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Scope of Accreditation

LAT Center No. 143 and RMP No. 143

The SIAD Group

SIAD is an international chemical group active for almost 100 years
in the businesses of **Industrial Gases, Engineering,**
Healthcare, LPG and Natural Gas;
in addition it offers energy solutions and environmental management services.



Values



Research,
Technology
and Innovation



Experience,
Tradition
and Strength



Geographical
and sector
diversification



Commitment to
Quality, Safety
and the Environment



Reliability,
Professionalism
and Expertise



Attention to
social and
cultural issues

Sections

Industrial Gases

SIAD - Production and distribution of industrial, specialty, food-grade and medical gases.

Present in 16 European countries with manufacturing and trading companies.

Tecnoservizi Ambientali - Services aimed at achieving environmental sustainability through the recovery and/or the disposal of hazardous and non-hazardous industrial waste.

Healthcare

Medigas Italia / Magaldi Life - Innovative services and products for home and hospital care.

Engineering

SIAD Macchine Impianti - Design, production and installation of cryogenic air separation units, cryogenic nitrogen generators, natural gas liquefaction systems, reciprocating compressors for process gas and air, plus instrument air packages.

ESA - Systems, solutions and components for industrial combustion.

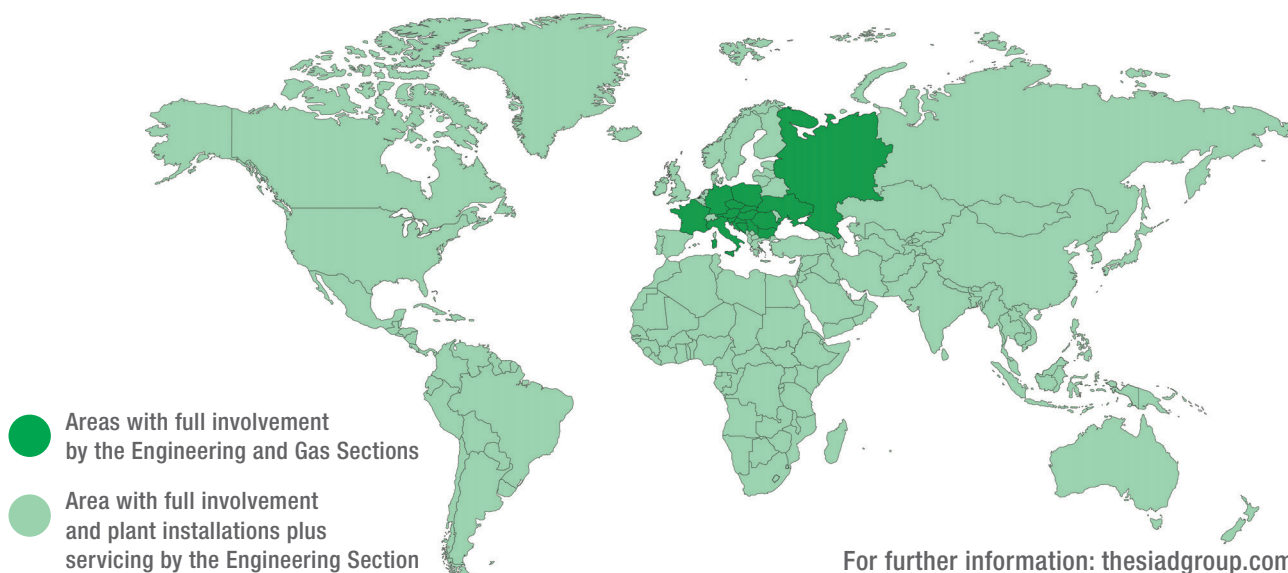
Tecno Project Industriale - Systems for the production, recovery, extraction, liquefaction and vaporization of carbon dioxide and biogas upgrading systems. Biogas upgrading plants to purify biogas produced by anaerobic digestion from organic waste, processing scrap and by-products, effluent from livestock farming, crop wastes and other biomass and plants for polishing and liquefaction of biomethane, bioLNG and bioCO₂.

Pentatec - Gas analysis systems.

LPG and Natural Gas

Istrabenz plini Group - Production and sale of liquefied petroleum gas and methane gas for civil and industrial use.

Worldwide presence



For further information: thesiadgroup.com



The Periodic Table of Elements

1.0 Hydrogen H	2.0 Helium He	3.0 Lithium Li	4.0 Beryllium Be	5.0 Boron B	6.0 Carbon C	7.0 Nitrogen N	8.0 Oxygen O	9.0 Fluorine F	10.0 Neon Ne
11.0 Sodium Na	12.0 Magnesium Mg	13.0 Aluminum Al	14.0 Silicon Si	15.0 Phosphorus P	16.0 Sulfur S	17.0 Chlorine Cl	18.0 Argon Ar	19.0 Potassium K	20.0 Calcium Ca
21.0 Scandium Sc	22.0 Titanium Ti	23.0 Vanadium V	24.0 Chromium Cr	25.0 Manganese Mn	26.0 Iron Fe	27.0 Cobalt Co	28.0 Nickel Ni	29.0 Copper Cu	30.0 Zinc Zn
31.0 Gallium Ga	32.0 Germanium Ge	33.0 Arsenic As	34.0 Selenium Se	35.0 Bromine Br	36.0 Krypton Kr	37.0 Rubidium Rb	38.0 Strontium Sr	39.0 Yttrium Y	40.0 Zirconium Zr
41.0 Niobium Nb	42.0 Molybdenum Mo	43.0 Technetium Tc	44.0 Ruthenium Ru	45.0 Rhodium Rh	46.0 Palladium Pd	47.0 Silver Ag	48.0 Cadmium Cd	49.0 Indium In	50.0 Tin Sn
51.0 Antimony Sb	52.0 Tellurium Te	53.0 Iodine I	54.0 Xenon Xe	55.0 Cesium Cs	56.0 Barium Ba	57.0 Lanthanum La	58.0 Cerium Ce	59.0 Praseodymium Pr	60.0 Neodymium Nd
61.0 Promethium Pm	62.0 Europium Eu	63.0 Gadolinium Gd	64.0 Terbium Tb	65.0 Dysprosium Dy	66.0 Holmium Ho	67.0 Erbium Er	68.0 Thulium Tm	69.0 Ytterbium Yb	70.0 Lutetium Lu
71.0 Hafnium Hf	72.0 Tantalum Ta	73.0 Tungsten W	74.0 Rhenium Re	75.0 Osmium Os	76.0 Iridium Ir	77.0 Platinum Pt	78.0 Gold Au	79.0 Mercury Hg	80.0 Thallium Tl
81.0 Lead Pb	82.0 Bismuth Bi	83.0 Polonium Po	84.0 Astatine At	85.0 Francium Fr	86.0 Radium Ra	87.0 Actinium Ac	88.0 Thorium Th	89.0 Protactinium Pa	90.0 Uranium U
91.0 Neptunium Np	92.0 Plutonium Pu	93.0 Americium Am	94.0 Curium Cm	95.0 Berkelium Bk	96.0 Californium Cf	97.0 Einsteinium Es	98.0 Fermium Fm	99.0 Mendelevium Md	100.0 Nobelium No
101.0 Lawrencium Lr	102.0 Hassium Hs	103.0 Meitnerium Mt	104.0 Darmstadtium Ds	105.0 Roentgenium Rg	106.0 Livermorium Lv	107.0 Tennessine Ts	108.0 Oganesson Og	109.0 Ununennium Uue	110.0 Unbinilium Uub
111.0 Roentgenium Rg	112.0 Copernicium Cn	113.0 Nihonium Nh	114.0 Flerovium Fl	115.0 Moscovium Mc	116.0 Livermorium Lv	117.0 Tennessine Ts	118.0 Oganesson Og	119.0 Ununennium Uue	120.0 Unbinilium Uub
121.0 Untrium Uut	122.0 Unquadrium Uuq	123.0 Unpentium Uup	124.0 Unsextium Uus	125.0 Unseptium Uus	126.0 Unoctium Uuo	127.0 Unnennium Uun	128.0 Unnilium Uun	129.0 Unundecium Uuu	130.0 Unbigium Uub
131.0 Untrium Uut	132.0 Unquadrium Uuq	133.0 Unpentium Uup	134.0 Unsextium Uus	135.0 Unseptium Uus	136.0 Unoctium Uuo	137.0 Unnennium Uun	138.0 Unnilium Uun	139.0 Unundecium Uuu	140.0 Unbigium Uub
141.0 Untrium Uut	142.0 Unquadrium Uuq	143.0 Unpentium Uup	144.0 Unsextium Uus	145.0 Unseptium Uus	146.0 Unoctium Uuo	147.0 Unnennium Uun	148.0 Unnilium Uun	149.0 Unundecium Uuu	150.0 Unbigium Uub
151.0 Untrium Uut	152.0 Unquadrium Uuq	153.0 Unpentium Uup	154.0 Unsextium Uus	155.0 Unseptium Uus	156.0 Unoctium Uuo	157.0 Unnennium Uun	158.0 Unnilium Uun	159.0 Unundecium Uuu	160.0 Unbigium Uub
161.0 Untrium Uut	162.0 Unquadrium Uuq	163.0 Unpentium Uup	164.0 Unsextium Uus	165.0 Unseptium Uus	166.0 Unoctium Uuo	167.0 Unnennium Uun	168.0 Unnilium Uun	169.0 Unundecium Uuu	170.0 Unbigium Uub
171.0 Untrium Uut	172.0 Unquadrium Uuq	173.0 Unpentium Uup	174.0 Unsextium Uus	175.0 Unseptium Uus	176.0 Unoctium Uuo	177.0 Unnennium Uun	178.0 Unnilium Uun	179.0 Unundecium Uuu	180.0 Unbigium Uub
181.0 Untrium Uut	182.0 Unquadrium Uuq	183.0 Unpentium Uup	184.0 Unsextium Uus	185.0 Unseptium Uus	186.0 Unoctium Uuo	187.0 Unnennium Uun	188.0 Unnilium Uun	189.0 Unundecium Uuu	190.0 Unbigium Uub
191.0 Untrium Uut	192.0 Unquadrium Uuq	193.0 Unpentium Uup	194.0 Unsextium Uus	195.0 Unseptium Uus	196.0 Unoctium Uuo	197.0 Unnennium Uun	198.0 Unnilium Uun	199.0 Unundecium Uuu	200.0 Unbigium Uub
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621.0 Untrium Uut	622.0 Unquadrium Uuq	623.0 Unpentium Uup	624.0 Unsextium Uus	625.0 Unseptium Uus	626.0				

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Certified Calibration mixtures and Certified Reference Materials



Over the last few years there has been progressive growth in the demand for Certified Reference Materials and traceable metrological calibration mixtures. There is also an increasing need to have clear and documented traceability to the samples of SI Units of Measurement maintained by National and International Metrological Institutes.

THE SIAD RESEARCH LABORATORY HAS OBTAINED THE ACCREDITATION AS LAT CALIBRATION CENTER NO. 143 IN 2001, IT ALSO IS ACCREDITED IN QUALITY OF PRODUCER OF REFERENCE MATERIALS RMP NO. 143.

LAT Calibration Center No. 143 and Reference Material Producer RMP No. 143

The LAT Center and the RMP Producer stem from the SIAD Research Laboratory and from its decades of experience and expertise in the preparation and analysis of traceable metrological mixtures.

The accredited mixtures are in fact the result of the evolution and improvement of the SIAD procedures used for preparing the calibration mixtures.



**TYPES OF
ACCREDITATION**



LAT N° 143



RMP N° 143

The LAT Center is accredited according to the **ISO/IEC 17025** standard for gravimetric and analytical calibration of gas mixtures and for the calibration of equipment for analytical measurement.

The RMP Producer is accredited according to the standard **ISO 17034** for the production of Certified Reference Materials.

Accredited metrological mixtures traceable to the International System of Units of Measurement

The calibrations performed by the LAT Center and the Certified Reference Materials of the RMP Producer refer to the national and international units of measurement samples of the International System of Units of Measurement (SI). To perform the correct measurements it is important that the units of measurement used are uniquely defined and shared

internationally. The International System (SI) of the Units of Measurement responds to this need, establishing the units of measurement “defined basic” and from which all the other measurements in use derive.

Accredited Calibrations and Certified Gaseous Reference Materials (CRM)

The attribute that distinguishes the calibrations of LAT Center no. 143 and the mixtures of the RMP Producer No. 143 is the traceability of the certified measurements, which enhances the value of the final product, enables the compliance to

the international standard measurement systems, has a competitive advantage while dealing in global markets because the certificates issued by the LAT Center and the RMP Producer are recognized and accepted internationally.



