



DECLARATION OF EQUIVALENCE

**Material Measurement Laboratory
National Institute of Standards and Technology - NIST
Gaithersburg, MD 20899, United States of America**

and

**VSL
Dutch Metrology Institute
Delft, The Netherlands**


NIST and VSL declare that on July 1, 2018 the suites of Primary Standard Gas Mixtures (PSMs), including dynamically prepared Standard Gas Mixtures, developed and maintained in both the Institutes, comprising a range of analyte amount fractions in the stated diluent gas as listed in Annex 1, can be considered as equivalent within the stated uncertainties. This declaration shall expire on July 1, 2020 at which time a new declaration shall take effect.

This declaration is based on the results of both BIPM (CCQM) Key Comparisons and intercomparisons carried out between the two Institutes. A continuous program of intercomparisons has been agreed to in order to maintain this declaration and is outlined in a mutual Memorandum of Cooperation, effective July 1, 2018.



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Date



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Date

Annex 1: NIST and VSL suites of Primary Standard Gas Mixtures which are declared to be equivalent

Component	Mole Fractions (mol/mol)	Maximum allowable difference	Date of Next Assessment
Carbon dioxide in nitrogen	$10 \cdot 10^{-6}$ to $20 \cdot 10^{-2}$	0.3 % relative	2021
Carbon dioxide in air	$100 \cdot 10^{-6}$ to $1000 \cdot 10^{-6}$	0.2 % relative	2021
Carbon monoxide in nitrogen	$1 \cdot 10^{-6}$ to $10 \cdot 10^{-2}$	0.3 % relative	2021
Carbon monoxide in air	$10 \cdot 10^{-6}$ to $10 \cdot 10^{-2}$	0.3 % relative	2021
Ethanol in nitrogen / air	$75 \cdot 10^{-6}$ to $1000 \cdot 10^{-6}$	0.5 % relative	2019
Oxygen in nitrogen	$10 \cdot 10^{-6}$ to $100 \cdot 10^{-6}$ $100 \cdot 10^{-6}$ to $25 \cdot 10^{-2}$	1 % relative 0.2 % relative	2020
Propane in nitrogen / air	$1 \cdot 10^{-6}$ to $1 \cdot 10^{-2}$	0.3 % relative	2019
Nitric oxide in nitrogen	$0.5 \cdot 10^{-6}$ to $1 \cdot 10^{-2}$	0.5 % relative	2019
Nitrogen dioxide in nitrogen / air	$10 \cdot 10^{-6}$ to $1 \cdot 10^{-2}$	0.5% relative	2019
Sulfur dioxide in nitrogen	$1 \cdot 10^{-6}$ to $1 \cdot 10^{-2}$	0.5 % relative	2020
Sulfur dioxide in air	$10 \cdot 10^{-6}$ to $1 \cdot 10^{-2}$	0.5 % relative	2020
VOC's (ethane, ethene, propane, propene, iso-butane, iso-butene, 1-butene, n-butane, 2-methyl butane, n-pentane, 1-pentene, 1,3-butadiene, trans-2-pentene, 2-methyl pentane, 2,2,4-trimethyl pentane, n-hexane, n-heptane, benzene, toluene, n-octane, o-xylene) in nitrogen	$1 \cdot 10^{-9}$ to $1 \cdot 10^{-6}$	2 % relative	2021
Hydrogen sulphide in nitrogen	$1 \cdot 10^{-6}$ to $1000 \cdot 10^{-6}$	1 % relative	2019
Ammonia in nitrogen	$10 \cdot 10^{-6}$ to $300 \cdot 10^{-6}$	3 % relative	2019

Stack gas (NO, CO, CO ₂ , C ₃ H ₈ , SO ₂) in nitrogen	Typical	1 % relative (CO, CO ₂ and C ₃ H ₈ 0.3 % relative)	2019
HCl in nitrogen	$10 \cdot 10^{-6}$ to $300 \cdot 10^{-6}$	5 % relative	2019
CH ₄ in nitrogen / air	$1.7 \cdot 10^{-6}$ to $10 \cdot 10^{-2}$	0.1 % relative	2020
N ₂ O in nitrogen/ air	$0.3 \cdot 10^{-6}$ to $1000 \cdot 10^{-6}$	1 % relative	2019