

DECLARATION OF EQUIVALENCE

Material Measurement Laboratory
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Gaithersburg, MD 20899, United States of America

and

VSL
Dutch Metrology Institute
Delft, The Netherlands

NIST and VSL declare that on July 1, 2016 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 concentrations 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, 2018 at which time a new declaration shall take effect.

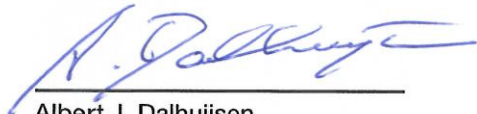
This declaration is based on the results of both BIPM (CCQM) Key Comparisons and intercomparisons carried out between the two Institutes. A continuous program of intercomparisons has been agreed to in order to maintain this declaration and is outlined in a mutual Memorandum of Cooperation, effective July 1, 2011.



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2 June 2016

Date

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

Component	Molar 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	2017
Carbon dioxide in air	$100 \cdot 10^{-6}$ to $1000 \cdot 10^{-6}$	0.2 % relative	2017
Carbon monoxide in nitrogen / air	$0.1 \cdot 10^{-6}$ to $1 \cdot 10^{-6}$ $1 \cdot 10^{-6}$ to $10 \cdot 10^{-2}$	1 % relative 0.3 % relative	2018
Ethanol in nitrogen / air	$75 \cdot 10^{-6}$ to $1000 \cdot 10^{-6}$	0.5 % relative	2016
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	2017
Propane in nitrogen / air	$1 \cdot 10^{-6}$ to $1 \cdot 10^{-2}$	0.3 % relative	2016
Nitric oxide in nitrogen	$0.1 \cdot 10^{-6}$ to $1 \cdot 10^{-2}$	0.5 % relative	2017
Nitrogen dioxide in nitrogen / air	$10 \cdot 10^{-6}$ to $1 \cdot 10^{-2}$	0.5 % relative	2016
N ₂ O in nitrogen N ₂ O in whole air	$0.3 \cdot 10^{-6}$ to $1000 \cdot 10^{-6}$ $0.3 \cdot 10^{-6}$ to $1000 \cdot 10^{-6}$	1 % relative 1 % relative	2017
Ammonia in nitrogen	$10 \cdot 10^{-6}$ to $300 \cdot 10^{-6}$	3 % relative	2018
Sulfur dioxide in nitrogen	$1 \cdot 10^{-6}$ to $1 \cdot 10^{-2}$	0.5 % relative	2017
Sulfur dioxide in air	$10 \cdot 10^{-6}$ to $1 \cdot 10^{-2}$	0.5 % relative	2019

Component	Molar fractions (mol/mol)	Maximum allowable difference	Date of next assessment
Hydrogen sulphide in nitrogen	$1 \cdot 10^{-6}$ to $1000 \cdot 10^{-6}$	1 % relative	2019
HCl in nitrogen	$10 \cdot 10^{-6}$ to $300 \cdot 10^{-6}$	2 % relative	2017
CH ₄ in nitrogen / air	$1.7 \cdot 10^{-6}$ to $10 \cdot 10^{-2}$	0.1 % relative	2017
VOCs (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	2018
Natural gas CH ₄ , C ₂ H ₆ , C ₃ H ₈ , n-C ₄ H ₁₀ , i-C ₄ H ₁₀ , n-C ₅ H ₁₂ , i-C ₅ H ₁₂ , neo-C ₅ H ₁₂ , n-C ₆ H ₁₄ , CO ₂ , N ₂ , H ₂ , O ₂ , He	Typical	0.5 % relative (CH ₄ 0.3 % 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)	2017
Zero gas impurities: NO ₂ NO SO ₂ CO CO ₂ C ₃ H ₈ H ₂ O N ₂ O	$1 \cdot 10^{-9}$ to $100 \cdot 10^{-9}$ $1 \cdot 10^{-9}$ to $100 \cdot 10^{-9}$ $1 \cdot 10^{-9}$ to $100 \cdot 10^{-9}$ $10 \cdot 10^{-9}$ to $1000 \cdot 10^{-9}$ $0.1 \cdot 10^{-6}$ to $1 \cdot 10^{-6}$ $3 \cdot 10^{-9}$ to $100 \cdot 10^{-9}$ $1 \cdot 10^{-6}$ to $5 \cdot 10^{-6}$ $0.5 \cdot 10^{-9}$ to $5 \cdot 10^{-9}$	1–20 % relative	2017