TRACEABILITY



Property of a measurement result whereby the result can be related to a reference through a documented unbroken chain of calibrations, each contributing to the measurement uncertainty.

The attribute that distinguishes the calibrations of the LAT Center no. 143 and the mixtures produced by the RMP producer no. 143 is the traceability of the certified measurements.

Thanks to these accreditations, SIAD can produce:

- ✓ gas mixtures calibrated gravimetrically according to the standard ISO 6142-1 or according to an accredited method internally developed, these are the Accredia traceable mixture G-CGM and W-CGM, both analytically verified;
- ✓ gas mixtures calibrated analytically by comparison with other traceable mixtures of the Center in accordance with standard ISO 6143; these are the traceable mixtures A-CGM;
- ✓ certified reference materials (C-CRM and W-CRM) produced gravimetrically according to ISO 6142-1 with guarantee stated on the certificate.



The LAT Center and the RMP Producer can produce traceable mixtures that can be used in the environmental field:

- for monitoring gas emissions into the atmosphere;
- for air quality and workplace monitoring;
- for monitoring of the industrial emissions;
- for controlling the emissions of vehicles and engines.

Furthermore, the Center and the Producer can produce traceable metrological mixtures and certified reference materials:

- with a methane matrix, reproducing the composition of natural gas, containing sulphur compounds and odorants for natural gas;
- for controlling refinery gases;
- for calibrating breathalyzers;
- for controlling the concentrations of moisture in gases.



STABILITY



The RMP Producer can warrant and declare the stability of these mixtures on the certificate.
This warranty is based on the studies carried out since birth of the laboratory and systematically since 2004.
Traceable mixtures are used to calibrate instruments involved in the validation of gravimetric results.

Accreditation tables of RMP Producer No. 143



AM - CA

ENVIRONMENTAL MONITORING

C-CRM



RMP N° 143

The RMP Producer No. 143 can produce Certified Reference Gas Materials (CRM) as it is accredited according to ISO 17034. For this type of mixtures the Producer warrants and certifies a range of time (stability) in which the homogeneity of the mixture and the values of concentration are stable.

THE CRMs ARE PRODUCED GRAVIMETRICALLY ACCORDING TO THE STANDARD ISO 6142-PART 1

Metrological traceability derives from the masses calibrated by a Primary Metrology Institute or by an Accredited Center used for gravimetric preparation of the mixtures.

The calculation of the concentration and the uncertainty of the calibration takes into account:

- the choice and quality of the raw materials and the original mixtures;

- the masses used for calibrating the scale and its performance;
- the calibration ambient conditions;
- the preparation procedure with all the uncertainties relating to the weighing process.

All the individually prepared mixtures are analytically verified. The analysis follows the guidelines of ISO 6143, which provides a three-point calibration, or the guidelines of ISO 12963, which

provides two-point or single-point calibration.

The samples used for instrumental calibration are traceable mixtures within the Center and of the Producer or certified by a Primary Metrology Institute.

The CRMs are characterized by the better preparation tolerance, defined as the difference between the requested value and the certified value, and by very small relative extended uncertainties.

The RMP is accredited for the quantity “amount of substance”

Permanent Laboratory

MEASURAND Production of Gaseous Reference Materials C-CRM (Gravimetric method)		CALIBRATION CAPABILITY Amount fraction range mol/mol		RELATIVE EXPANDED UNCERTAINTY (*)
Analyte	Matrix	From	To	C-CRM
ENVIRONMENTAL MONITORING				
Ammonia (NH ₃)	Nitrogen - Air	5·10 ⁻⁶	500·10 ⁻⁶	3%
Benzene (C ₆ H ₆)	Nitrogen	5·10 ⁻⁹	200·10 ⁻⁹	2%
Butanol (C ₄ H ₁₀ O)	Nitrogen	20·10 ⁻⁶	0,1·10 ⁻²	2%
Carbon dioxide (CO ₂)	Nitrogen	10·10 ⁻⁶	100·10 ⁻⁶	0,8%
		100·10 ⁻⁶	1·10 ⁻²	0,4%
		1·10 ⁻²	50·10 ⁻²	0,3%
		50·10 ⁻²	99,8·10 ⁻²	0,2%
	Methane	500·10 ⁻⁶	1·10 ⁻²	1%
		1·10 ⁻²	60·10 ⁻²	0,5%
	Air	100·10 ⁻⁶	1·10 ⁻²	0,4%
		1·10 ⁻²	50·10 ⁻²	0,3%
	Helium	40·10 ⁻⁶	100·10 ⁻²	0,5%
		100·10 ⁻⁶	1·10 ⁻²	0,4%
		1·10 ⁻²	50·10 ⁻²	0,3%

C-CRM



CA - XY

ENVIRONMENTAL MONITORING

MEASURAND Production of Gaseous Reference Materials C-CRM (Gravimetric method)		CALIBRATION CAPABILITY Amount fraction range mol/mol		RELATIVE EXPANDED UNCERTAINTY (*)
Analyte	Matrix	From	To	C-CRM
ENVIRONMENTAL MONITORING				
Carbon dioxide (CO ₂)	Oxygen	12·10 ⁻⁶	100·10 ⁻⁶	0,5%
		100·10 ⁻⁶	1·10 ⁻²	0,4%
		1·10 ⁻²	50·10 ⁻²	0,3%
Carbon monoxide (CO)	Nitrogen	1·10 ⁻⁶	10·10 ⁻⁶	1%
		10·10 ⁻⁶	100·10 ⁻⁶	0,8%
		100·10 ⁻⁶	0,1·10 ⁻²	0,7%
		0,1·10 ⁻²	10·10 ⁻²	0,6%
	Air	1·10 ⁻⁶	10·10 ⁻⁶	1%
		10·10 ⁻⁶	100·10 ⁻⁶	0,8%
		100·10 ⁻⁶	0,1·10 ⁻²	0,7%
		0,1·10 ⁻²	5,45·10 ⁻²	0,6%
	Oxygen	0,5·10 ⁻⁶	10·10 ⁻⁶	2%
Ethylbenzene (C ₈ H ₁₀)	Nitrogen	5·10 ⁻⁹	200·10 ⁻⁹	4,5%
Nitric oxide (NO)	Nitrogen	0,12·10 ⁻⁶	0,4·10 ⁻⁶	3%
		0,4·10 ⁻⁶	1·10 ⁻⁶	1,2%
		1·10 ⁻⁶	10·10 ⁻⁶	1%
		10·10 ⁻⁶	0,1·10 ⁻²	0,7%
		0,1·10 ⁻²	0,25·10 ⁻²	0,5%
Nitrogen dioxide (NO ₂)	Nitrogen - Air	5·10 ⁻⁶	100·10 ⁻⁶	3%
Nitrous oxide (N ₂ O)	Nitrogen - Air	1·10 ⁻⁶	30·10 ⁻⁶	1,5%
		30·10 ⁻⁶	0,1·10 ⁻²	1%
Oxygen (O ₂)	Nitrogen	10·10 ⁻⁶	100·10 ⁻⁶	2%
		100·10 ⁻⁶	0,1·10 ⁻²	1%
		0,1·10 ⁻²	1·10 ⁻²	0,66%
		1·10 ⁻²	25·10 ⁻²	0,42%
		25·10 ⁻²	99,8·10 ⁻²	0,2%
	Methane	200·10 ⁻⁶	2·10 ⁻²	2%
	Helium	100·10 ⁻⁶	0,1·10 ⁻²	1%
		0,1·10 ⁻²	3·10 ⁻²	0,66%
Sulphur dioxide (SO ₂)	Nitrogen - Air	3·10 ⁻²	25·10 ⁻²	0,42%
		3·10 ⁻²	80·10 ⁻²	0,42%
		0,1·10 ⁻⁶	0,25·10 ⁻⁶	4%
		0,25·10 ⁻⁶	1·10 ⁻⁶	3%
		1·10 ⁻⁶	100·10 ⁻⁶	1,5%
Toluene (C ₇ H ₈)	Nitrogen	100·10 ⁻⁶	0,3·10 ⁻²	0,66%
		5·10 ⁻⁹	200·10 ⁻⁹	3%
Water (H ₂ O)	Nitrogen	10·10 ⁻⁶	100·10 ⁻⁶	6,5%
o-Xylene (o-C ₈ H ₁₀)	Nitrogen	5·10 ⁻⁹	200·10 ⁻⁹	4,5%
m-Xylene (m-C ₈ H ₁₀)	Nitrogen	5·10 ⁻⁹	200·10 ⁻⁹	4,5%
p-Xylene (p-C ₈ H ₁₀)	Nitrogen	5·10 ⁻⁹	200·10 ⁻⁹	4,5%

MEASURAND Production of Gaseous Reference Materials C-CRM (Gravimetric method)		CALIBRATION CAPABILITY Amount fraction range mol/mol		RELATIVE EXPANDED UNCERTAINTY (%)
Analyte	Matrix	From	To	C-CRM
HYDROCARBONS / NATURAL GAS				
Acetylene (C ₂ H ₂)	Nitrogen	1·10 ⁻⁶	100·10 ⁻⁶	2%
		100·10 ⁻⁶	0,4·10 ⁻²	1%
Argon (Ar)	Methane	200·10 ⁻⁶	5·10 ⁻²	5%
Butadiene 1.3 (C ₄ H ₆)	Nitrogen	1·10 ⁻⁶	0,1·10 ⁻²	2%
		0,5·10 ⁻²	3·10 ⁻²	2%
Butane (C ₄ H ₁₀)	Nitrogen	1·10 ⁻⁶	100·10 ⁻⁶	2%
		100·10 ⁻⁶	0,1·10 ⁻²	1%
	Methane	0,1·10 ⁻²	5·10 ⁻²	0,8%
		100·10 ⁻⁶	0,1·10 ⁻²	1%
Butene - 1 (C ₄ H ₈)	Nitrogen	0,1·10 ⁻²	4·10 ⁻²	0,8%
		100·10 ⁻⁶	0,1·10 ⁻²	1%
	Methane	1·10 ⁻⁶	100·10 ⁻⁶	2%
		100·10 ⁻⁶	0,1·10 ⁻²	1%
Carbon dioxide (CO ₂)	Nitrogen	1·10 ⁻⁶	100·10 ⁻⁶	2%
		100·10 ⁻⁶	0,1·10 ⁻²	1%
		0,1·10 ⁻²	5·10 ⁻²	0,8%
		100·10 ⁻⁶	0,1·10 ⁻²	1%
	Methane	1·10 ⁻⁶	100·10 ⁻⁶	2%
		100·10 ⁻⁶	0,1·10 ⁻²	1%
		0,1·10 ⁻²	5·10 ⁻²	0,8%
		100·10 ⁻⁶	0,1·10 ⁻²	1%
	Air	1·10 ⁻⁶	100·10 ⁻⁶	2%
		100·10 ⁻⁶	0,1·10 ⁻²	1%
		0,1·10 ⁻²	5·10 ⁻²	0,8%
		100·10 ⁻⁶	0,1·10 ⁻²	1%
Carbon monoxide (CO)	Methane	1·10 ⁻⁶	100·10 ⁻⁶	2%
		100·10 ⁻⁶	0,1·10 ⁻²	1%
		0,1·10 ⁻²	5·10 ⁻²	0,8%
		100·10 ⁻⁶	0,1·10 ⁻²	1%
Ethane (C ₂ H ₆)	Nitrogen	1·10 ⁻⁶	100·10 ⁻⁶	2%
		100·10 ⁻⁶	0,1·10 ⁻²	1%
		0,1·10 ⁻²	5·10 ⁻²	0,8%
		100·10 ⁻⁶	0,1·10 ⁻²	1%
Ethylene (C ₂ H ₄)	Methane	1·10 ⁻⁶	100·10 ⁻⁶	2%
		100·10 ⁻⁶	0,1·10 ⁻²	1%
		0,1·10 ⁻²	5·10 ⁻²	0,8%
		100·10 ⁻⁶	0,1·10 ⁻²	1%
Helium (He)	Nitrogen	1·10 ⁻⁶	100·10 ⁻⁶	2%
		100·10 ⁻⁶	0,1·10 ⁻²	1%
Heptane (C ₇ H ₁₆)	Methane	1·10 ⁻⁶	100·10 ⁻⁶	2%
		100·10 ⁻⁶	0,1·10 ⁻²	1%
Hexane (C ₆ H ₁₄)	Methane	1·10 ⁻⁶	100·10 ⁻⁶	2%
		100·10 ⁻⁶	0,1·10 ⁻²	1%

