

# ภาคผนวก ข-32

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เอกสารการสอบเทียบ



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www.caesia.com.sg Co. Reg. No: 198701240Z

Job No. 23L403

### SERVICE REPORT

Customer: Linde Thailand	Contact Person: Mr.Sakburut Chotsaeng	Chargeable Services <input checked="" type="checkbox"/> Warranty Services <input type="checkbox"/> Contract Services <input type="checkbox"/> On Call Services <input type="checkbox"/>
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TIME RECORD		Wed	Tue				
Date		25-Oct-23	21-Nov-23				
Arrived at Site (Time)		8:00am	8:00am				
Left Site (Time)		17:00pm	17:00pm				
Normal Hour		8	8				
Overtime @ 1.5							
Overtime @ 2.0							
Travel Time							
Total Chargeable Hours		8	8				

#### Report Detail:

Job Scope: Health Check and verufy the CO, CH4 LaserGas-II MP analyzer tag number:AT18015/AT18016 Product number:14388-14541 Serial No.:5655

Job Performed:

1. Check analyzer display as found reading.

As found reading, Tr = 41%, CO 0.21 ppm, CH4 = 2.14 ppm.

2. Purge multipass cell with N2.

3. Verify with N2 that reading Tr = 46%, CO 0.08 ppm, CH4 = 0.02 ppm.

4. Verify with CH4 span gas 9.2 ppm in H2 balance that reading Tr = 46.24%, CO = 1.98 ppm, CH4 = 8.66 ppm

5. Perform Calibration analyzer with CH4 Span Gas 9.2 ppm in H2 balance then analyzer result as following

Tr = 46.05%, CO = 1.2 ppm, CH4 = 9.19 ppm

6. Verify with CO span gas 7.9 ppm in H2 balance that reading Tr = 46.15%, CO = 8.35 ppm, CH4 = 0.06 ppm

7. Perform Calibration analyzer with CO span Gas 7.9 ppm in H2 balance then analyzer result as following

Tr = 46.22%, CO =7.93 ppm, CH4 = -0.01 ppm

8. According to the result at point 5 and 7, found that analyzer repeatability as per data sheet is 1% of FS

Analyzer FS range = 50 ppm. Reading result is within 0.5 ppm. Analyzer calibration is pass.

**Note:** COA of CH4 span gas number : 3136/23 Expire Date:7-Nov-2025

COA of CO span gas number: 3190/23 Expire Date:12-Nov-2025



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## CALIBRATION TEST REPORT

Rev1-30Mar2015

JOB NO.: 23L403

D-2A ANALYZER CALIBRATION REPORT

TAG NO.: AT18015/AT18016

CLIENT: Linde Thailand  
PROJECT: PM VERIFY AND CALIBRATE  
MODEL NO.: Laser Gas II MP  
SERIAL NO.: 5655  
POWER SUPPLY: 24 Vdc

CAE PROJECT NO.: 23L403  
ANALYZER TYPE: CO,CH4 Analyzer  
MANUFACTURER: NEO Monitor  
OUTPUT SIGNAL: 4-20mA

STREAM	COMPONENT	MEASUREMENT RANGE
1	CO	0-50 ppm
2	CH4	0-50ppm

CALIBRATION STANDARD		ANALYZER READOUT		STATUS (Pass or Fail)	REMARKS
TYPE	Calibration Standard	As Found	As Left		
CO	7.9 ppm	8.35 ppm	7.93 ppm	Pass	
CH4	9.2 ppm	8.66 ppm	9.19 ppm	Pass	
CO	UHP N2	0.11 ppm	0.02 ppm	Pass	
CH4	UHP N2	-0.12 ppm	-0.04 ppm	Pass	

ITEM	DESCRIPTION				CHECK			REMARKS
					YES	NO	NA	
1	High Alarm Contact, Setpoint:				<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
2	Low Alarm Contact, Setpoint:				<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
3	Low Flow Alarm	NO	<input type="checkbox"/>	NC	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
4	Malfunction Contacts	NO	<input type="checkbox"/>	NC	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5	Purge Contacts	NO	<input type="checkbox"/>	NC	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
6	Purge Type: X-purge				<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
7	Stability Test (hrs)				<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
8	Loop test to junction box				<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
9	Communication check to control station				<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

