



CERTIFICATE OF ACCREDITATION

This is to attest that

AIR LIQUIDE INDIA SPECIALITY GASES PRIVATE LIMITED

PLOT NO N 163 MIDC TARAPUR, BOISAR, DIST PALGHAR-401506
BOISAR, MAHARASHTRA, REPUBLIC OF INDIA

Calibration Laboratory CL-259

has met the requirements of AC204, *IAS Accreditation Criteria for Calibration Laboratories*, and has demonstrated compliance with ISO/IEC Standard 17025:2017, *General requirements for the competence of testing and calibration laboratories*. This organization is accredited to provide the services specified in the scope of accreditation.

Effective Date April 16, 2023

Expiration Date January 1, 2025



A handwritten signature in black ink that reads 'Raj Nathan'.

President

SCOPE OF ACCREDITATION

International Accreditation Service, Inc.

3060 Saturn Street, Suite 100, Brea, California 92821, U.S.A. | www.iasonline.org

AIR LIQUIDE INDIA SPECIALITY GASES PRIVATE LIMITED

www.airliquide.com/india

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Accredited to ISO/IEC 17025:2017

Effective Date April 16, 2023

CALIBRATION AND MEASUREMENT CAPABILITY (CMC)*

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY ^{1,2} (\pm)	CALIBRATION METHOD OR PROCEDURE, STANDARD EQUIPMENT (OPTIONAL)
Chemical/Gas			
Natural Gas Mixture			
amount fraction	(% mol/mol)	(% mol/mol)	In-house method TM005/TA
nitrogen	0.1 to 12	0.3 % relative + 0.0005	Calibration of gas mixtures by ISO 6143:2001 using gas chromatography with thermal conductivity detection (GC-TCD)
carbon dioxide	0.05 to 8	0.22 % relative + 0.0003	
methane	64 to 100	-0.10 % relative + 0.11	
ethane	0.1 to 14	0.25 % relative	
propane	0.05 to 8	0.5 % relative + 0.0005	
iso-butane	0.01 to 0.15 0.15 to 1.2	0.0006 0.4 % relative	
n-butane	0.01 to 0.15 0.15 to 1.2	0.0006 0.4 % relative	
neo-pentane	0.002 to 0.35	1.0 % relative + 0.0002	
iso-pentane	0.005 to 0.35	0.6 % relative + 0.0002	
n-pentane	0.005 to 0.35	0.6 % relative + 0.0002	
n-hexane	0.001 to 0.35	1.6 % relative + 0.00005	Calibration of gas mixtures using gas chromatography with flame ionization detection (GC-FID)
2-methylpentane	0.001 to 0.35	1.6 % relative + 0.00005	
3-methylpentane	0.001 to 0.35	1.6 % relative + 0.00005	

* If information in this CMC is presented in non-SI units, the conversion factors stated in NIST Special Publication 811 "Guide for the Use of the International System of Units (SI)" apply.

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2,2-dimethylbutane	0.001 to 0.35	1.6 % relative + 0.00005	Calibration of gas mixtures using gas chromatography with flame ionization detection (GC-FID)
benzene	0.001 to 0.2	1.6 % relative + 0.00005	
cyclohexane	0.001 to 0.2	1.6 % relative + 0.00005	
n-heptane	0.001 to 0.2	1.6 % relative + 0.00005	
toluene	0.001 to 0.1	1.6 % relative + 0.00005	
methylcyclohexane	0.001 to 0.1	1.6 % relative + 0.00005	
n-octane	0.0005 to 0.05	1.6 % relative + 0.00005	
n-nonane	0.0005 to 0.02	1.6 % relative + 0.00005	
n-decane	0.0005 to 0.005	1.6 % relative + 0.00005	
oxygen	0.005 to 1	5 % relative	Calibration of gas mixtures using gas chromatography with thermal conductivity detection (GC-TCD)
Gas Mixture Properties (Calculated Values from composition)			
superior calorific value molar basis (kJ·mol ⁻¹) mass basis (MJ·kg ⁻¹) volume basis (MJ·m ⁻³)	Calculations are restricted to gas mixtures with amount fraction (%mol/mol) nitrogen: <30 carbon dioxide: <15 ethane: <15 other component: <5 methane: no restriction	0.1% relative	Values calculated according to ISO 6976:1995 (including amendment No.1, May 1998) on a real or ideal gas basis assuming mixture is dry (free from water) Combustion properties can be expressed in units of the Joule (J) or in kilowatt hours (kWh)
net calorific value molar basis (kJ·mol ⁻¹) mass basis (MJ·kg ⁻¹) volume basis (MJ·m ⁻³)		0.1% relative	
relative density density (kg·m ⁻³)		0.1% relative	
gross Wobbe index (MJ·m ⁻³)		0.1% relative	
net Wobbe index (MJ·m ⁻³)		0.1% relative	
molar mass (kg·kmol ⁻¹)		0.1% relative	
compression factor		0.1% relative	