C-CRM



HE - OX

HYDROCARBONS / NATURAL GAS

MEASURAND Production of Gaseous Reference Materials C-CRM (Gravimetric method)		CALIBRATION CAPABILITY Amount fraction range mol/mol		RELATIVE EXPANDED UNCERTAINTY (*)
Analyte	Matrix	From	To	C-CRM
HYDROCARBONS / NATURAL GAS				
Hexane (C ₆ H ₁₄)	Methane	50·10 ⁻⁶	0,1·10 ⁻²	1%
		0,1·10 ⁻²	1·10 ⁻²	0,8%
Hydrogen (H ₂)	Nitrogen	0,07·10 ⁻²	6·10 ⁻²	1,1%
		6·10 ⁻²	90·10 ⁻²	0,5%
	Methane	100·10 ⁻⁶	2·10 ⁻²	2%
		2·10 ⁻²	20·10 ⁻²	1%
		20·10 ⁻²	90·10 ⁻²	0,5%
Isobutane (C ₄ H ₁₀)	Helium	2·10 ⁻²	6·10 ⁻²	1,1%
		2·10 ⁻²	6·10 ⁻²	1,1%
	Argon	2·10 ⁻²	6·10 ⁻²	1,1%
Isobutene (C ₄ H ₈)	Nitrogen	1·10 ⁻⁶	100·10 ⁻⁶	2%
		100·10 ⁻⁶	0,1·10 ⁻²	1%
Isopentane (C ₅ H ₁₂)	Methane	0,1·10 ⁻²	5·10 ⁻²	0,8%
		100·10 ⁻⁶	0,1·10 ⁻²	1%
Isobutene (C ₄ H ₈)	Nitrogen	1·10 ⁻⁶	100·10 ⁻⁶	2%
		100·10 ⁻⁶	0,1·10 ⁻²	1%
Isopentane (C ₅ H ₁₂)	Methane	0,1·10 ⁻²	1·10 ⁻²	0,8%
		50·10 ⁻⁶	0,1·10 ⁻²	1%
Methane (CH ₄)	Nitrogen	0,1·10 ⁻²	3,5·10 ⁻²	0,8%
		1·10 ⁻⁶	10·10 ⁻⁶	0,5%
Neopentane (C ₅ H ₁₂)	Methane	1·10 ⁻⁶	10·10 ⁻⁶	0,5%
		10·10 ⁻⁶	0,1·10 ⁻²	0,4%
Nitrogen (N ₂)	Methane	0,1·10 ⁻²	98·10 ⁻²	0,3%
		1·10 ⁻²	50·10 ⁻²	0,4%
Nonane (C ₉ H ₂₀)	Methane	50·10 ⁻⁶	99,8·10 ⁻²	0,2%
		0,1·10 ⁻²	3,5·10 ⁻²	0,8%
Octane (C ₈ H ₁₈)	Methane	1·10 ⁻²	99·10 ⁻²	0,2%
		500·10 ⁻⁶	10·10 ⁻²	3%
Oxygen (O ₂)	Nitrogen	10·10 ⁻⁶	95·10 ⁻²	0,5%
		100·10 ⁻⁶	0,02·10 ⁻²	1%
Oxygen (O ₂)	Methane	50·10 ⁻⁶	0,05·10 ⁻²	1%
		10·10 ⁻⁶	100·10 ⁻⁶	2%
Oxygen (O ₂)	Helium	100·10 ⁻⁶	0,1·10 ⁻²	1%
		0,1·10 ⁻²	1·10 ⁻²	0,66%
Oxygen (O ₂)	Argon	1·10 ⁻²	25·10 ⁻²	0,42%
		25·10 ⁻²	99,8·10 ⁻²	0,2%
Oxygen (O ₂)	Methane	200·10 ⁻⁶	0,1·10 ⁻²	5%
		0,1·10 ⁻²	2·10 ⁻²	2%
Oxygen (O ₂)	Helium	100·10 ⁻⁶	0,1·10 ⁻²	1%
		0,1·10 ⁻²	3·10 ⁻²	0,66%
Oxygen (O ₂)	Argon	3·10 ⁻²	25·10 ⁻²	0,42%
		80·10 ⁻²	80·10 ⁻²	0,42%

MEASURAND Production of Gaseous Reference Materials C-CRM (Gravimetric method)		CALIBRATION CAPABILITY Amount fraction range mol/mol		RELATIVE EXPANDED UNCERTAINTY (%)
Analyte	Matrix	From	To	C-CRM
HYDROCARBONS / NATURAL GAS				
Pentane (C ₅ H ₁₂)	Methane	50·10 ⁻⁶	0,1·10 ⁻²	1%
		0,1·10 ⁻²	2·10 ⁻²	0,8%
Propane (C ₃ H ₈)	Nitrogen	0,1·10 ⁻⁶	1·10 ⁻⁶	2%
		1·10 ⁻⁶	10·10 ⁻⁶	1%
		10·10 ⁻⁶	100·10 ⁻⁶	0,8%
		100·10 ⁻⁶	0,1·10 ⁻²	0,4%
		0,1·10 ⁻²	18·10 ⁻²	0,3%
	Methane	1·10 ⁻⁶	10·10 ⁻⁶	1,5%
		10·10 ⁻⁶	100·10 ⁻⁶	1,2%
		100·10 ⁻⁶	0,1·10 ⁻²	0,8%
		0,1·10 ⁻²	18·10 ⁻²	0,7%
	Air	1·10 ⁻⁶	10·10 ⁻⁶	1%
		10·10 ⁻⁶	100·10 ⁻⁶	0,8%
		100·10 ⁻⁶	0,1·10 ⁻²	0,4%
		0,1·10 ⁻²	0,85·10 ⁻²	0,3%
Propylene (C ₃ H ₆)	Nitrogen - Methane	0,05·10 ⁻²	7·10 ⁻²	0,8%

C-CRM



CA - TE

SULPHURATED GASES

MEASURAND Production of Gaseous Reference Materials C-CRM (Gravimetric method)		CALIBRATION CAPABILITY Amount fraction range mol/mol		RELATIVE EXPANDED UNCERTAINTY (*)
Analyte	Matrix	From	To	C-CRM
SULPHURATED GASES				
Carbonyl sulphide (COS)	Nitrogen - Methane	$1 \cdot 10^{-6}$	$100 \cdot 10^{-6}$	5%
Dimethyl sulphide (C ₂ H ₆ S)	Nitrogen - Methane	$0,5 \cdot 10^{-6}$	$10 \cdot 10^{-6}$	10%
		$10 \cdot 10^{-6}$	$100 \cdot 10^{-6}$	5%
Hydrogen sulphide (H ₂ S)	Nitrogen - Methane	$1 \cdot 10^{-6}$	$10 \cdot 10^{-6}$	5%
		$10 \cdot 10^{-6}$	$100 \cdot 10^{-6}$	3%
		$100 \cdot 10^{-6}$	$250 \cdot 10^{-6}$	2%
Isopropyl mercaptan (C ₃ H ₈ S)	Nitrogen - Methane	$1 \cdot 10^{-6}$	$10 \cdot 10^{-6}$	10%
		$10 \cdot 10^{-6}$	$100 \cdot 10^{-6}$	5%
Methyl ethyl sulphide (C ₃ H ₈ S)	Nitrogen - Methane	$1 \cdot 10^{-6}$	$10 \cdot 10^{-6}$	10%
		$10 \cdot 10^{-6}$	$100 \cdot 10^{-6}$	5%
Methyl mercaptan (CH ₄ S)	Nitrogen - Methane	$1 \cdot 10^{-6}$	$10 \cdot 10^{-6}$	10%
		$10 \cdot 10^{-6}$	$100 \cdot 10^{-6}$	5%
Methyl sulphide (C ₂ H ₆ S)	Nitrogen - Methane	$1 \cdot 10^{-6}$	$10 \cdot 10^{-6}$	10%
		$10 \cdot 10^{-6}$	$100 \cdot 10^{-6}$	5%
N-Propyl mercaptan (C ₃ H ₈ S)	Nitrogen - Methane	$1 \cdot 10^{-6}$	$10 \cdot 10^{-6}$	10%
		$10 \cdot 10^{-6}$	$100 \cdot 10^{-6}$	5%
Tert-butyl mercaptan (C ₄ H ₁₀ S)	Nitrogen - Methane	$1 \cdot 10^{-6}$	$10 \cdot 10^{-6}$	10%
		$10 \cdot 10^{-6}$	$100 \cdot 10^{-6}$	5%
Tetrahydrothiophene (C ₄ H ₈ S)	Nitrogen - Methane	$1 \cdot 10^{-6}$	$10 \cdot 10^{-6}$	5%
		$10 \cdot 10^{-6}$	$100 \cdot 10^{-6}$	3%

MEASURAND Production of Gaseous Reference Materials C-CRM (Gravimetric method)		CALIBRATION CAPABILITY Amount fraction range mol/mol		RELATIVE EXPANDED UNCERTAINTY (*)
Analyte	Matrix	From	To	C-CRM
FUEL GAS				
Carbon dioxide (CO ₂)	Nitrogen	10·10 ⁻⁶	100·10 ⁻⁶	0,5%
		100·10 ⁻⁶	1·10 ⁻²	0,4%
		1·10 ⁻²	50·10 ⁻²	0,3%
		50·10 ⁻²	99,8·10 ⁻²	0,2%
	Methane	500·10 ⁻⁶	1·10 ⁻²	0,4%
		1·10 ⁻²	60·10 ⁻²	0,3%
	Air	100·10 ⁻⁶	1·10 ⁻²	0,4%
		1·10 ⁻²	50·10 ⁻²	0,3%
	Helium	40·10 ⁻⁶	100·10 ⁻²	0,5%
		100·10 ⁻⁶	1·10 ⁻²	0,4%
		1·10 ⁻²	50·10 ⁻²	0,3%
	Oxygen	12·10 ⁻⁶	100·10 ⁻⁶	0,5%
		100·10 ⁻⁶	1·10 ⁻²	0,4%
		1·10 ⁻²	50·10 ⁻²	0,3%
Carbon monoxide (CO)	Nitrogen	1·10 ⁻⁶	10·10 ⁻⁶	1%
		10·10 ⁻⁶	100·10 ⁻⁶	0,8%
		100·10 ⁻⁶	0,1·10 ⁻²	0,7%
		0,1·10 ⁻²	10·10 ⁻²	0,6%
	Air	1·10 ⁻⁶	10·10 ⁻⁶	1%
		10·10 ⁻⁶	100·10 ⁻⁶	0,8%
		100·10 ⁻⁶	0,1·10 ⁻²	0,7%
		0,1·10 ⁻²	5,45·10 ⁻²	0,6%
Oxygen	0,5·10 ⁻⁶	10·10 ⁻⁶	2%	
Hydrogen (H ₂)	Nitrogen	0,07·10 ⁻²	6·10 ⁻²	1,1%
		6·10 ⁻²	90·10 ⁻²	0,5%
	Methane	100·10 ⁻⁶	2·10 ⁻²	2%
		2·10 ⁻²	20·10 ⁻²	1%
20·10 ⁻²	90·10 ⁻²	0,5%		
Helium - Argon	2·10 ⁻²	6·10 ⁻²	1,1%	
Methane (CH ₄)	Nitrogen	1·10 ⁻⁶	10·10 ⁻⁶	0,5%
		10·10 ⁻⁶	0,1·10 ⁻²	0,4%
		0,1·10 ⁻²	98·10 ⁻²	0,3%
	Methane	1·10 ⁻²	50·10 ⁻²	0,2%
		50·10 ⁻²	99,8·10 ⁻²	0,1%
	Air	1·10 ⁻⁶	10·10 ⁻⁶	0,5%
Nitrogen (N ₂)	10·10 ⁻⁶	0,1·10 ⁻²	0,4%	
	0,1·10 ⁻²	2,2·10 ⁻²	0,3%	
	Nitrogen	1·10 ⁻²	99·10 ⁻²	0,2%
Methane	500·10 ⁻⁶	10 ·10 ⁻²	3%	
	10·10 ⁻²	95 ·10 ⁻²	0,5%	

C-CRM



FORENSIC

MEASURAND Production of Gaseous Reference Materials C-CRM (Gravimetric method)		CALIBRATION CAPABILITY Amount fraction range mol/mol		RELATIVE EXPANDED UNCERTAINTY (*)
Analyte	Matrix	From	To	C-CRM
FORENSIC				
Ethanol (C ₂ H ₆ O)	Nitrogen - Air	100·10 ⁻⁶	0,1·10 ⁻²	2%

(*) The relative expanded uncertainties reported in the table are the minimum values that can be stated on the certificate. The expanded uncertainty of the measurement is expressed as standard uncertainty multiplied by a coverage factor $k=2$ which, for a t -distribution characterized by calculated effective degrees of freedom, provides a level of confidence of approximately 95%.