REMARKS: COA of CH4 span gas number : 3136/23 Expire Date:7-Nov-2025

COA of CO span gas number: 3190/23 Expire Date:12-Nov-2025

Te

Si

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## CH<sub>4</sub> Gas Span Check Before Calibration

5635 Measurements

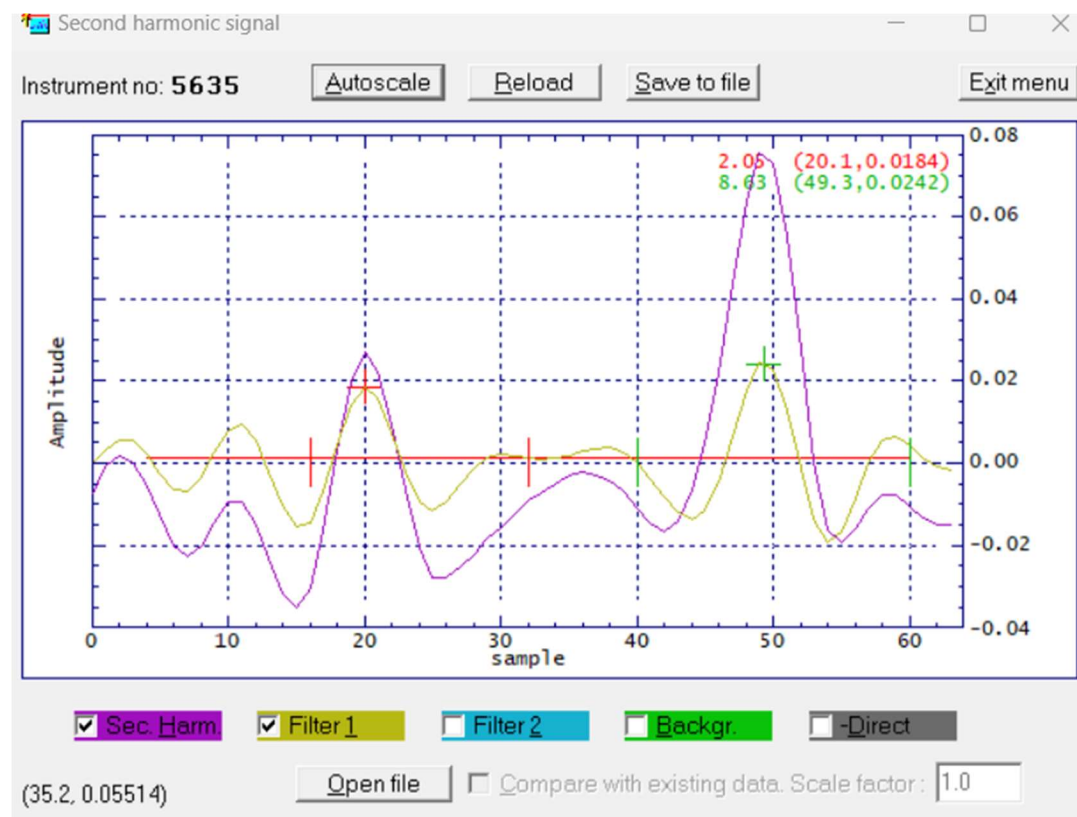
Preferences

Status: **OK** Serial No.: **5635** Mode: **Normal** [About](#)

	CO	CH <sub>4</sub>
Concentration Inst	2.03 ppm	8.70 ppm
Concentration Avg	1.98 ppm	8.66 ppm
Concentration Std	0.07 ppm	0.05 ppm
Line width	0.977	0.979
Line position	20.14	49.27
Line amplitude	0.01813	0.02443
Transmission (%)	46.28	
Gas Temperature (C)	41.92	
Gas Pressure (Bar abs.)	0.9862	
Dry conversion factor	1.000	
Max. Direct	927	
Dark Direct	291	
Laser temp. (V)	1.3318	
Laser temp. err. (V)	0.005	
Peltier pump (A)	-0.099	
Modulation ampl. (V)	3.315	
TU temperature (C)	62.4	
RU temperature (C)	51.3	
Extra current input (mA)	0.000	
Air pressure (Bar abs.)	1.009	

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## CH<sub>4</sub> Gas Span Check After Calibration

