATE
นพรัตน์ งาม		8/6/2023

UNIT 1A



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SERVICE REPORT

Job No. :	JID2300041-005	Customer name :	EGCO COGENERATION
Equipment :	CEMS	Unit name :	1SAA-IRK-1A
Manufacturer :	ABB	Location :	Rayong
Model :	URAS 26	Contact name :	K. Pipat Udom
Serial No. :	3.345753.3	Telephone :	038-637-051-57 #9241
Working date :	7-June-2023	Fax. :	081-862-4780
Traveling hour :	4 Hr.	Email address :	Pipat.udo@egco.com
Mileage :	360 km.	Working Hour :	2 Hr.

SCOPE OF WORK	Preventive maintenance continuous emission monitoring system unit 1SAA-IRK-1A.
PHYSICAL & FUNCTION CHECK	<p>Sampling system.</p> <ul style="list-style-type: none"> - Checked the heated line was normal condition. - Checked the sample gas cooler was normal operation. - Checked the automatic condensate drain was normal operation. - Checked the acid filter was clean. - Checked the sample gas feed unit was normal operation. - Checked the filter membrane was clean. - Checked the sample flow and bypass flow were kept in set point. - Checked the condensate alarm for cut-off pump was normal operation. <p>Gas analyzer</p> <ul style="list-style-type: none"> - Diagnostics checked of the gas analyzer before calibration found were normal condition such as temperature, pressure. - Validate zero and span for the gas analyzer found normal responding.
CORRECT ACTION	<p>Gas analyzer</p> <ul style="list-style-type: none"> - Performed zero and span calibration for the gas analyzer by feed standard gas direct to the sample gas cooler. - Diagnostics checked of the gas analyzer after calibrations were normal condition.
PART REPLACEMENT	- No part replacement.
RECOMMENDATION	-

Internal information: ID Warranty.

Gas analyzer (Uras26) : 1360

Gas cooler (SCC-C) : 7703

Gas feed unit (SCC-F) : 7705

NO_x Converter : 7707

Sampling system 1A : 4156



PETRO - INSTRUMENTS CORP., LTD.

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http : // www.pico.co.th E-mail-address : combustion@pico.co.th

CHECK BY :	Mr. Phuwanai	DATE :	7-June-2023
APPROVE BY:	Mr. Nadthapong	DATE:	9-June-2023
CUSTOMER SIGN :		DATE :	



PETRO - INSTRUMENTS CORP., LTD.

บริษัท เพทโร-อินสตรูเมนต์ จำกัด

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GENERAL CHECK

UNIT NAME :	1SAA-IRK-1A	LOCATION :	HRSG 11
-------------	-------------	------------	---------

ITEM	DESCRIPTION	SET-POINT VALUE	STATUS/VALUE		REMARK
			BEFORE	AFTER	
	Inside cabinet				
1	Temperature in Cabinet	20-25 °C	22.7 °C	24.7 °C	
2	Air conditioner	Operate	OK	OK	
3	Humidity in Cabinet	-	46 %	59 %	
4	Sample gas cooler temperature	3.0 °C	3.0 °C	3.0 °C	
5	Automatic Condensate Drain	Drain	Drain	Drain	
6	Flexible tube	Normal	Normal	Normal	
7	Acid filter	Clean	Clean	Clean	
8	Sample gas feed pump operate	Run	Run	Run	
9	Condensate filter	Clean	Clean	Clean	
10	Condensate monitor	Normal	Normal	Normal	
11	Sample flow	60 l/h	61 l/h	60 l/h	
12	Bypass flow	60 l/h	60 l/h	60 l/h	
13	Disposable filter unit.	Clean	Clean	Clean	
14	Span gas NO cylinder	> 300 psi	1,150 psi	1,100 psi	
15	Span gas CO cylinder	> 300 psi	1,300 psi	1,300 psi	
	On stack				
16	Heated sample probe	Hot	Hot	Hot	
17	Filter probe	Clean	Clean	Clean	
18	Heated line Main	140 °C	139.7 °C	139.7 °C	
19	Heated line Bypass	140 °C	139.7 °C	139.7 °C	

CHECK BY : Mr. Phuwanai

DATE : 7-June-2023



PETRO - INSTRUMENTS CORP., LTD.

บริษัท เพโตร-อินสตรูเมนต์ จำกัด

PETRO-INSTRUMENTS CORP., LTD.