For some types of mixtures, where requested by the customer, the calculation of the parameters of the calorific value of the mixture is reported, calculated in accordance with the prescriptions of the ISO 6976 standard. (Upper heating value, Lower heating value, density, relative density, Wobbe index and compressibility factor).

The schedules, divided by application and aimed to help the end-user to find out the proper mixture, are purely illustrative examples. The gases listed above may be used in all the following combinations within the accredited concentration ranges.

	NO	CO	O ₂	CO ₂	H ₂	N ₂ O	NO ₂	BTEX	Hydrocarbons	SO ₂	H ₂ O	Sulphurated gases	He, N ₂	Ethanol	NH ₃
NO	-	Yes ¹	No	Yes	No ⁵	No ⁵	No ⁵	No ⁵	No ⁵	Yes	No ⁵	No ⁵	Yes	No	No
CO		-	Yes ¹	Yes	Yes	Yes ¹	Yes ¹	Yes	Yes	Yes	Yes ²	Yes	Yes	Yes	Yes
O ₂			-	Yes	Yes ¹	Yes	Yes	Yes ¹	Yes ¹	Yes	Yes ²	Yes ¹	Yes	Yes	Yes ¹
CO ₂				-	Yes	Yes	No	Yes	Yes	Yes	Yes ²	Yes	Yes	Yes	Yes
H ₂					-	No	No	Yes	Yes	Yes	Yes ²	Yes	Yes	Yes	No
N ₂ O						-	No ⁵	Yes ¹	Yes ¹	Yes	Yes ²	No ⁵	Yes	No	No
NO ₂							-	No ⁵	No ⁵	No ⁵	No	No ⁵	Yes	No	No
BTEX								-	Yes	Yes	Yes ²	Yes	Yes	No	No
Hydrocarbons									-	Yes	Yes ²	Yes	Yes	Yes	Yes
SO ₂										-	No	Yes ⁴	Yes	No	Yes
H ₂ O											-	No	Yes	No	No
Sulphurated gases												-	Yes	No	No
He, N ₂													-	Yes	Yes
Ethanol														-	No
NH ₃															-

¹ Feasible up to safety limit levels concerning oxidant and flammable gases.

² Only for concentrations of water lower than 100 ppm.

³ Applicable to saturated hydrocarbons.

⁴ Hydrogen sulphide excluded.

⁵ Analysis can't be performed.

Accreditation tables of RMP Producer No. 143



AM - NI

W-CRM



LAT N° 143

The W-CRM working mixtures are produced individually by gravimetric method, following an accredited internal method that allows you to obtain a metrologically traceable product, but with higher uncertainty than CRMs. For this type of mixture, the Manufacturer certifies a time interval within which the homogeneity of the mixture and the stability of the certified values is guaranteed. W-CRM guarantee traceability in all those cases where the uncertainty of the measurement is not a binding factor.

THE CERTIFIED VALUE IS TRACEABLE, VIA AN UNBROKEN CHAIN OF COMPARISONS, TO THE NATIONAL MASS SAMPLES CERTIFIED BY PRIMARY METROLOGY INSTITUTES OR ACCREDITED CALIBRATION CENTERS

Following preparation, the gravimetric concentration of the mixture is analyzed with the aim of confirming the result. Certification uncertainty is calculated on the basis of the

mixture production process; this uncertainty may vary, depending on the requested concentration, in percentages ranging between 1 and 10%.

W-CGM are also available as a multi-component gas mixture in line with the compatibility constraints due to the chemical-physical characteristics of the gases.

MEASURAND Production of Gaseous Reference Materials W-CRM		CALIBRATION CAPABILITY Amount fraction range mol/mol		RELATIVE EXPANDED UNCERTAINTY (*)
Analyte	Matrix	From	To	W-CRM
Ammonia (NH ₃)	Nitrogen - Air	5·10 ⁻⁶	500·10 ⁻⁶	10%
Benzene (C ₆ H ₆)	Nitrogen - Air	5·10 ⁻⁹	200·10 ⁻⁹	6%
Carbon dioxide (CO ₂)	Nitrogen - Air - Helium	100·10 ⁻⁶	1·10 ⁻²	2%
	Oxygen	1·10 ⁻²	99,5·10 ⁻²	1%
Carbon monoxide (CO)	Nitrogen	1·10 ⁻⁶	10·10 ⁻⁶	6%
		10·10 ⁻⁶	1·10 ⁻²	2%
		1·10 ⁻²	90·10 ⁻²	1%
	Air - Helium	1·10 ⁻⁶	10·10 ⁻⁶	6%
		10·10 ⁻⁶	1·10 ⁻²	2%
		1·10 ⁻²	8·10 ⁻²	1%
Ethylbenzene (C ₈ H ₁₀)	Nitrogen - Air	5·10 ⁻⁹	200·10 ⁻⁹	6%
Hydrogen (H ₂)	Nitrogen - Helium	0,07·10 ⁻²	90·10 ⁻²	2%
	Argon	2·10 ⁻²	90·10 ⁻²	2%
Methane (CH ₄)	Nitrogen	1·10 ⁻⁶	10·10 ⁻⁶	3,5%
		10·10 ⁻⁶	1·10 ⁻²	2%
		1·10 ⁻²	90·10 ⁻²	1%
	Air	1·10 ⁻⁶	10·10 ⁻⁶	3,5%
		10·10 ⁻⁶	1·10 ⁻²	2%
		1·10 ⁻²	2,2·10 ⁻²	1%
	Helium - Argon	1·10 ⁻²	90·10 ⁻²	1%
Nitrogen dioxide (NO ₂)	Nitrogen - Air	5·10 ⁻⁶	1·10 ⁻²	6%
Nitrogen oxide (NO)	Nitrogen	0,12·10 ⁻⁶	0,4·10 ⁻⁶	8%
		0,4·10 ⁻⁶	5·10 ⁻⁶	6%
		5·10 ⁻⁶	20·10 ⁻⁶	3,5%
		20·10 ⁻⁶	2500·10 ⁻⁶	2%
Nitrous oxide (N ₂ O)	Nitrogen - Air	1·10 ⁻⁶	10·10 ⁻²	2%
		10·10 ⁻²	90·10 ⁻²	1%

W-CRM



OS - XY

MEASURAND Production of Gaseous Reference Materials W-CRM		CALIBRATION CAPABILITY Amount fraction range mol/mol		RELATIVE EXPANDED UNCERTAINTY (*)
Analyte	Matrix	From	To	W-CRM
Oxygen (O ₂)	Nitrogen - Helium	1·10 ⁻⁶ 10·10 ⁻⁶ 1·10 ⁻²	10·10 ⁻⁶ 1·10 ⁻² 90·10 ⁻²	3,5% 2% 1%
	Argon	3·10 ⁻²	90·10 ⁻²	1%
Propane (C ₃ H ₈)	Nitrogen - Methane	1·10 ⁻⁶ 10·10 ⁻⁶ 1,1·10 ⁻²	10·10 ⁻⁶ 1,1·10 ⁻² 90·10 ⁻²	3,5% 2% 1%
	Air	1·10 ⁻⁶ 10·10 ⁻⁶	10·10 ⁻⁶ 1,1·10 ⁻²	3,5% 2%
Sulphur dioxide (SO ₂)	Nitrogen - Air	1·10 ⁻⁶	2500·10 ⁻⁶	3%
		2500·10 ⁻⁶	10·10 ⁻²	2%
Toluene (C ₇ H ₈)	Nitrogen - Air	5·10 ⁻⁹	200·10 ⁻⁹	6%
o-Xylene (o-C ₈ H ₁₀)	Nitrogen - Air	5·10 ⁻⁹	200·10 ⁻⁹	8%
m-Xylene (m-C ₈ H ₁₀)	Nitrogen - Air	5·10 ⁻⁹	200·10 ⁻⁹	8%
p-Xylene (p-C ₈ H ₁₀)	Nitrogen - Air	5·10 ⁻⁹	200·10 ⁻⁹	8%

(*) The expanded measurement uncertainty is expressed as the model uncertainty multiplied by the coverage factor $k=2$, which for a normal probability distribution corresponds to a confidence level of about 95%.

For gases whose concentration appears in two successive measuring ranges, the relative expanded uncertainty is adopted.

The gases listed above may form mixtures, in which they are individually in the above concentration, in the following combinations.

	NO	C ₃ H ₈	CO	O ₂	CO ₂	H ₂	N ₂ O	NO ₂	BTEX	CH ₄	SO ₂	NH ₃
NO	-	No	Yes ¹	No	Yes	No	No	No	No	No	No	No
C ₃ H ₈		-	Yes	Yes ¹	Yes	Yes	Yes ¹	No	No	Yes	No	Yes
CO			-	Yes ¹	Yes	Yes	Yes ¹	No	Yes	Yes	Yes	Yes
O ₂				-	Yes	Yes ¹	Yes	Yes	Yes ¹	Yes ¹	Yes	Yes ¹
CO ₂					-	Yes	No	No	Yes	Yes	Yes	Yes
H ₂						-	Yes ¹	Yes ¹	Yes	Yes	Yes	No
N ₂ O							-	No	Yes ¹	Yes ¹	Yes	No
NO ₂								-	Yes ¹	Yes ¹	No	No
BTEX									-	Yes	Yes	No
CH ₄										-	Yes	Yes
SO ₂											-	Yes
NH ₃												-

¹ Compatible up to the safety limit inherent of oxidizing and flammable gases.

Accreditation tables of LAT Centre No. 143

G-CGM



LAT N° 143

G-CGMs are gas mixtures calibrated gravimetrically according to the standard ISO 6142. Metrological traceability derives from the masses calibrated by a Primary Metrology Institute or by an Accredited Center used for preparing the mixtures.

METROLOGICAL TRACEABILITY DERIVES FROM THE MASSES CALIBRATED AND USED FOR PREPARING THE MIXTURES

The calculation of the concentration and the uncertainty of the calibration takes into account: the choice and quality of the raw materials and the original mixtures, the masses used for calibrating the balance and its performance, the calibration ambient conditions, and the preparation procedure with all the uncertainties relating to the weighing process. All the individually prepared mixtures are analytically verified. The analysis follows the guidelines

of ISO 6143, which provides a three-point calibration, or the guidelines of ISO 12963, which provides two-point or single-point calibration. The samples used for instrumental calibration are traceable mixtures or certified by a Primary Metrological Institute. The G-CGM mixture is then traceable to the mass that is validated by analysis with respect to traceable mixtures. The validation process is a distinguishing feature of the

Center's mixtures to further support the high quality of these mixtures. G-CGM mixtures, on a par with CRMs, are characterized by the best possible preparation tolerance with current technology, and by very small relative extended uncertainties. G-CGMs are also available as a multi-component gas mixture in line with the compatibility constraints due to the chemical-physical characteristics of the gases.

A-CGM



LAT N° 143

Analytically calibrated traceable gas mixtures are defined A-CGM: the certified uncertainty and concentration are determined by comparison with the Center's traceable standard (G-CGM o CRM) or with the ones certified/produced by a Primary Metrology Institute.

THE METROLOGICAL TRACEABILITY DERIVES FROM THE MIXTURES USED IN THE CALIBRATION PHASE

The reference standard for analytical calibration is ISO 6143. Instrumental calibration is performed for each mixture using the method of generalized least squares (GLS): 3 traceable gas mixtures are used (G-CGM, CRM or Primary Metrology Institutes mixtures).

The sample to calibrate may be supplied by the customer or produced by SIAD: the Center provides only the analytical calibration for the mixtures of the customer. If the mixture is produced by SIAD, the Special Gas mixtures stability guarantees apply.

In the hierarchy of the traceability of the Center's products, A-CGM mixtures are metrologically inferior to the gravimetrically calibrated G-CGM mixtures: the calibration is made by comparison and not with a primary method; therefore also the certified minimum uncertainty is higher.