5635 Measurements

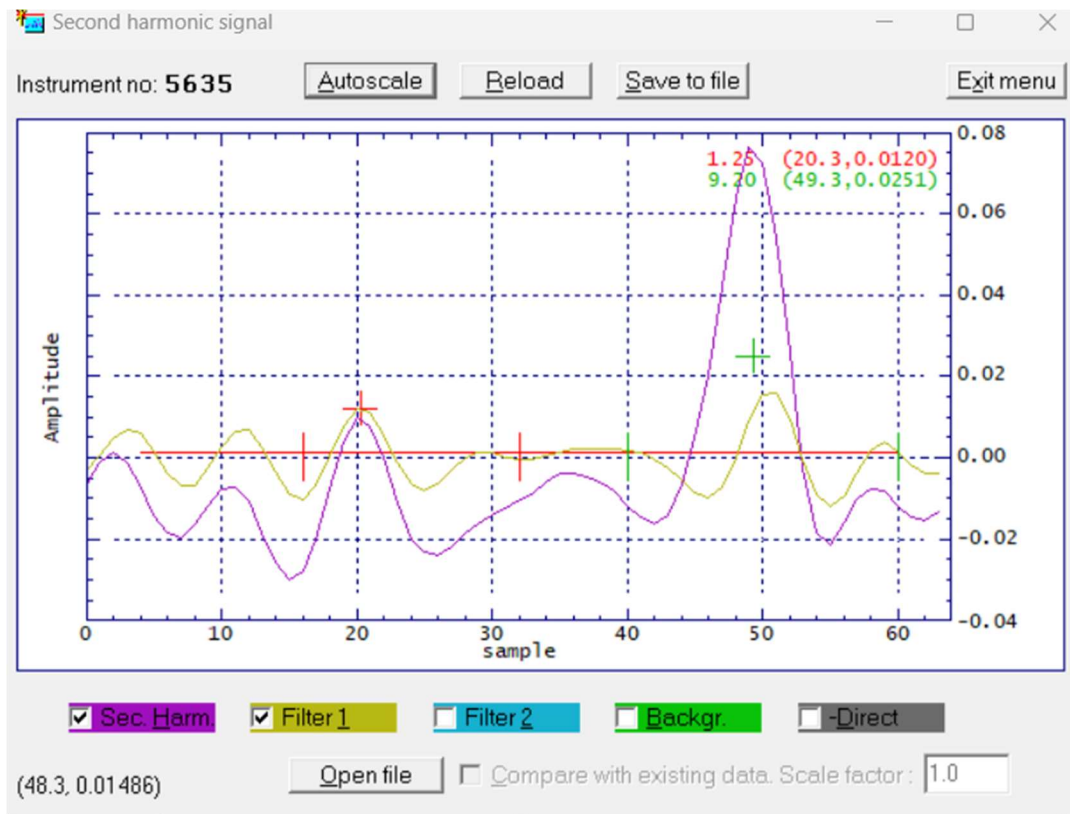
Preferences

Status: **OK** Serial No.: **5635** Mode: **Normal** [About](#)