7/409 ซ.วิภาวดีรังสิต 36 ถ.วิภาวดีรังสิต แขวงจตุจักร เขตจตุจักร กรุงเทพฯ 10900

7/409 Soi Vibhavadi-Rangsit 36 Vibhavadi-Rangsit Rd., Chatuchak, Bangkok 10900, Thailand

TEL: (662) 939 5711 (12 Lines), 513 2333 (12 Lines), 513 9575-9 FAX: (662) 939 4207

http : // www.pico.co.th E-mail-address : combustion@pico.co.th

ANALYZER TEST REPORT

ANALYZER TYPE :	GAS ANALYZER	MANUFACTURER :	ABB
MODEL :	URAS 26	SERIAL NO. :	3.345753.3
UNIT NAME :	1SAA-IRK-1A	LOCATION :	HRSG 11

Standard gas concentration

Parameter	Concentration	Start date	Expire date	Cylinder No.
CO	164.6 ppm	28-Dec-2017	28-Dec-2025	CC703275
NO	82.5 ppm	27-Oct-2021	27-Oct-2025	D878359

Use ambient air for calibrate span point O₂ 20.95 Vol%.

MEASUREMENT RESULT BEFORE CALIBRATE						
Parameter	Measurement Value		Status Reactive Calibration Drifts		Offset&Amplify Acceptance	Note
	Reading	Analog (mA)	Offset (%)	Amplify (%)		
CO 0 - 200 ppm	1.0	4.08	0%	0%	±30%	Passed
CO@7% 0 - 200 ppm	2.0	-	-	-		
NO _x 0 - 250 ppm	40.9	6.62	3%	7%		Passed
NO _x @7% 0 - 250 ppm	82.8	-	-	-		
O ₂ 0 - 25 Vol%	14.06	13.00	0%	3%		Passed

VALIDATION RESULT												
Parameter			Zero				Span				% Error Acceptance	Note
			Ideal	Actual	Drift	% Error	Ideal	Actual	Drift	% Error		
CO	0 - 200	ppm	0.0	0.0	0.00	0.00	164.6	164.5	-0.10	0.05	±5.0 %	Passed
NO	0 - 250	ppm	0.0	-0.2	-0.20	0.08	82.5	82.3	-0.20	0.08	±2.5 %	Passed
O ₂	0 - 25	Vol%	0.00	0.02	0.02	-0.02	20.95	20.90	-0.05	0.05	±0.5 %	Passed

CALIBRATION RESULT												
Parameter			Zero				Span				% Error Acceptance	Note
			Ideal	Actual	Drift	% Error	Ideal	Actual	Drift	% Error		
CO	0 - 200	ppm	0.0	0.0	0.00	0.00	164.6	164.6	0.00	0.00	±5.0 %	Passed
NO	0 - 250	ppm	0.0	0.0	0.00	0.00	82.5	82.5	0.00	0.00	±2.5 %	Passed
O ₂	0 - 25	Vol%	0.00	0.00	0.00	0.00	20.95	20.95	0.00	0.00	±0.5 %	Passed

MEASUREMENT RESULT AFTER CALIBRATE						
Parameter	Measurement Value		Status Reactive Calibration Drifts		Offset&Amplify Acceptance	Note
	Reading	Analog (mA)	Offset (%)	Amplify (%)		
CO 0 - 200 ppm	1.0	4.08	0%	-2%	±30%	Passed
CO@7% 0 - 200 ppm	2.0	-	-	-		
NO _x 0 - 250 ppm	54.5	7.49	0%	6%		Passed
NO _x @7% 0 - 250 ppm	117.9	-	-	-		
O ₂ 0 - 25 Vol%	14.50	13.28	0%	0%		Passed

* % Error Calculate from percent of range.

CHECK BY : Mr. Phuwanai

DATE : 7-June-2023

UNIT 1B



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SERVICE REPORT

Job No. :	JID2300041-005	Customer name :	EGCO COGENERATION
Equipment :	CEMS	Unit name :	1SAA-IRK-1B
Manufacturer :	ABB	Location :	Rayong
Model :	URAS 26	Contact name :	K. Pipat Udom
Serial No. :	3.387669.9	Telephone :	038-637-051-57 #9241
Working date :	7-June-2023	Fax. :	081-862-4780
Traveling hour :	4 Hr.	Email address :	Pipat.udo@egco.com
Mileage :	360 km.	Working Hour :	2 Hr.