G-CGM / A-CGM



AM - NI

ENVIRONMENTAL MONITORING

LAT Center n. 143 is accredited for the quantity "Amount of substance"

Permanent Laboratory

MEASURAND Calibration of gas mixtures by gravimetric method G-CGM and by analytical method A-CGM		CALIBRATION CAPABILITY Amount fraction range mol/mol		RELATIVE EXPANDED UNCERTAINTY (*)	
Analyte	Matrix	From	To	G-CGM	A-CGM
ENVIRONMENTAL MONITORING					
Ammonia (NH ₃)	Nitrogen - Air	5·10 ⁻⁶	500·10 ⁻⁶	3%	7%
Benzene (C ₆ H ₆)	Nitrogen	5·10 ⁻⁹	200·10 ⁻⁹	2%	3%
Butanol (C ₄ H ₁₀ O)	Nitrogen	20·10 ⁻⁶	0,1·10 ⁻²	2%	3%
Carbon dioxide (CO ₂)	Nitrogen	10·10 ⁻⁶	100·10 ⁻⁶	0,8%	3%
		100·10 ⁻⁶	1·10 ⁻²	0,4%	1%
		1·10 ⁻²	50·10 ⁻²	0,3%	1%
		50·10 ⁻²	99,8·10 ⁻²	0,2%	0,3%
	Methane	500·10 ⁻⁶	1·10 ⁻²	1%	1%
		1·10 ⁻²	60·10 ⁻²	0,5%	1%
	Air	100·10 ⁻⁶	1·10 ⁻²	0,4%	1%
		1·10 ⁻²	50·10 ⁻²	0,3%	1%
	Helium	40·10 ⁻⁶	100·10 ⁻²	0,5%	2%
		100·10 ⁻⁶	1·10 ⁻²	0,4%	1%
	Oxygen	1·10 ⁻²	50·10 ⁻²	0,3%	1%
		12·10 ⁻⁶	100·10 ⁻⁶	0,5%	1%
Carbon monoxide (CO)	Nitrogen	1·10 ⁻⁶	10·10 ⁻⁶	1%	2%
		10·10 ⁻⁶	100·10 ⁻⁶	0,8%	2%
		100·10 ⁻⁶	0,1·10 ⁻²	0,7%	2%
		0,1·10 ⁻²	10·10 ⁻²	0,6%	1%
	Air	1·10 ⁻⁶	10·10 ⁻⁶	1%	2%
		10·10 ⁻⁶	100·10 ⁻⁶	0,8%	2%
		100·10 ⁻⁶	0,1·10 ⁻²	0,7%	2%
		0,1·10 ⁻²	5,45·10 ⁻²	0,6%	1%
Ethylbenzene (C ₈ H ₁₀)	Nitrogen	0,5·10 ⁻⁶	10·10 ⁻⁶	2%	3%
		10·10 ⁻⁶	100·10 ⁻⁶	0,8%	2%
Nitric oxide (NO)	Nitrogen	5·10 ⁻⁹	200·10 ⁻⁹	4,5%	N.A.
		0,12·10 ⁻⁶	0,4·10 ⁻⁶	3%	4%
		0,4·10 ⁻⁶	1·10 ⁻⁶	1,2%	3%
		1·10 ⁻⁶	10·10 ⁻⁶	1%	2%
		10·10 ⁻⁶	0,1·10 ⁻²	0,7%	1,5%
Nitrogen dioxide (NO ₂)	Nitrogen - Air	0,1·10 ⁻²	0,25·10 ⁻²	0,5%	1%
		5·10 ⁻⁶	100·10 ⁻⁶	3%	3%
Nitrous oxide (N ₂ O)	Nitrogen	1·10 ⁻⁶	30·10 ⁻⁶	1,5%	3%
		30·10 ⁻⁶	0,1·10 ⁻²	1%	1,5%
	Air	1·10 ⁻⁶	30·10 ⁻⁶	1,5%	3%
		30·10 ⁻⁶	0,1·10 ⁻²	1%	3%

G-CGM / A-CGM



OS - XY

ENVIRONMENTAL MONITORING

MEASURAND Calibration of gas mixtures by gravimetric method G-CGM and by analytical method A-CGM		CALIBRATION CAPABILITY Amount fraction range mol/mol		RELATIVE EXPANDED UNCERTAINTY (%)	
Analyte	Matrix	From	To	G-CGM	A-CGM
ENVIRONMENTAL MONITORING					
Oxygen (O ₂)	Nitrogen	10·10 ⁻⁶	100·10 ⁻⁶	2%	2%
		100·10 ⁻⁶	0,1·10 ⁻²	1%	2%
		0,1·10 ⁻²	1·10 ⁻²	0,66%	1%
		1·10 ⁻²	25·10 ⁻²	0,42%	1%
	Methane	25·10 ⁻²	99,8·10 ⁻²	0,2%	0,3%
		200·10 ⁻⁶	2·10 ⁻²	2%	2%
	Helium	100·10 ⁻⁶	0,1·10 ⁻²	1%	2%
		0,1·10 ⁻²	3·10 ⁻²	0,66%	1%
Sulphur dioxide (SO ₂)	Nitrogen	3·10 ⁻²	25·10 ⁻²	0,42%	1%
	Argon	3·10 ⁻²	80·10 ⁻²	0,42%	2%
	Nitrogen	0,1·10 ⁻⁶	0,25·10 ⁻⁶	4%	5%
		0,25·10 ⁻⁶	1·10 ⁻⁶	3%	5%
		1·10 ⁻⁶	100·10 ⁻⁶	1,5%	2%
		100·10 ⁻⁶	0,3·10 ⁻²	0,66%	1%
	Air	0,1·10 ⁻⁶	0,25·10 ⁻⁶	4%	4,5%
		0,25·10 ⁻⁶	1·10 ⁻⁶	3%	4,5%
Toluene (C ₇ H ₈)	Nitrogen	1·10 ⁻⁶	100·10 ⁻⁶	1,5%	2%
		100·10 ⁻⁶	0,3·10 ⁻²	0,66%	1%
	Nitrogen	5·10 ⁻⁹	200·10 ⁻⁹	3%	3,5%
	Nitrogen	10·10 ⁻⁶	100·10 ⁻⁶	6,5%	7%
	Nitrogen	5·10 ⁻⁹	200·10 ⁻⁹	4,5%	N.A.
o-Xylene (o-C ₈ H ₁₀)	Nitrogen	5·10 ⁻⁹	200·10 ⁻⁹	4,5%	N.A.
	Nitrogen	5·10 ⁻⁹	200·10 ⁻⁹	4,5%	N.A.
	Nitrogen	5·10 ⁻⁹	200·10 ⁻⁹	4,5%	N.A.
m-Xylene (m-C ₈ H ₁₀)	Nitrogen	5·10 ⁻⁹	200·10 ⁻⁹	4,5%	N.A.
	Nitrogen	5·10 ⁻⁹	200·10 ⁻⁹	4,5%	N.A.
p-Xylene (p-C ₈ H ₁₀)	Nitrogen	5·10 ⁻⁹	200·10 ⁻⁹	4,5%	N.A.
	Nitrogen	5·10 ⁻⁹	200·10 ⁻⁹	4,5%	N.A.

G-CGM / A-CGM



AC - HE

HYDROCARBONS / NATURAL GAS

MEASURAND Calibration of gas mixtures by gravimetric method G-CGM and by analytical method A-CGM		CALIBRATION CAPABILITY Amount fraction range mol/mol		RELATIVE EXPANDED UNCERTAINTY (*)	
Analyte	Matrix	From	To	G-CGM	A-CGM
HYDROCARBONS / NATURAL GAS					
Acetylene (C ₂ H ₂)	Nitrogen	1·10 ⁻⁶ 100·10 ⁻⁶	100·10 ⁻⁶ 0,4·10 ⁻²	2% 1%	4% 3%
Argon (Ar)	Methane	200·10 ⁻⁶	5·10 ⁻²	5%	N.A.
Butadiene 1.3 (C ₄ H ₆)	Nitrogen	1·10 ⁻⁶	0,1·10 ⁻²	2%	3%
	Methane	0,5·10 ⁻²	3·10 ⁻²	2%	3%
Butane (C ₄ H ₁₀)	Nitrogen	1·10 ⁻⁶ 100·10 ⁻⁶ 0,1·10 ⁻²	100·10 ⁻⁶ 0,1·10 ⁻² 5·10 ⁻²	2% 1% 0,8%	3% 2% 1,5%
	Methane	100·10 ⁻⁶ 0,1·10 ⁻²	0,1·10 ⁻² 4·10 ⁻²	1% 0,8%	2% 1,5%
Butene - 1 (C ₄ H ₈)	Nitrogen	1·10 ⁻⁶ 100·10 ⁻⁶ 0,1·10 ⁻²	100·10 ⁻⁶ 0,1·10 ⁻² 5·10 ⁻²	2% 1% 0,8%	3% 2% 1,5%
	Methane	0,1·10 ⁻²	1·10 ⁻²	0,8%	1%
Carbon dioxide (CO ₂)	Nitrogen	10·10 ⁻⁶ 100·10 ⁻⁶ 1·10 ⁻² 50·10 ⁻²	100·10 ⁻⁶ 1·10 ⁻² 50·10 ⁻² 99,8·10 ⁻²	0,8% 0,4% 0,3% 0,2%	3% 1% 1% 0,3%
		500·10 ⁻⁶ 1·10 ⁻²	1·10 ⁻² 60·10 ⁻²	1% 0,5%	1,5% 1,5%
	Air	100·10 ⁻⁶ 1·10 ⁻²	1·10 ⁻² 50·10 ⁻²	0,4% 0,3%	1% 1%
		40·10 ⁻⁶ 100·10 ⁻⁶ 1·10 ⁻²	100·10 ⁻² 1·10 ⁻² 50·10 ⁻²	0,5% 0,4% 0,3%	2% 1% 1%
	Oxygen	12·10 ⁻⁶ 100·10 ⁻⁶ 1·10 ⁻²	100·10 ⁻⁶ 1·10 ⁻² 50·10 ⁻²	0,5% 0,4% 0,3%	1% 1% 1%
	Methane	500·10 ⁻⁶ 0,1·10 ⁻² 10·10 ⁻²	0,1·10 ⁻² 10·10 ⁻² 35·10 ⁻²	1% 0,8% 0,5%	2% 2% 2%
Carbon monoxide (CO)	Methane	0,025·10 ⁻²	25·10 ⁻²	0,6%	1%
Ethane (C ₂ H ₆)	Nitrogen	1·10 ⁻⁶ 100·10 ⁻⁶ 0,1·10 ⁻² 5·10 ⁻²	100·10 ⁻⁶ 0,1·10 ⁻² 5·10 ⁻² 35·10 ⁻²	1,2% 1% 0,8% 0,5%	3% 2% 1% 1%
Ethylene (C ₂ H ₄)	Nitrogen	1·10 ⁻⁶ 100·10 ⁻⁶ 0,1·10 ⁻²	100·10 ⁻⁶ 0,1·10 ⁻² 5·10 ⁻²	1,2% 1% 0,8%	3% 2% 1%
	Methane	1·10 ⁻² 10·10 ⁻²	10·10 ⁻² 16·10 ⁻²	1% 0,8%	2% 1%
Helium (He)	Nitrogen	1·10 ⁻²	20·10 ⁻²	1%	1,5%
	Methane	100·10 ⁻⁶	50·10 ⁻²	3%	3%
Heptane (C ₇ H ₁₆)	Methane	50·10 ⁻⁶	0,2·10 ⁻²	1%	2%
Hexane (C ₆ H ₁₄)	Nitrogen	1·10 ⁻⁶ 100·10 ⁻⁶ 0,1·10 ⁻²	100·10 ⁻⁶ 0,1·10 ⁻² 0,4·10 ⁻²	2% 1% 0,8%	3% 2% 1,5%