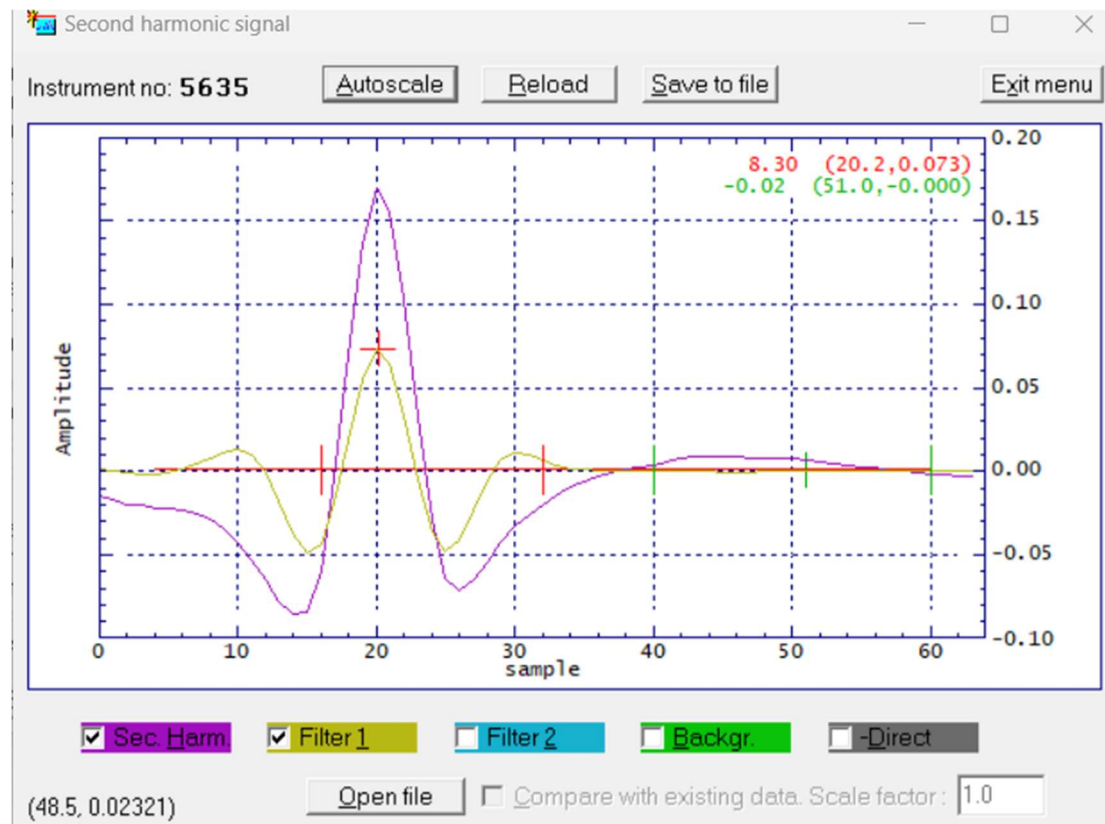
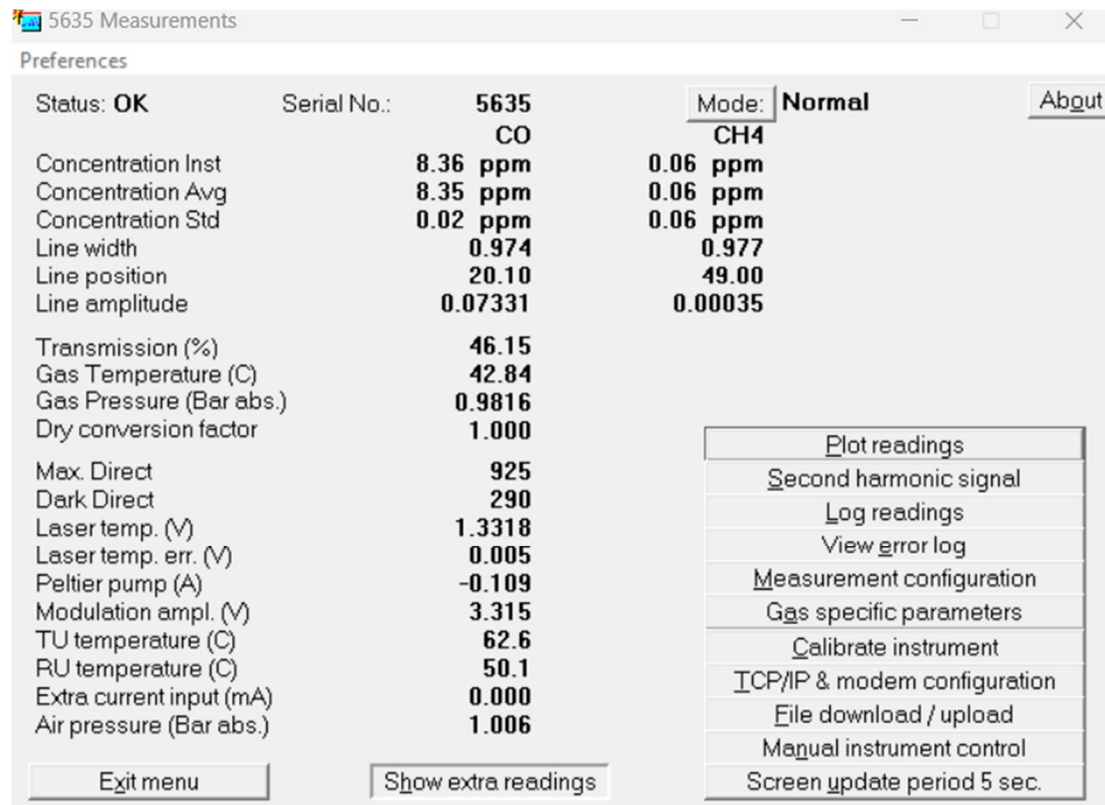
	CO	CH <sub>4</sub>
Concentration Inst	1.21 ppm	9.19 ppm
Concentration Avg	1.20 ppm	9.19 ppm
Concentration Std	0.01 ppm	0.07 ppm
Line width	0.975	0.977
Line position	20.29	49.36
Line amplitude	0.01159	0.02513
Transmission (%)	46.05	
Gas Temperature (C)	43.07	
Gas Pressure (Bar abs.)	0.9832	
Dry conversion factor	1.000	
Max. Direct	923	
Dark Direct	290	
Laser temp. (V)	1.3318	
Laser temp. err. (V)	0.000	
Peltier pump (A)	-0.111	
Modulation ampl. (V)	3.310	
TU temperature (C)	64.1	
RU temperature (C)	53.1	
Extra current input (mA)	0.000	
Air pressure (Bar abs.)	1.007	

