NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
U.S. DEPARTMENT OF COMMERCE

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Standard Reference Material® 1687b
Nitric Oxide in Nitrogen
(Nominal Amount-of-Substance Fraction 1000 µmol/mol)
Lot 41-M-XX

CERTIFICATE OF ANALYSIS

Purpose: The certified value delivered by this Standard Reference Material (SRM) is intended for use in producing metrologically traceable secondary standards for the calibration of instruments used for nitric oxide determinations.

Description: This SRM is a primary gas mixture supplied in a DOT 3AL-specification aluminum (6061 alloy) cylinder with a water volume of 6 L. Mixtures are shipped with a nominal pressure exceeding 12.4 MPa (1800 psig), which provides the user with 0.73 m^3 (25.8 ft^3) of usable mixture. The cylinder is the property of the purchaser and is equipped with a CGA-660 stainless-steel valve, which is the recommended outlet for this nitric oxide mixture.

Certified Value: A NIST certified value is a value for which NIST has the highest confidence in that all known or suspected sources of bias and imprecision have been accounted [1]. This SRM mixture has been certified for nitric oxide amount-of-substance fraction (mole fraction, sometimes termed "molar concentration"). This certified value is traceable to the International System of Units (SI) through the gravimetric primary standards and procedures used in the preparation of this mixture. The certified value given below applies to all cylinders in this lot.

Nitric Oxide Mole Fraction: 996.7 µmol/mol ± 5.0 µmol/mol[(a)]

[(a)] The certified value is expressed as $x \pm U_{95\,\%}(x)$, where x is the value and $U_{95\,\%}(x)$ is the expanded uncertainty of the value. The true value of the analyte lies within the interval $x \pm U_{95\,\%}(x)$ with 95 % confidence. The uncertainty is expressed as an expanded uncertainty $U = ku_c$ with u_c determined by experiment and a coverage factor $k = 2$. For guidance in propagating this uncertainty, see reference 2.

Additional Information: Appendix A contains a table of all cylinder Sample Numbers and their associated information for this lot.

Period of Validity: The certified value delivered by **SRM 1687b**, **Lot No. 41-M-XX** is valid within the measurement uncertainty specified until **13 February 2030**, provided the SRM is handled and stored in accordance with the instructions given in this certificate (see "Storage" and "Cylinder and Gas Handling Information"). The certification is nullified if the SRM is damaged, contaminated or otherwise modified, or if the internal pressure drops below 0.7 MPa (100 psig).

Maintenance of Certified Value: NIST will monitor this SRM over the period of its validity. If substantive technical changes occur that affect the certification, NIST will issue an amended certificate through the NIST SRM website (https://www.nist.gov/srm). Before making use of any value delivered by this material, users should verify they have the most recent version of this documentation, available through the NIST SRM website (https://www.nist.gov/srm).

Marcela Najarro, Acting Chief
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Steven J. Choquette, Director
Office of Reference Materials

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Safety: Consult the Safety Data Sheet (SDS) for hazard information.

Storage: This SRM should be stored under normal laboratory conditions within the temperature range of 15 °C to 30 °C.

Cylinder and Gas Handling Information: NIST recommends the use of a high-purity, two-stage pressure regulator with a stainless-steel diaphragm and CGA-660 outlet to safely reduce the pressure and to deliver this mixture to the instrument. The regulator should be purged to prevent accidental contamination of the SRM by repeatedly (minimum three times) opening the valve and pressurizing the regulator, then closing the valve and releasing the pressure safely into a vent line.

Mixture Preparation: The gas mixtures comprising this SRM lot were prepared in accordance with NIST technical specifications by a commercial specialty gas vendor under contract to NIST. The specifications stipulate that each SRM mixture within the lot be identical in nitric oxide mole fraction and stable with time.

Analytical Method: Analyses of the nitric oxide mole fraction for this lot of cylinders were conducted by comparison to a representative cylinder chosen from the lot, designated as the SRM lot standard (LS). The LS was compared to NIST primary gravimetric standards using chemiluminescence. Each of the nitric oxide mixtures that comprise this SRM lot was then compared to the LS using chemiluminescence. Within the precision of the NIST measurements, all the cylinders comprising this SRM lot have identical nitric oxide mole fractions.

CAS Registry Numbers: This SRM is certified for nitric oxide in nitrogen. The relevant CAS Registry numbers for these components are: nitric oxide CAS Registry 10102-43-9; nitrogen (balance gas) CAS Registry 7727-37-9.

NOTICE TO USERS

NIST strives to maintain the SRM inventory supply, but NIST cannot guarantee the continued or continuous supply of any specific SRM. Accordingly, NIST encourages the use of this SRM as a primary benchmark for the quality and accuracy of the user's in-house reference materials and working standards. As such, the SRM should be used to validate the more routinely used reference materials in a laboratory. Comparisons between the SRM and in house reference materials or working measurement standards should take place at intervals appropriate to the conservation of the SRM and the stability of relevant in house materials. For further guidance on how this approach can be implemented, contact NIST by email at srms@nist.gov.