G-CGM / A-CGM



HE - OX

HYDROCARBONS / NATURAL GAS

MEASURAND Calibration of gas mixtures by gravimetric method G-CGM and by analytical method A-CGM		CALIBRATION CAPABILITY Amount fraction range mol/mol		RELATIVE EXPANDED UNCERTAINTY (*)	
Analyte	Matrix	From	To	G-CGM	A-CGM
HYDROCARBONS / NATURAL GAS					
Hexane (C ₆ H ₁₄)	Methane	50·10 ⁻⁶	0,1·10 ⁻²	1%	2%
		0,1·10 ⁻²	1·10 ⁻²	0,8%	1,5%
Hydrogen (H ₂)	Nitrogen	0,07·10 ⁻²	6·10 ⁻²	1,1%	2%
		6·10 ⁻²	90·10 ⁻²	0,5%	0,7%
	Methane	100·10 ⁻⁶	2·10 ⁻²	2%	2%
		2·10 ⁻²	20·10 ⁻²	1%	0,7%
		20·10 ⁻²	90·10 ⁻²	0,5%	0,7%
	Helium - Argon	2·10 ⁻²	6·10 ⁻²	1,1%	2%
Isobutane (C ₄ H ₁₀)	Nitrogen	1·10 ⁻⁶	100·10 ⁻⁶	2%	3%
		100·10 ⁻⁶	0,1·10 ⁻²	1%	2%
		0,1·10 ⁻²	5·10 ⁻²	0,8%	1,5%
	Methane	100·10 ⁻⁶	0,1·10 ⁻²	1%	2%
Isobutene (C ₄ H ₈)	Nitrogen	1·10 ⁻⁶	100·10 ⁻⁶	2%	3%
		100·10 ⁻⁶	0,1·10 ⁻²	1%	2%
		0,1·10 ⁻²	5·10 ⁻²	0,8%	1,5%
	Methane	0,1·10 ⁻²	1·10 ⁻²	0,8%	1,5%
Isopentane (C ₅ H ₁₂)	Methane	50·10 ⁻⁶	0,1·10 ⁻²	1%	2%
		0,1·10 ⁻²	3,5·10 ⁻²	0,8%	1,5%
Methane (CH ₄)	Nitrogen	1·10 ⁻⁶	10·10 ⁻⁶	0,5%	2%
		10·10 ⁻⁶	0,1·10 ⁻²	0,4%	1%
		0,1·10 ⁻²	98·10 ⁻²	0,3%	0,5%
	Methane	1·10 ⁻²	50·10 ⁻²	0,4%	0,4%
		50·10 ⁻²	99,8·10 ⁻²	0,2%	0,2%
Neopentane (C ₅ H ₁₂)	Air	1·10 ⁻⁶	10·10 ⁻⁶	0,5%	2%
		10·10 ⁻⁶	0,1·10 ⁻²	0,4%	1%
		0,1·10 ⁻²	2,2·10 ⁻²	0,3%	1%
Nitrogen (N ₂)	Methane	50·10 ⁻⁶	0,1·10 ⁻²	1%	2%
		0,1·10 ⁻²	3,5·10 ⁻²	0,8%	1,5%
Nonane (C ₉ H ₂₀)	Nitrogen	1·10 ⁻²	99·10 ⁻²	0,2%	0,3%
		500·10 ⁻⁶	10 ·10 ⁻²	3%	3%
Octane (C ₈ H ₁₈)	Methane	10·10 ⁻⁶	95 ·10 ⁻²	0,5%	1,5%
		50·10 ⁻⁶	0,02·10 ⁻²	1%	2%
Oxygen (O ₂)	Methane	10·10 ⁻⁶	100·10 ⁻⁶	2%	2%
		100·10 ⁻⁶	0,1·10 ⁻²	1%	2%
		0,1·10 ⁻²	1·10 ⁻²	0,66%	1%
		1·10 ⁻²	25·10 ⁻²	0,42%	1%
		25·10 ⁻²	99,8·10 ⁻²	0,2%	0,3%
	Methane	200·10 ⁻⁶	0,1·10 ⁻²	5%	6%
		0,1·10 ⁻²	2·10 ⁻²	2%	3%
	Helium	100·10 ⁻⁶	0,1·10 ⁻²	1%	2%
		0,1·10 ⁻²	3·10 ⁻²	0,66%	1%
		3·10 ⁻²	25·10 ⁻²	0,42%	1%
	Argon	3·10 ⁻²	80·10 ⁻²	0,42%	2%



Follow on page 24

G-CGM / A-CGM



PE - PR

HYDROCARBONS / NATURAL GAS

MEASURAND Calibration of gas mixtures by gravimetric method G-CGM and by analytical method A-CGM		CALIBRATION CAPABILITY Amount fraction range mol/mol		RELATIVE EXPANDED UNCERTAINTY (*)	
Analyte	Matrix	From	To	G-CGM	A-CGM
HYDROCARBONS / NATURAL GAS					
Pentane (C ₅ H ₁₂)	Methane	50·10 ⁻⁶	0,1·10 ⁻²	1%	2%
		0,1·10 ⁻²	2·10 ⁻²	0,8%	1,5%
Propane (C ₃ H ₈)	Nitrogen	0,1·10 ⁻⁶	1·10 ⁻⁶	2%	3%
		1·10 ⁻⁶	10·10 ⁻⁶	1%	2%
		10·10 ⁻⁶	100·10 ⁻⁶	0,8%	2%
		100·10 ⁻⁶	0,1·10 ⁻²	0,4%	2%
		0,1·10 ⁻²	18·10 ⁻²	0,3%	1%
	Methane	1·10 ⁻⁶	10·10 ⁻⁶	1,5%	3%
		10·10 ⁻⁶	100·10 ⁻⁶	1,2%	2%
		100·10 ⁻⁶	0,1·10 ⁻²	0,8%	1%
		0,1·10 ⁻²	18·10 ⁻²	0,7%	1%
	Air	1·10 ⁻⁶	10·10 ⁻⁶	1%	3%
		10·10 ⁻⁶	100·10 ⁻⁶	0,8%	2%
		100·10 ⁻⁶	0,1·10 ⁻²	0,4%	1%
		0,1·10 ⁻²	0,85·10 ⁻²	0,3%	1%
Propylene (C ₃ H ₆)	Nitrogen - Methane	0,05·10 ⁻²	7·10 ⁻²	0,8%	1%

There are mixtures, when required by the customer, for whom are stated on the certificate the calorific values calculated according to ISO 6976. (Superior calorific value, inferior calorific value, density, relative density, Wobbe index and compressibility factor).
For gases whose concentrations are in consecutive measurement ranges, the certified relative expanded uncertainty is the highest.

G-CGM / A-CGM



CA - TE

SULPHURATED GASES

MEASURAND Calibration of gas mixtures by gravimetric method G-CGM and by analytical method A-CGM		CALIBRATION CAPABILITY Amount fraction range mol/mol		RELATIVE EXPANDED UNCERTAINTY (*)	
Analyte	Matrix	From	To	G-CGM	A-CGM
SULPHURATED GASES					
Carbonyl sulphide (COS)(**)	Nitrogen - Methane	$1 \cdot 10^{-6}$	$100 \cdot 10^{-6}$	5%	5%
Dimethyl sulphide (C ₂ H ₆ S)(**)	Nitrogen - Methane	$0,5 \cdot 10^{-6}$	$10 \cdot 10^{-6}$	10%	10%
		$10 \cdot 10^{-6}$	$100 \cdot 10^{-6}$	5%	5%
Hydrogen sulphide (H ₂ S)(**)	Nitrogen - Methane	$1 \cdot 10^{-6}$	$10 \cdot 10^{-6}$	5%	5%
		$10 \cdot 10^{-6}$	$100 \cdot 10^{-6}$	3%	3%
		$100 \cdot 10^{-6}$	$250 \cdot 10^{-6}$	2%	2%
Isopropyl mercaptan (C ₃ H ₈ S)(**)	Nitrogen - Methane	$1 \cdot 10^{-6}$	$10 \cdot 10^{-6}$	10%	10%
		$10 \cdot 10^{-6}$	$100 \cdot 10^{-6}$	5%	5%
Methyl ethyl sulphide (C ₃ H ₈ S)(**)	Nitrogen - Methane	$1 \cdot 10^{-6}$	$10 \cdot 10^{-6}$	10%	10%
		$10 \cdot 10^{-6}$	$100 \cdot 10^{-6}$	5%	5%
Methyl mercaptan (CH ₄ S)(**)	Nitrogen - Methane	$1 \cdot 10^{-6}$	$10 \cdot 10^{-6}$	10%	10%
		$10 \cdot 10^{-6}$	$100 \cdot 10^{-6}$	5%	5%
Methyl sulphide (C ₂ H ₆ S)(**)	Nitrogen - Methane	$1 \cdot 10^{-6}$	$10 \cdot 10^{-6}$	10%	10%
		$10 \cdot 10^{-6}$	$100 \cdot 10^{-6}$	5%	5%
N-Propyl mercaptan (C ₃ H ₈ S)(**)	Nitrogen - Methane	$1 \cdot 10^{-6}$	$10 \cdot 10^{-6}$	10%	10%
		$10 \cdot 10^{-6}$	$100 \cdot 10^{-6}$	5%	5%
Tert-butyl mercaptan (C ₄ H ₁₀ S)	Nitrogen - Methane	$1 \cdot 10^{-6}$	$10 \cdot 10^{-6}$	10%	10%
		$10 \cdot 10^{-6}$	$100 \cdot 10^{-6}$	5%	5%
Tetrahydrothiophene (C ₄ H ₈ S)	Nitrogen - Methane	$1 \cdot 10^{-6}$	$10 \cdot 10^{-6}$	5%	5%
		$10 \cdot 10^{-6}$	$100 \cdot 10^{-6}$	3%	3%

(**) In case of analytical calibration, the component cannot be combined with other sulphurates.

G-CGM / A-CGM



CA - NI

FUEL GAS

MEASURAND Calibration of gas mixtures by gravimetric method G-CGM and by analytical method A-CGM		CALIBRATION CAPABILITY Amount fraction range mol/mol		RELATIVE EXPANDED UNCERTAINTY (*)	
Analyte	Matrix	From	To	G-CGM	A-CGM
FUEL GAS					
Carbon dioxide (CO ₂)	Nitrogen	10·10 ⁻⁶	100·10 ⁻⁶	0,5%	3%
		100·10 ⁻⁶	1·10 ⁻²	0,4%	1%
		1·10 ⁻²	50·10 ⁻²	0,3%	1%
		50·10 ⁻²	99,8·10 ⁻²	0,2%	0,3%
	Methane	500·10 ⁻⁶	1·10 ⁻²	0,4%	1%
		1·10 ⁻²	60·10 ⁻²	0,3%	1%
	Air	100·10 ⁻⁶	1·10 ⁻²	0,4%	1%
		1·10 ⁻²	50·10 ⁻²	0,3%	1%
	Helium	40·10 ⁻⁶	100·10 ⁻²	0,5%	2%
		100·10 ⁻⁶	1·10 ⁻²	0,4%	1%
		1·10 ⁻²	50·10 ⁻²	0,3%	1%
	Oxygen	12·10 ⁻⁶	100·10 ⁻⁶	0,5%	1%
		100·10 ⁻⁶	1·10 ⁻²	0,4%	1%
		1·10 ⁻²	50·10 ⁻²	0,3%	1%
Carbon monoxide (CO)	Nitrogen	1·10 ⁻⁶	10·10 ⁻⁶	1%	2%
		10·10 ⁻⁶	100·10 ⁻⁶	0,8%	2%
		100·10 ⁻⁶	0,1·10 ⁻²	0,7%	2%
		0,1·10 ⁻²	10·10 ⁻²	0,6%	1%
	Air	1·10 ⁻⁶	10·10 ⁻⁶	1%	2%
		10·10 ⁻⁶	100·10 ⁻⁶	0,8%	2%
		100·10 ⁻⁶	0,1·10 ⁻²	0,7%	2%
		0,1·10 ⁻²	5,45·10 ⁻²	0,6%	1%
Oxygen	0,5·10 ⁻⁶	10·10 ⁻⁶	2%	3%	
Hydrogen (H ₂)	Nitrogen	0,07·10 ⁻²	6·10 ⁻²	1,1%	2%
		6·10 ⁻²	90·10 ⁻²	0,5%	0,7%
	Methane	100·10 ⁻⁶	2·10 ⁻²	2%	2%
		2·10 ⁻²	20·10 ⁻²	1%	0,7%
		20·10 ⁻²	90·10 ⁻²	0,5%	0,7%
Helium - Argon	2·10 ⁻²	6·10 ⁻²	1,1%	2%	
Methane (CH ₄)	Nitrogen	1·10 ⁻⁶	10·10 ⁻⁶	0,5%	2%
		10·10 ⁻⁶	0,1·10 ⁻²	0,4%	1%
		0,1·10 ⁻²	98·10 ⁻²	0,3%	0,5%
	Methane	1·10 ⁻²	50·10 ⁻²	0,2%	0,2%
		50·10 ⁻²	99,8·10 ⁻²	0,1%	0,1%
	Air	1·10 ⁻⁶	10·10 ⁻⁶	0,5%	2%
Nitrogen (N ₂)	Nitrogen	10·10 ⁻⁶	0,1·10 ⁻²	0,4%	1%
		0,1·10 ⁻²	2,2·10 ⁻²	0,3%	1%
	Methane	1·10 ⁻²	99·10 ⁻²	0,2%	0,3%
		500·10 ⁻⁶	10 ·10 ⁻²	3%	3%
10·10 ⁻²	95 ·10 ⁻²	0,5%	1,5%		

G-CGM / A-CGM



FORENSIC

MEASURAND Calibration of gas mixtures by gravimetric method G-CGM and by analytical method A-CGM		CALIBRATION CAPABILITY Amount fraction range mol/mol		RELATIVE EXPANDED UNCERTAINTY (*)	
Analyte	Matrix	From	To	G-CGM	A-CGM
FORENSIC					
Ethanol (C ₂ H ₆ O)	Nitrogen - Air	100·10 ⁻⁶	0,1·10 ⁻²	2%	5%

(*) The relative expanded uncertainties reported in the table are the minimum values that can be stated on the certificate. The expanded uncertainty of the measurement is expressed as standard uncertainty multiplied by a coverage factor $k=2$ which, for a t -distribution characterized by calculated effective degrees of freedom, provides a level of confidence of approximately 95%.