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## CO Gas Span Check Before Calibration



## CO Gas Span Check After Calibration CO

5635 Measurements

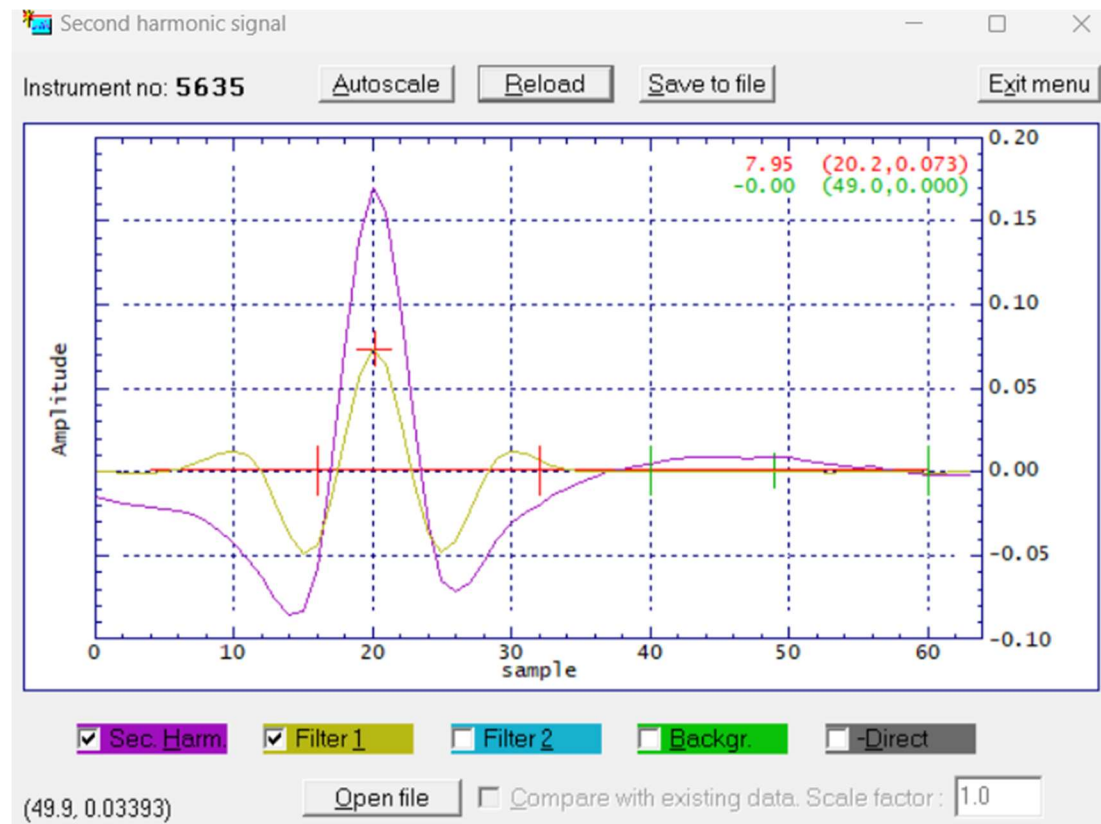
Preferences

Status: **OK** Serial No.: **5635** Mode: **Normal** [About](#)