REFERENCES

[1] Beauchamp, C.R.; Camara, J.E.; Carney, J.; Choquette, S.J.; Cole, K.D.; DeRose, P.C.; Duewer, D.L.; Epstein, M.S.; Kline, M.C.; Lippa, K.A.; Lucon, E.; Molloy, J.; Nelson, M.A.; Phinney, K.W.; Polakoski, M.; Possolo, A.; Sander, L.C.; Schiel, J.E.; Sharpless, K.E.; Toman, B.; Winchester, M.R.; Windover, D.; *Metrological Tools for the Reference Materials and Reference Instruments of the NIST Material Measurement Laboratory*; NIST Special Publication (NIST SP) 260-136, 2021 edition; U.S. Government Printing Office: Washington, DC (2021); available at https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.260-136-2021.pdf (accessed Nov 2026).

[2] Possolo, A.; *Evaluating, Expressing, and Propagating Measurement Uncertainty for NIST Reference Materials*; NIST Special Publication (NIST SP) 260-202; U.S. Government Printing Office: Washington, DC (2020); available at https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.260-202.pdf (accessed Nov 2026).

If you use this SRM in published work, please reference:

Cecelski C, Harris K, Goodman C, Kimes W, Liu Q, Miller W, Carney J (2021) Certification of NIST Gas Mixture Standard Reference Materials. (National Institute of Standards and Technology, Gaithersburg, MD), NIST Special Publication (SP) 260-222. https://doi.org/10.6028/NIST.SP.260-222

Certificate Revision History: 03 November 2026 (Change of period of validity; removal of Total Oxides of Nitrogen (NOx) value; editorial changes; format update); **21 March 2018** (Original certificate date).

Certain commercial equipment, instruments, or materials may be identified in this Certificate of Analysis to adequately specify the experimental procedure. Such identification does not imply recommendation or endorsement by the National Institute of Standards and Technology, nor does it imply that the materials or equipment identified are necessarily the best available for the purpose.

Users of this SRM should ensure that the Certificate of Analysis in their possession is current. This can be accomplished by contacting the Office of Reference Materials 100 Bureau Drive, Stop 2300, Gaithersburg, MD 20899-2300; telephone (301) 975-2200; e-mail srminfo@nist.gov; or the Internet at https://www.nist.gov/srm.

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APPENDIX A

The table contains all cylinder Sample Numbers and their associated information for this lot.

Sample Number	Cylinder Number	Hydrostat Date	Fill Date
41-M-05	FF55461	November 2015	February 2016
41-M-06	FF55793	November 2015	February 2016
41-M-07	FF55750	November 2015	February 2016
41-M-08	FF55782	November 2015	February 2016
41-M-09	FF55786	November 2015	February 2016
41-M-10	FF55460	November 2015	February 2016
41-M-13	FF55457	November 2015	February 2016
41-M-14	FF55752	November 2015	February 2016
41-M-16	FF55780	November 2015	February 2016
41-M-17	FF55459	November 2015	February 2016
41-M-18	FF28085	January 2015	February 2016
41-M-19	FF55447	November 2015	February 2016
41-M-20	FF28099	January 2015	February 2016
41-M-21	FF55438	November 2015	February 2016
41-M-23	FF55784	November 2015	February 2016
41-M-24	FF55467	November 2015	February 2016
41-M-25	FF55774	November 2015	February 2016
41-M-26	FF55764	November 2015	February 2016
41-M-27	FF55794	November 2015	February 2016
41-M-28	FF55455	November 2015	February 2016
41-M-29	FF55792	November 2015	February 2016
41-M-30	FF28064	January 2015	February 2016
41-M-31	FF28044	January 2015	February 2016
41-M-33	FF55781	November 2015	February 2016
41-M-34	FF55744	November 2015	February 2016
41-M-35	FF55441	November 2015	February 2016
41-M-36	FF55767	November 2015	February 2016
41-M-37	FF55736	November 2015	February 2016
41-M-39	FF55770	November 2015	February 2016
41-M-40	FF55796	November 2015	February 2016
41-M-41	FF55791	November 2015	February 2016
41-M-42	FF55777	November 2015	February 2016
41-M-43	FF28093	January 2015	February 2016
41-M-44	FF28065	January 2015	February 2016
41-M-45	FF55456	November 2015	February 2016
41-M-47	FF55450	November 2015	February 2016
41-M-48	FF55442	November 2015	February 2016
41-M-49	FF55439	November 2015	February 2016
41-M-50	FF55464	November 2015	February 2016
41-M-51	FF28060	January 2015	February 2016
41-M-52	FF55468	November 2015	February 2016
41-M-53	FF55445	November 2015	February 2016
41-M-54	FF55775	November 2015	February 2016
41-M-55	FF55778	November 2015	February 2016
41-M-56	FF55746	November 2015	February 2016
41-M-57	FF55795	November 2015	February 2016
41-M-58	FF55449	November 2015	February 2016
41-M-59	FF55451	November 2015	February 2016

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