For some types of mixtures, where requested by the customer, the calculation of the parameters of the calorific value of the mixture is reported, calculated in accordance with the prescriptions of the ISO 6976 standard. (Upper heating value, Lower heating value, density, relative density, Wobbe index and compressibility factor).

The schedules, divided by application and aimed to help the end-user to find out the proper mixture, are purely illustrative examples. The gases listed above may be used in all the following combinations within the accredited concentration ranges.

	NO	CO	O ₂	CO ₂	H ₂	N ₂ O	NO ₂	BTEX	Hydrocarbons	SO ₂	H ₂ O	Sulphurated gases	He, N ₂	Ethanol	NH ₃
NO	-	Yes ¹	No	Yes	No ⁵	No ⁵	No ⁵	No ⁵	No ⁵	Yes	No ⁵	No ⁵	Yes	No	No
CO		-	Yes ¹	Yes	Yes	Yes ¹	Yes ¹	Yes	Yes	Yes	Yes ²	Yes	Yes	Yes	Yes
O ₂			-	Yes	Yes ¹	Yes	Yes	Yes ¹	Yes ¹	Yes	Yes ²	Yes ¹	Yes	Yes	Yes ¹
CO ₂				-	Yes	Yes	No	Yes	Yes	Yes	Yes ²	Yes	Yes	Yes	Yes
H ₂					-	No	No	Yes	Yes	Yes	Yes ²	Yes	Yes	Yes	No
N ₂ O						-	No ⁵	Yes ¹	Yes ¹	Yes	Yes ²	No ⁵	Yes	No	No
NO ₂							-	No ⁵	No ⁵	No ⁵	No	No ⁵	Yes	No	No
BTEX								-	Yes	Yes	Yes ²	Yes	Yes	No	No
Hydrocarbons									-	Yes	Yes ²	Yes	Yes	Yes	Yes
SO ₂										-	No	Yes ⁴	Yes	No	Yes
H ₂ O											-	No	Yes	No	No
Sulphurated gases												-	Yes	No	No
He, N ₂													-	Yes	Yes
Ethanol														-	No
NH ₃															-

¹ Feasible up to safety limit levels concerning oxidant and flammable gases.

² Only for concentrations of water lower than 100 ppm.

³ Applicable to saturated hydrocarbons.

⁴ Hydrogen sulphide excluded.

⁵ Analysis can't be performed.

Accreditation tables of LAT Centre No. 143



AM - NI

W-CGM



LAT N° 143

The W-CGMs are prepared individually, following an accredited internal method that provides a metrologically traceable mixture, but with a higher uncertainty than the G-CGMs. The W-CGMs guarantee traceability in all those cases where measurement uncertainty is not a binding factor.

THE CERTIFIED VALUE IS TRACEABLE, VIA AN UNBROKEN CHAIN OF COMPARISONS, TO THE NATIONAL MASS SAMPLES CERTIFIED BY PRIMARY METROLOGY INSTITUTES OR ACCREDITED CALIBRATION CENTERS.

Following preparation, the gravimetric concentration of the mixture is analyzed with the aim of confirming the result. Certification uncertainty is

calculated on the basis of the mixture production process; this uncertainty may vary, depending on the requested concentration, in percentages ranging between

1 and 10%. W-CGM are also available as a multi-component gas mixture in line with the compatibility constraints due to the chemical-physical characteristics of the gases.

LAT Center n. 143 is accredited for the quantity "Amount of substance"

Permanent Laboratory

MEASURAND "Working standard" gas mixtures W-CGM		CALIBRATION CAPABILITY Amount fraction range mol/mol		RELATIVE EXPANDED UNCERTAINTY (*)
Analyte	Matrix	From	To	W-CGM
Ammonia (NH ₃)	Nitrogen - Air	5·10 ⁻⁶	500·10 ⁻⁶	10%
Benzene (C ₆ H ₆)	Nitrogen - Air	5·10 ⁻⁹	200·10 ⁻⁹	6%
Carbon dioxide (CO ₂)	Nitrogen - Air - Helium	100·10 ⁻⁶	1·10 ⁻²	2%
		1·10 ⁻²	99,5·10 ⁻²	1%
Carbon monoxide (CO)	Nitrogen	12·10 ⁻²	99,5·10 ⁻²	1%
		1·10 ⁻⁶	10·10 ⁻⁶	6%
		10·10 ⁻⁶	1·10 ⁻²	2%
	Air - Helium	1·10 ⁻²	90·10 ⁻²	1%
		1·10 ⁻⁶	10·10 ⁻⁶	6%
		10·10 ⁻⁶	1·10 ⁻²	2%
Ethylbenzene (C ₈ H ₁₀)	Nitrogen - Air	1·10 ⁻²	8·10 ⁻²	1%
Hydrogen (H ₂)	Nitrogen - Helium	5·10 ⁻⁹	200·10 ⁻⁹	8%
	Argon	0,07·10 ⁻²	90·10 ⁻²	2%
Methane (CH ₄)	Nitrogen	2·10 ⁻²	90·10 ⁻²	2%
		1·10 ⁻⁶	10·10 ⁻⁶	3,5%
		10·10 ⁻⁶	1·10 ⁻²	2%
	Air	1·10 ⁻²	90·10 ⁻²	1%
		1·10 ⁻⁶	10·10 ⁻⁶	3,5%
		10·10 ⁻⁶	1·10 ⁻²	2%
Nitric oxide (NO)	Nitrogen	1·10 ⁻²	2,2·10 ⁻²	1%
		1·10 ⁻²	90·10 ⁻²	1%
		0,12·10 ⁻⁶	0,4·10 ⁻⁶	8%
		0,4·10 ⁻⁶	5·10 ⁻⁶	6%
		5·10 ⁻⁶	20·10 ⁻⁶	3,5%
		20·10 ⁻⁶	2500·10 ⁻⁶	2%

MEASURAND "Working standard" gas mixtures W-CGM		CALIBRATION CAPABILITY Amount fraction range mol/mol		RELATIVE EXPANDED UNCERTAINTY (*)
Analyte	Matrix	From	To	W-CGM
Nitrogen dioxide (NO ₂)	Nitrogen - Air	5·10 ⁻⁶	1·10 ⁻²	6%
Nitrous oxide (N ₂ O)	Nitrogen - Air	1·10 ⁻⁶ 10·10 ⁻²	10·10 ⁻² 90·10 ⁻²	2% 1%
Oxygen (O ₂)	Nitrogen - Helium	1·10 ⁻⁶ 10·10 ⁻⁶ 1·10 ⁻²	10·10 ⁻⁶ 1·10 ⁻² 90·10 ⁻²	3,5% 2% 1%
	Argon	3·10 ⁻²	90·10 ⁻²	1%
Propane (C ₃ H ₈)	Nitrogen - Methane	1·10 ⁻⁶ 10·10 ⁻⁶ 1,1·10 ⁻²	10·10 ⁻⁶ 1,1·10 ⁻² 90·10 ⁻²	3,5% 2% 1%
	Air	1·10 ⁻⁶ 10·10 ⁻⁶	10·10 ⁻⁶ 1,1·10 ⁻²	3,5% 2%
Sulphur dioxide (SO ₂)	Nitrogen - Air	1·10 ⁻⁶	2500·10 ⁻⁶	3%
		2500·10 ⁻⁶	10·10 ⁻²	2%
Toluene (C ₇ H ₈)	Nitrogen - Air	5·10 ⁻⁹	200·10 ⁻⁹	6%
o-Xylene (o-C ₈ H ₁₀)	Nitrogen - Air	5·10 ⁻⁹	200·10 ⁻⁹	8%
m-Xylene (m-C ₈ H ₁₀)	Nitrogen - Air	5·10 ⁻⁹	200·10 ⁻⁹	8%
p-Xylene (p-C ₈ H ₁₀)	Nitrogen - Air	5·10 ⁻⁹	200·10 ⁻⁹	8%

(*) The relative expanded uncertainties reported in the table are the minimum values that can be stated on the certificate. The expanded uncertainty of the measurement is expressed as standard uncertainty multiplied by a coverage factor $k=2$ which, for a t -distribution characterized by calculated effective degrees of freedom, provides a level of confidence of approximately 95%.

Gases listed above can be used in multicomponent mixtures, each one in the range of concentration reported in the table, complying the matrix hereafter.

	NO	C ₃ H ₈	CO	O ₂	CO ₂	H ₂	N ₂ O	NO ₂	BTEX	CH ₄	SO ₂	NH ₃
NO	-	No	Yes ¹	No	Yes	No	No	No	No	No	Yes	No
C ₃ H ₈		-	Yes	Yes ¹	Yes	Yes	Yes ¹	No	No	Yes	No	Yes
CO			-	Yes ¹	Yes	Yes	Yes ¹	No	Yes	Yes	Yes	Yes
O ₂				-	Yes	Yes ¹	Yes	Yes	Yes ¹	Yes ¹	Yes	Yes ¹
CO ₂					-	Yes	No	No	Yes	Yes	Yes	Yes
H ₂						-	Yes ¹	Yes ¹	Yes	Yes	Yes	No
N ₂ O							-	No	Yes ¹	Yes ¹	Yes	No
NO ₂								-	Yes ¹	Yes ¹	No	No
BTEX									-	Yes	Yes	No
CH ₄										-	Yes	Yes
SO ₂											-	Yes
NH ₃												-

¹ Feasible up to safety limit levels concerning oxidant and flammable gases.

Calibration of equipment for analytical measurement in the laboratory or at customer

ANALYTICAL MEASUREMENT



LAT N° 143

The LAT Center can calibrate analytical measuring equipment, gas chromatographs and analyzers. The main calibrated detectors are indicated below

Gas chromatographs with:

- *FID* detector for hydrocarbons;
- *TCD* and *PDD* detectors for oxygen, carbon dioxide, nitrogen, carbon monoxide;
- *SCD* and *AED* detectors for sulfur compounds.

Analyzers with:

- *IR* cell for carbon dioxide, carbon monoxide, nitrogen oxide;
- *UV* cell for sulfur dioxide, nitrogen oxide;
- *chemiluminescence* for nitrogen oxide and nitrogen dioxide;
- *paramagnetic* for oxygen;
- *cooled mirror cell* for humidity.

THE CALIBRATION IS PERFORMED IN ACCORDANCE WITH STANDARD ISO 6143, USING THE METHOD OF GENERALIZED LEAST SQUARES (GLS).

It is important to define the correct calibration conditions so that they reflect the actual use of the instrument.

It is therefore necessary to request calibration in the most suitable range and to indicate the matrix gas in which the instrument is to be used.

SIAD technicians assist the customer in defining the correct conditions in which the calibration

must be carried out according to: type of detector, calibration range, analysis function (e.g., quadratic or linear), linearity of response of the instrument.

The number of traceable mixtures necessary for calibrating the equipment will depend on these variables being correctly defined.

The accreditation table gives the calibration ranges and the minimum uncertainty that can

be certified for each type of detector. The main recommended applications are:

- checking the state of calibration of analytical equipment (for example, checking the measurement line or realignment);
- compliance of the instrument with standards (legislative parameters, specifications of supply, etc.).