	CO	CH4
Concentration Inst	7.93 ppm	-0.04 ppm
Concentration Avg	7.93 ppm	-0.01 ppm
Concentration Std	0.02 ppm	0.03 ppm
Line width	0.974	0.977
Line position	20.17	50.00
Line amplitude	0.07308	-0.00023
Transmission (%)	46.22	
Gas Temperature (C)	42.84	
Gas Pressure (Bar abs.)	0.9816	
Dry conversion factor	1.000	
Max. Direct	926	
Dark Direct	291	
Laser temp. (V)	1.3318	
Laser temp. err. (V)	0.010	
Peltier pump (A)	-0.104	
Modulation ampl. (V)	3.315	
TU temperature (C)	60.3	
RU temperature (C)	48.9	
Extra current input (mA)	0.000	
Air pressure (Bar abs.)	1.006	

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## Verify Zero with UHP N<sub>2</sub> gas after Calibration

5635 Measurements

Preferences

Status: <b>OK</b>	Serial No.: <b>5635</b>	Mode: <b>Normal</b>	<a href="#">About</a>
	<b>CO</b>	<b>CH4</b>	
Concentration Inst	<b>0.02 ppm</b>	<b>-0.03 ppm</b>	
Concentration Avg	<b>0.02 ppm</b>	<b>-0.04 ppm</b>	
Concentration Std	<b>0.02 ppm</b>	<b>0.03 ppm</b>	
Transmission (%)	<b>46.11</b>		
Gas Temperature (C)	<b>40.55</b>		
Gas Pressure (Bar abs.)	<b>0.9862</b>		
Dry conversion factor	<b>1.000</b>		
		<a href="#">Plot readings</a>	
		<a href="#">Second harmonic signal</a>	
		<a href="#">Log readings</a>	
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		<a href="#">Measurement configuration</a>	
		<a href="#">Gas specific parameters</a>	
		<a href="#">Calibrate instrument</a>	
		<a href="#">ICP/IP &amp; modem configuration</a>	
		<a href="#">File download / upload</a>	
		<a href="#">Manual instrument control</a>	
		<a href="#">Screen update period 5 sec.</a>	

[Exit program](#) [Show extra readings](#)



Certificate Of Analysis  
Special Gases Mixture

## Customer Details

Name:

Linde Maptaphut (Plant 9119)

Address:

Customer Tag No.:

## Certificate Details

Number:	3136/23	Date of Issue:	8-Nov-2023	Expiry date:	7-Nov-2025
Material Details					
Production Order:	90180843	Material Code:	765900-J-22	Cylinder No.:	SS67876
Gas content:	6.10 M <sup>3</sup> (nominal)	Filling pressure:	145.0 bar (g)	Valve:	CGA 350 BRASS
Cylinder Owner:	LINDE	Cylinder Material:	STEEL	Cylinder Size:	47 L

## Laboratory Report

Component	Nominal Concentration	Analysis Result <sup>1</sup>	Uncertainty <sup>2</sup>	Method of Analysis <sup>3</sup>
Methane	8.0 ppm	9.2 ppm	± 10% relative	(1) ACC-FID-01
In Hydrogen				

## 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

## Note:

- 1 All results expressed in this report are on mole/mole basis, unless otherwise specified.
- 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)

Certificate Of Analysis  
Special Gases Mixture

## Customer Details

Name:

Linde Maplaput (Plant 9119)

Address:

Customer Tag No.:

## Certificate Details

Number:	3190/23	Date of Issue:	13-Nov-2023	Expiry date:	12-Nov-2025
Material Details					
Production Order:	90180845	Material Code:	511000-AL-62	Cylinder No:	D213939
Gas content:	6.490 M <sup>3</sup> (nominal)	Filling pressure:	145 bar (g)	Valve:	CGA 350 BRASS
Cylinder Owner:	LINDE	Cylinder Material:	Aluminum	Cylinder Size:	50 L

## Laboratory Report

Component	Nominal Concentration	Analysis Result <sup>1</sup>	Uncertainty <sup>2</sup>	Method of Analysis <sup>3</sup>
Carbon Monoxide In Hydrogen	8.0 ppm	7.9 ppm	± 10% relative	(1) ACC-MET-01

## 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

## Note:

- 1 All results expressed in this report are on mole/mole basis, unless otherwise specified
- 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