

ภาคผนวก ฉ  
เอกสารสอบเทียบเครื่องมือที่ใช้ในการวิเคราะห์



## ORANGE INNOVATION COMPANY LIMITED

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### CALIBRATION CERTIFICATE

Certificate No.: 2021-0705

Date Issued: 29 Jul 2021

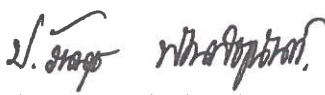
**Customer** : Suranaree University of Technology  
**Address** : 111 University Avenue, Sub District Suranaree, Muang District,  
Nakhon Ratchasima 30000, Thailand  
**Equipment** : GAS DETECTOR  
**Manufacturer** : WatchGas Detection  
**Model** : MP400P  
**Serial Number** : M00404001449  
**ID No./Tag No** : -  
**Date Received** : 27 Jul 2021  
**Date Calibrated** : 27 Jul 2021  
**Calibration Location** : Orange Innovation Laboratory  
**Calibrated by** : Mr.Ittipon Anisakpitaya

#### Environment Condition

Temperature : (23±5) °C

Relative Humidity : (50±15) %

Approved by:

  
(Ms. Phaweeranuch Phanphitchayanan)

Calibration Laboratory Manager



#### Calibration Method

The Calibration was performed follow by comparison in-house method WI No.WI-LAB-01 , of the gas detector reading with the reference gas mixture for traceable measurement results. Based on the uncertainty

#### Tabulation of results

The table on the following page gives the calibration results and associated measurement uncertainties at approximately 95% confidence level of the gas detector under calibration.

#### Uncertainty of measurement

The uncertainty stated is the expanded uncertainty obtained by multiplying the standard uncertainty by the coverage factor  $k=2$ . It has been determined in accordance with EA publication EA-4/02 "Expression of the Uncertainty of Measurement in Calibration" and JCGM 100:2008 "Evaluation of Measurement Data Guide to The Expression of Uncertainty of Measurement." The value of the measured lies within the assigned range of value with probability of 95%

#### Traceability

- The certificate provides metrological traceability of measurement to recognized national standards. The reference gas mixtures used for calibration were produced by producers conforming to NIST
- Temperature & Humidity and Flow meter have been calibrated with ISO 17025 accredited laboratory.
- RMs have been manufactured under ISO 17034 and ISO 17025

Certificate Document : 2731/19 , 1341/19

Cylinder Number : D400507 , D882000

**Calibration Results:**

The calibration was performed following the 1-point calibration by using standard gasmixer in nitrogen at the inlet pressure of 1 bar and flowrate of 0.5 L/min



Without adjust

Sensors	Certified Concentration	Concentration Reading	Expanded Uncertainty (Relative value, $k=2$ )
Oxygen	17.9 cmol/mol	17.43 cmol/mol	3.9% (0.7cmol/mol)
Carbon Monoxide	100 $\mu$ mol/mol	101.3 $\mu$ mol/mol	3.3% (3.3 $\mu$ mol/mol)
Methane	50%LEL (25 mmol/mol )	50.7%LEL (25.4 mmol/mol )	4.5% (2.3mmol/mol)
Hydrogen Sulfide	22.5 $\mu$ mol/mol	23.1 $\mu$ mol/mol	3.8% (0.9 $\mu$ mol/mol)



With adjusted

Sensors	Certified Concentration	Concentration Reading	Expanded Uncertainty (Relative value, $k=2$ )
Oxygen	17.9 cmol/mol		
Carbon Monoxide	100 $\mu$ mol/mol		
Methane	50%LEL (25 mmol/mol )		
Hydrogen Sulfide	22.5 $\mu$ mol/mol		

**Remark:**

Calibrated by gas from Linde (Thailand) PCL.

**Notice:**

The above results are valid exclusively for tested / analyzed samples as mentioned in the report. Publicity and reproduce some past are prohibited unless written permission is attained from Orange Innovation Co., Ltd

**End of Calibration Certificate**