SCOPE OF WORK	Preventive maintenance continuous emission monitoring system unit 1SAA-IRK-1B.
PHYSICAL & FUNCTION CHECK	<p>Sampling system.</p> <ul style="list-style-type: none"> - Checked the heated line was normal condition. - Checked the sample gas cooler was normal operation. - Checked the automatic condensate drain was normal operation. - Checked the acid filter was clean. - Checked the sample gas feed unit was normal operation. - Checked the filter membrane was clean. - Checked the sample flow and bypass flow were kept in set point. - Checked the condensate alarm for cut-off pump was normal operation. <p>Gas analyzer</p> <ul style="list-style-type: none"> - Diagnostics checked of the gas analyzer before calibration found were normal condition. - Validate zero and span for the gas analyzer was normal responding.
CORRECT ACTION	<p>Gas analyzer</p> <ul style="list-style-type: none"> - Performed zero and span calibration for the gas analyzer by feed standard gas direct to the sample gas cooler. - Diagnostics checked of the gas analyzer after calibrations were normal condition.
PART REPLACEMENT	- No part replacement.
RECOMMENDATION	-

Internal information: ID Warranty.

Sampling system 1B	: 4157
Gas analyzer (Uras26)	: 4723
Gas cooler (SCC-C)	: 7704
Gas feed unit (SCC-F)	: 7706
NO _x Converter	: 7708



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http : // www.pico.co.th E-mail-address : combustion@pico.co.th

CHECK BY :	Mr. Phuwanai	DATE :	7-June-2023
APPROVE BY:	Mr. Nadthapong	DATE:	9-June-2023
CUSTOMER SIGN :		DATE :	



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GENERAL CHECK

UNIT NAME :	1SAA-IRK-1B	LOCATION :	HRSG 12
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ITEM	DESCRIPTION	SET-POINT VALUE	STATUS/VALUE		REMARK
			BEFORE	AFTER	
	Inside cabinet				
1	Temperature in Cabinet	20-25 °C	23.3 °C	24.1 °C	
2	Air conditioner	Operate	OK	OK	
3	Humidity in Cabinet	-	43 %	48 %	
4	Sample gas cooler temperature	3.0 °C	3.0 °C	3.0 °C	
5	Automatic Condensate Drain	Drain	Drain	Drain	
6	Flexible tube	Normal	Normal	Normal	
7	Acid filter	Clean	Clean	Clean	
8	Sample gas feed pump operate	Run	Run	Run	
9	Condensate filter	Clean	Clean	Clean	
10	Condensate monitor	Normal	Normal	Normal	
11	Sample flow	60 l/h	60 l/h	60 l/h	
12	Bypass flow	≈20 l/h	20 l/h	20 l/h	
13	Disposable filter unit.	Clean	Clean	Clean	
14	Span gas NO cylinder	> 300 psi	1,100 psi	1,100 psi	
15	Span gas CO cylinder	> 300 psi	1,300 psi	1,300 psi	
	On stack				
16	Heated sample probe	Hot	Hot	Hot	
17	Filter probe	Clean	Clean	Clean	
18	Heated line Main	140 °C	139.4 °C	139.3 °C	
19	Heated line Bypass	140 °C	139.4 °C	139.3 °C	

CHECK BY : Mr. Phuwanai

DATE : 7-June-2023



PETRO - INSTRUMENTS CORP., LTD.

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http : // www.pico.co.th E-mail-address : combustion@pico.co.th

ANALYZER TEST REPORT

ANALYZER TYPE :	GAS ANALYZER	MANUFACTURER :	ABB
MODEL :	URAS 26	SERIAL NO. :	3.387669.9
UNIT NAME :	1SAA-IRK-1B	LOCATION :	HRSG 12

Standard gas concentration

Parameter	Concentration	Start date	Expire date	Cylinder No.
CO	164.6 ppm	28-Dec-2017	28-Dec-2025	CC703275
NO	82.5 ppm	27-Oct-2022	27-Oct-2025	D878359

Use ambient air for calibrate span point O₂ 20.95 Vol%.