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gross calorific value molar basis (kJ·mol ⁻¹) mass basis (MJ·kg ⁻¹) volume basis (MJ·m ⁻³)	Calculations are applicable to any gaseous natural gas, natural gas substitute, or other combustible fuel, except that for properties on a volume basis, where the method is restricted only to gas mixtures for which the compression factor is greater than 0.9	1.0 kJ·mol ⁻¹ 0.025 MJ·kg ⁻¹ 0.040 MJ·m ⁻³	Values calculated by ISO 6976:2016 on a real or ideal gas basis assuming mixture is dry (free from water)
net calorific value molar basis (kJ·mol ⁻¹) mass basis (MJ·kg ⁻¹) volume basis (MJ·m ⁻³)		0.9 kJ·mol ⁻¹ 0.023 MJ·kg ⁻¹ 0.037 MJ·m ⁻³	Combustion properties can be expressed in units of the Joule (J) or in kilowatt hours (kWh)
relative density density (kg·m ⁻³)		0.0006 0.0008 kg·m ⁻³	
gross Wobbe index (MJ·m ⁻³) net Wobbe index (MJ·m ⁻³)		0.032 MJ·m ⁻³ 0.030 MJ·m ⁻³	
molar mass (kg·kmol ⁻¹) compression factor		0.017 kg·kmol ⁻¹ 0.0001	
gross heating value net heating value relative density compressibility factor		There are no composition or property-related restrictions on the method specified	0.1 % relative 0.1 % relative 0.1 % relative 0.1 % relative
gross heating value net heating value relative density density compressibility factor	There are no composition or property-related restrictions on the method specified	0.1 % relative 0.1 % relative 0.1 % relative 0.1 % relative	Calculated values according to methods given in ASTM D3588-98 (2011) using data tables from GPA 2145-09
Binary Emission Gas Mixtures			
amount fraction	(mol/mol)	(mol/mol)	In-house method TM014
carbon dioxide in nitrogen or synthetic air	0.1 % to 5 %	0.50 % relative + 15 parts in 10 ⁶	Calibration of gas mixture by ISO 12963:2017 using dynamically generated reference gases in accordance with ISO 6145 Part 7: Thermal mass flow controllers
	5 % to 15 %	0.20 % relative + 170 parts in 10 ⁶	
oxygen in nitrogen	0.5 % to 3 %	0.50 % relative + 85 parts in 10 ⁶	
	3 % to 25 %	0.40 % relative + 100 parts in 10 ⁶	
methane in nitrogen	0.1 % to 2 %	0.35 % relative + 10 parts in 10 ⁶	
	2 % to 5 %	0.15 % relative + 50 parts in 10 ⁶	

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MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY ^{1,2} (±)	CALIBRATION METHOD OR PROCEDURE, STANDARD EQUIPMENT (OPTIONAL)
Binary Emission Gas Mixtures (continued)			
amount fraction	(mol/mol)	(mol/mol)	In-house method TM014
methane in synthetic air	0.1% to 2 %	0.35 % relative + 10 parts in 10 ⁶	Calibration of gas mixture by ISO 12963:2017 using dynamically generated reference gases in accordance with ISO 6145 Part 7: Thermal mass flow controllers
	2 % to 2.5 %	0.15 % relative + 50 parts in 10 ⁶	
carbon monoxide in nitrogen or synthetic air	10 ppm to 100 ppm	0.25 % relative + 0.55 parts in 10 ⁶	
	100 ppm to 1000 ppm	0.80 % relative	
nitric oxide in nitrogen	10 ppm to 60 ppm	0.20 % relative + 0.25 parts in 10 ⁶	
	60 ppm to 600 ppm	0.40 % relative + 0.13 parts in 10 ⁶	
nitrogen dioxide in synthetic air	5 ppm to 500 ppm	4.0 % relative	
sulphur dioxide in nitrogen or synthetic air	10 ppm to 200 ppm	0.17 % relative + 1.0 parts in 10 ⁶	
	200 ppm to 1000 ppm	0.60 % relative + 0.12 parts in 10 ⁶	

¹The uncertainty covered by the Calibration and Measurement Capability (CMC) is expressed as the expanded uncertainty having a coverage probability of approximately 95 %. It is the smallest measurement uncertainty that a laboratory can achieve within its scope of accreditation when performing calibrations of a best existing device. The measurement uncertainty reported on a calibration certificate may be greater than that provided in the CMC due to the behavior of the calibration item and other factors that may contribute to the uncertainty of a specific calibration.

²When uncertainty is stated in relative terms (such as percent, a multiplier expressed as a decimal fraction or in scientific notation), it is in relation to instrument reading or instrument output, as appropriate, unless otherwise indicated.

ppm = parts in 10⁶