Calibration of equipment for analytical measurement: at LAT center and external calibration

Table

MEASURAND Analytical measurement equipment: at the LAT Center and External Calibrations	CALIBRATION CAPABILITY Amount fraction range mol/mol		RELATIVE EXPANDED UNCERTAINTY (*)
GAS CHROMATOGRAPHY AND ANALYZER DETECTORS	From	To	
TCD E FID per			
Acetylene (C ₂ H ₂)	1·10 ⁻⁶	0,4·10 ⁻²	
Butanol (C ₄ H ₁₀ O)	20·10 ⁻⁶	0,1·10 ⁻²	2%
Butane (C ₄ H ₁₀)	1·10 ⁻⁶	5·10 ⁻²	2%
Etano (C ₂ H ₆)	1·10 ⁻⁶	35·10 ⁻²	1%
Ethanol (C ₂ H ₆ O)	100·10 ⁻⁶	1000·10 ⁻⁶	5%
Ethylene (C ₂ H ₄)	1·10 ⁻⁶	16·10 ⁻²	1%
Heptane (C ₇ H ₁₆)	50·10 ⁻⁶	0,2·10 ⁻²	1%

AT LAT CENTER AND EXTERNAL CALIBRATIONS

MEASURAND Analytical measurement equipment: at the LAT Center and External Calibrations	CALIBRATION CAPABILITY Amount fraction range mol/mol		RELATIVE EXPANDED UNCERTAINTY (%)
GAS CHROMATOGRAPHY AND ANALYZER DETECTORS	From	To	
Hexane (C ₆ H ₁₄)	1·10 ⁻⁶	1·10 ⁻²	2%
Isobutane (C ₄ H ₁₀)	1·10 ⁻⁶	5·10 ⁻²	2%
Isobutene (C ₄ H ₈)	1·10 ⁻⁶	5·10 ⁻²	2%
Isopentane (C ₅ H ₁₂)	50·10 ⁻⁶	3,5·10 ⁻²	1%
Methane (CH ₄)	1·10 ⁻⁶ 50·10 ⁻²	50·10 ⁻² 99,8·10 ⁻²	2% 0,1%
Neopentane (C ₅ H ₁₂)	50·10 ⁻⁶	3,5·10 ⁻²	1%
Nonane (C ₉ H ₂₀)	50·10 ⁻⁶	0,02·10 ⁻²	1%
Octane (C ₈ H ₁₈)	50·10 ⁻⁶	0,05·10 ⁻²	1%
Pentane (C ₅ H ₁₂)	50·10 ⁻⁶	3·10 ⁻²	1%
Propane (C ₃ H ₈)	1·10 ⁻⁶	18·10 ⁻²	1%
Propylene (C ₃ H ₆)	0,05·10 ⁻²	7·10 ⁻²	0,3%
1-3 butadiene (C ₄ H ₆)	1·10 ⁻⁶	3·10 ⁻²	2%
1-butene (C ₄ H ₈)	1·10 ⁻⁶	5·10 ⁻²	2%
PID and FID for			
Benzene (C ₆ H ₆)	5·10 ⁻⁹	200·10 ⁻⁹	2,5%
Ethylbenzene (C ₈ H ₁₀)	5·10 ⁻⁹	200·10 ⁻⁹	4,5%
Toluene (C ₇ H ₈)	5·10 ⁻⁹	200·10 ⁻⁹	3%
m-Xylene (m-C ₈ H ₁₀)	5·10 ⁻⁹	200·10 ⁻⁹	4,5%
o-Xylene (o-C ₈ H ₁₀)	5·10 ⁻⁹	200·10 ⁻⁹	4,5%
p-Xylene (p-C ₈ H ₁₀)	5·10 ⁻⁹	200·10 ⁻⁹	4,5%
AED, PFPD, SCD, TCD and ELECTROCHEMICAL for			
Carbonyl sulphide (COS)	1·10 ⁻⁶	100·10 ⁻⁶	5%
Dimethyl sulphide (C ₂ H ₆ S)	0,5·10 ⁻⁶ 10·10 ⁻⁶	10·10 ⁻⁶ 100·10 ⁻⁶	10% 5%
Hydrogen sulphide (H ₂ S)	1·10	250·10 ⁻⁶	5%
Isopropyl mercaptan (C ₃ H ₈ S)	1·10 ⁻⁶ 10·10 ⁻⁶	10·10 ⁻⁶ 100·10 ⁻⁶	10% 5%
Methyl ethyl sulphide (CH ₄ S)	1·10 ⁻⁶ 10·10 ⁻⁶	10·10 ⁻⁶ 100·10 ⁻⁶	10% 5%
Methyl mercaptan (CH ₄ S)	1·10 ⁻⁶ 10·10 ⁻⁶	10·10 ⁻⁶ 100·10 ⁻⁶	10% 5%
Methyl sulphide (C ₂ H ₆ S)	1·10 ⁻⁶ 10·10 ⁻⁶	10·10 ⁻⁶ 100·10 ⁻⁶	10% 5%
N-Propyl mercaptan (C ₃ H ₈ S)	1·10 ⁻⁶ 10·10 ⁻⁶	10·10 ⁻⁶ 100·10 ⁻⁶	10% 5%
Tert-butyl mercaptan (C ₄ H ₁₀ S)	1·10 ⁻⁶ 10·10 ⁻⁶	10·10 ⁻⁶ 100·10 ⁻⁶	10% 5%
Tetrahydrothiophene (C ₄ H ₈ S)	1·10 ⁻⁶ 10·10 ⁻⁶	10·10 ⁻⁶ 100·10 ⁻⁶	5% 3%

AT LAT CENTER AND EXTERNAL CALIBRATIONS

MEASURAND Analytical measurement equipment: at the LAT Center and External Calibrations	CALIBRATION CAPABILITY Amount fraction range mol/mol		RELATIVE EXPANDED UNCERTAINTY (*)
GAS CHROMATOGRAPHY AND ANALYZER DETECTORS	From	To	
PDD and TCD for			
Carbon dioxide (CO ₂)	10·10 ⁻⁶	50·10 ⁻²	1%
	50·10 ⁻²	99,8·10 ⁻²	0,3%
Carbon monoxide (CO)	1·10 ⁻⁶	10·10 ⁻²	1%
	10·10 ⁻⁶	90·10 ⁻²	0,3%
Helium (He)	100·10 ⁻⁶	50·10 ⁻²	3%
Hydrogen (H ₂)	500·10 ⁻⁶	20·10 ⁻²	1%
	20·10 ⁻⁶	90·10 ⁻²	0,3%
Nitrogen (N ₂)	500·10 ⁻⁶	10·10 ⁻²	3%
	10·10 ⁻²	99·10 ⁻²	0,3%
Nitrous oxide (N ₂ O)	1·10 ⁻⁶	0,1·10 ⁻²	1%
Oxygen (O ₂)	10·10 ⁻⁶	25·10 ⁻²	1%
	25·10 ⁻²	99,8·10 ⁻⁶	0,3%
FID – METHANIZER for			
Carbon dioxide (CO ₂)	10·10 ⁻⁶	2000·10 ⁻⁶	1%
Carbon monoxide (CO)	1·10 ⁻⁶	4000·10 ⁻⁶	1%
Methane (CH ₄)	1·10 ⁻⁶	2000·10 ⁻⁶	1%
INFRARED (NDIR and FTIR) for			
Ammonia (NH ₃)	5·10 ⁻⁶	500·10 ⁻⁶	3%
Carbon dioxide (CO ₂)	1·10 ⁻⁶	50·10 ⁻²	1%
	50·10 ⁻²	99,8·10 ⁻²	0,3%
Carbon monoxide (CO)	1·10 ⁻⁶	10·10 ⁻²	1%
	10·10 ⁻²	90·10 ⁻²	0,3%
Nitric oxide (NO)	0,12·10 ⁻⁶	0,4·10 ⁻⁶	3%
	0,4·10 ⁻⁶	2500·10 ⁻⁶	1%
Nitrogen dioxide (NO ₂)	5·10 ⁻⁶	100·10 ⁻⁶	3%
Nitrous oxide (N ₂ O)	1·10 ⁻⁶	0,1·10 ⁻²	1%
Sulphur dioxide (SO ₂)	0,1·10 ⁻⁶	1·10 ⁻⁶	5%
	1·10 ⁻⁶	100·10 ⁻⁶	2%
	100·10 ⁻⁶	3000·10 ⁻⁶	1%
CHEMILUMINESCENCE for			
Nitric oxide (NO)	0,12·10 ⁻⁶	0,4·10 ⁻⁶	3%
	0,4·10 ⁻⁶	2500·10 ⁻⁶	1%
Nitrogen dioxide (NO ₂)	5·10 ⁻⁶	100·10 ⁻⁶	5%
ULTRAVIOLET for			
Ammonia (NH ₃)	5·10 ⁻⁶	500·10 ⁻⁶	3%
Hydrogen sulphide (H ₂ S)	1·10 ⁻⁶	250·10 ⁻⁶	5%
Nitric oxide (NO)	0,12·10 ⁻⁶	0,4·10 ⁻⁶	3%
	0,4·10 ⁻⁶	2500·10 ⁻⁶	1%
Nitrogen dioxide (NO ₂)	5·10 ⁻⁶	100·10 ⁻⁶	5%
Sulphur dioxide (SO ₂)	0,1·10 ⁻⁶	3000·10 ⁻⁶	1%

AT LAT CENTER AND EXTERNAL CALIBRATIONS

MEASURAND Analytical measurement equipment: at the LAT Center and External Calibrations	CALIBRATION CAPABILITY Amount fraction range mol/mol		RELATIVE EXPANDED UNCERTAINTY (*)
GAS CHROMATOGRAPHY AND ANALYZER DETECTORS	From	To	
ELECTROCHEMICAL. ELECTROLYTIC AND CATALYTIC for			
Carbon dioxide (CO ₂)	10·10 ⁻⁶	50·10 ⁻²	1%
	50·10 ⁻²	99,8·10 ⁻²	0,3%
Carbon monoxide (CO)	1·10 ⁻⁶	10·10 ⁻²	1%
	10·10 ⁻²	90·10 ⁻²	0,3%
Methane (CH ₄)	1·10 ⁻⁶	50·10 ⁻²	1%
	50·10 ⁻²	99,8·10 ⁻²	0,3%
Nitric oxide (NO)	0,12·10 ⁻⁶	0,4·10 ⁻⁶	3%
	0,4·10 ⁻⁶	2500·10 ⁻⁶	1%
Oxygen (O ₂)	10·10 ⁻⁶	25·10 ⁻²	1%
	25·10 ⁻²	99,8·10 ⁻²	0,3%
Sulphur dioxide (SO ₂)	0,1·10 ⁻⁶	1·10 ⁻⁶	5%
	1·10 ⁻⁶	100·10 ⁻⁶	2%
	100·10 ⁻⁶	3000·10 ⁻⁶	1%
Water (H ₂ O)	10·10 ⁻⁶	100·10 ⁻⁶	6,5%
CAPACITIVE and CHILLED MIRROR for			
Water (H ₂ O)	10·10 ⁻⁶	100·10 ⁻⁶	6,5%
PARAMAGNETIC and ZIRCONIUM OXIDE for			
Oxygen (O ₂)	10·10 ⁻⁶	25·10 ⁻²	1%
	25·10 ⁻²	99,8·10 ⁻²	0,3%
LASER (TDL, QCL, OA-ICOS, CRDS) for			
Ammonia (NH ₃)	5·10 ⁻⁶	500·10 ⁻⁶	3%
Carbon dioxide (CO ₂)	10·10 ⁻⁶	50·10 ⁻²	1%
	50·10 ⁻²	99,8·10 ⁻²	0,3%
Carbon monoxide (CO)	1·10 ⁻⁶	10·10 ⁻²	1%
	10·10 ⁻²	90·10 ⁻²	0,3%
Methane (CH ₄)	1·10 ⁻⁶	50·10 ⁻²	1%
	50·10 ⁻²	99,8·10 ⁻²	0,3%
Nitric oxide (NO)	0,12·10 ⁻⁶	0,4·10 ⁻⁶	3%
	0,4·10 ⁻⁶	2500·10 ⁻⁶	1%
Nitrogen dioxide (NO ₂)	5·10 ⁻⁶	100·10 ⁻⁶	3%
Nitrous oxide (N ₂ O)	1·10 ⁻⁶	0,1·10 ⁻²	1%
Oxygen (O ₂)	10·10 ⁻⁶	25·10 ⁻²	1%
	25·10 ⁻²	99,8·10 ⁻²	0,3%
Sulphur dioxide (SO ₂)	0,1·10 ⁻⁶	1·10 ⁻⁶	5%
	1·10 ⁻⁶	100·10 ⁻⁶	2%
	100·10 ⁻⁶	3000·10 ⁻⁶	1%
Water (H ₂ O)	10·10 ⁻⁶	100·10 ⁻⁶	6,5%

(*) The relative expanded uncertainties reported in the table are the minimum values that can be stated on the certificate. The expanded uncertainty of the measurement is expressed as standard uncertainty multiplied by a coverage factor $k=2$ which, for a t -distribution characterized by calculated effective degrees of freedom, provides a level of confidence of approximately 95%. For gases whose concentrations are in consecutive measurement ranges, the certified relative expanded uncertainty is the highest.

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