MEASUREMENT RESULT BEFORE CALIBRATE						
Parameter	Measurement Value		Status Reactive Calibration Drifts		Offset&Amplify Acceptance	Note
	Reading	Analog (mA)	Offset (%)	Amplify (%)		
CO 0 - 200 ppm	1.6	4.13	-1%	-3%	±30%	Passed
CO@7% 0 - 200 ppm	3.3	-	-	-		
NO _x 0 - 250 ppm	41.1	6.63	0%	-2%		Passed
NO _x @7% 0 - 250 ppm	86.0	-	-	-		
O ₂ 0 - 25 Vol%	14.28	13.14	0%	1%		Passed

VALIDATION RESULT												
Parameter			Zero				Span				% Error Acceptance	Note
			Ideal	Actual	Drift	% Error	Ideal	Actual	Drift	% Error		
CO	0 - 200	ppm	0.0	0.1	0.10	-0.05	164.6	164.8	0.20	-0.10	±5.0 %	Passed
NO	0 - 250	ppm	0.0	0.1	0.10	-0.04	82.5	82.0	-0.50	0.20	±2.5 %	Passed
O ₂	0 - 25	Vol%	0.00	0.02	0.02	-0.02	20.95	20.92	-0.03	0.03	±0.5 %	Passed

CALIBRATION RESULT												
Parameter			Zero				Span				% Error Acceptance	Note
			Ideal	Actual	Drift	% Error	Ideal	Actual	Drift	% Error		
CO	0 - 200	ppm	0.0	0.0	0.00	0.00	164.6	164.6	0.00	0.00	±5.0 %	Passed
NO	0 - 250	ppm	0.0	0.0	0.00	0.00	82.5	82.5	0.00	0.00	±2.5 %	Passed
O ₂	0 - 25	Vol%	0.00	0.00	0.00	0.00	20.95	20.95	0.00	0.00	±0.5 %	Passed

MEASUREMENT RESULT AFTER CALIBRATE						
Parameter	Measurement Value		Status Reactive Calibration Drifts		Offset&Amplify Acceptance	Note
	Reading	Analog (mA)	Offset (%)	Amplify (%)		
CO 0 - 200 ppm	1.0	4.08	-1%	-4%	±30%	Passed
CO@7% 0 - 200 ppm	2.2	-	-	-		
NO _x 0 - 250 ppm	42.1	6.69	0%	-2%		Passed
NO _x @7% 0 - 250 ppm	93.8	-	-	-		
O ₂ 0 - 25 Vol%	14.69	13.40	0%	0%		Passed

* % Error Calculate from percent of range.

CHECK BY : Mr. Phuwanai

DATE : 7-June-2023

CERTIFICATE OF STANDARD GAS

BPC - GT HRS6
CO

Airgas Specialty Gases
Airgas USA, LLC
600 Union Landing Road
Cinnaminson, NJ 08077-0000
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E02NI99E15A3300 Reference Number: 82-401076401-1
Cylinder Number: CC703275 Cylinder Volume: 144.3 CF
Laboratory: 124 - Riverton (SAP) - NJ Cylinder Pressure: 2015 PSIG
PGVP Number: B52017 Valve Outlet: 350
Gas Code: CO,BALN Certification Date: Dec 28, 2017

Expiration Date: Dec 28, 2025

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, 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 volume/volume basis unless otherwise noted.

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

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON MONOXIDE	160.0 PPM	164.6 PPM	G1	+/- 0.9% NIST Traceable	12/28/2017
NITROGEN	Balance				
CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	12062228	CC365471	97.56 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	May 25, 2018
ANALYTICAL EQUIPMENT					
Instrument/Make/Model		Analytical Principle		Last Multipoint Calibration	
Nicolet 6700 AHR0801933 CO		FTIR		Dec 08, 2017	

Triad Data Available Upon Request

NOTES: PO# 5217005382

This calibration std. has been certified in accordance with the May 2012 EPA Traceability Protocol, Document EPA-600/R-12/531. All testing processes and measurements conform to the requirements of ISO/IEC 17025 and to Airgas ISO 9001:2000 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. 2000.02


Approved for Release

Page 1 of 82-401076401-1

Certificate Of Analysis
Special Gases Mixture

Customer Details

Name: EGCO ENGINEERING AND SERVICE
Address: 222 Moo. 8, A. Mabkha, A. King Aumphur
Nikhom Pattana, Rayong 21180
Customer Tag No.:

Certificate Details

Number:	3218/22	Date of Issue:	27-Oct-2022	Expiry date:	27-Oct-2025
Material Details					
Production Order:	90174084	Material Code:	431600-SV-44	Cylinder No.:	D878359
Gas content:	1.25 M ³	Filling pressure:	130.0 bar	Valve:	CGA 660 SS
Cylinder Owner:	LINDE	Cylinder Material:	Spectra seal	Cylinder Size:	10 L

Laboratory Report

Analytical Result

Component	Nominal Concentration	Analysis Result ¹	Uncertainty ²	Method of Analysis ³	Assay Date
Nitric Oxide	85.0 ppm	82.5 ppm	± 1% relative	(6) I-PB-352	19-Oct & 26-Oct-22
Other NOx impurity In Nitrogen		Less than 4.1 ppm			

Reference Standard used in Assay

Reference Standard	Cylinder number	Concentration	Expiry date:
Nitric Oxide In Nitrogen	1228205G	50.87 ± 0.25 ppm	6-May-2023

Analytical Instruments used in Assay

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
FTIR Spectrometers Nicolet iS50	FTIR-NO	1-Oct-2022

Recommend usage condition

Minimum utilization: 5% of actual content or before expire date whichever comes first.
Storage condition: Keep in well ventilation and secure area.

Comments

When reordering, please quote the material number

Note:

- All results expressed in this report are on mole/mole basis, unless otherwise specified. The Assay of this Standard has been performed in accordance with the EPA Traceability Protocol EPA-600/R-12/531 for the Assay and Certification of Gaseous Calibration Standards using procedure G1
- The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The measurement of this material is traceable to the SI through the reference gas standard which is traceable to Swiss National Standard of Mass or other recognised national metrology institutes.
- (1) Gas Chromatography, (2) Paramagnetic Oxygen Analyzer, (3) Electrochemical Oxygen Analyzer, (4) Electrochemical Moisture Analyzer, (5) Total Hydrocarbon Analyzer, (6) Other - Specified

Sukanya Parinyasontorn

Signatory for and on behalf of Linde (Thailand) Co., Ltd.

PB-002/F006

Linde (Thailand) Public Company Limited Iss:K/2, 15 Oct 2021

PLC Registration no. 0107537000785

15th Floor, Bangna Tower A, 2/3 Moo 14, Bangna Trad KM. 6.5 Road, Bangkaew

Bangplee, Samutprakarn 10540, Tel (66) 2338-6100 Fax (66) 2338-6333

Wellgrow Plant: 105 Moo 5, T.Bangamak, A.Bangpakong, Chachoengsao 24180

Thailand, Tel (66) 38.570-479-93

Fax (66) 38.570-323

PREVENTIVE MAINTENANCE PLAN

SCHEDULE PLAN FOR PREVENTIVE MAINTENANCE CEMS																
Item	Part name	P/N	Interval	Q'ty	Unit	2023										
						1	2	3	4	5	6	7	8	9	10	11
						Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
	PM Schedule		1 M			X	X	X	X	X	X	X	X	X	X	X
	Sampling probe															
1	Ceramic filter	IT0001141	1 Y	2	pc				X							
2	Set of gaskets FPM	IT0001152	1 Y	2	set				X							
	Sample gas cooler SCC-C															
3	sealing GL25-12mm (SCC-C)	IT0001830	1 Y	2	pc				X							
4	sealing GL18-8mm (SCC-C)	IT0001831	1 Y	4	pc				X							
5	Driver complete	IT0001823	1 Y	2	pc				X							
6	Flexible tube	IT0001931	3 M	1	Pack	X			X			X			X	
	Acid filter unit															
7	Filter element for acid filter	IT0000732	-	4	pc	Up to condition										
8	O-ring 56 x 3, FPM	IT0000777	1 Y	2	pc				X							
	Gas feed unit SCC-F															
9	Spare parts set (for diaphragm pump)	IT0000716	1 Y	2	set							X				
10	O-ring 60x3.5mm , FPM70	IT0000800	1 Y	2	pc							X				
11	Filter membrane	IT0001128	-	1	Pack	Up to condition										
	Gas analyzer															
13	Oxygen sensor	IT0000702	1 Y	2	pc	Up to condition										
14	Disposable filter unit	IT0001136	3	4	pc	Up to condition										
15	Viton tube FPM-70-SW 4x1.5	IT0000741	1 Y	4	Meter			X								

X กำหนดการเข้าปฏิบัติงานการบำรุงรักษาเชิงป้องกันตามแผน
X กำหนดการเปลี่ยนวัสดุสิ้นเปลืองตามแผนแต่ละรายการ