

National Institute of Advanced Industrial Science and Technology

## National Metrology Institute of Japan



## Reference Material Certificate

NMIJ CRM 4003-b

No. +++

Toluene



This certified reference material (CRM) is produced in accordance with the NMIJ's management system and is in compliance with ISO 17034 and ISO/IEC 17025. This CRM is primarily intended for use in calibrating analytical instruments. It is also intended for quality control of analytical instruments, and validation of analytical techniques and instruments.

**Certified Value**

The certified value is purity (amount-of-substance fraction), given in the table below. The uncertainty of the certified value is the half-width of the expanded uncertainty interval calculated using a coverage factor ( $k$ ) of 2, which gives a level of confidence of approximately 95 %.

	CAS No.	Certified Value, Amount-of-Substance Fraction (mol/mol)	Expanded Uncertainty, Amount-of-Substance Fraction (mol/mol)
Toluene	108-88-3	0.9997	0.0003

**Analysis**

The certified value was determined by the freezing point depression method with adiabatic calorimeters by using the fractional melting method. The combined standard uncertainty was estimated by the combination of standard uncertainties due to purity determination, homogeneity test and stability test.

**Metrological Traceability**

The certified value is determined by the freezing point depression method with adiabatic calorimeters. Temperature (platinum resistance thermometer), voltage (digital multi-meter), resistance (standard resistor) and heating duration (universal counter) of the adiabatic calorimeters were calibrated and they were traceable to the International System of Units (SI). Therefore, the certified value is traceable to the SI.

**Indicative Value**

Purity in the mass fraction is given in the table below. It was obtained by converting the purity in the amount-of-substance fraction using the average molecular weight of impurities. The uncertainty of the indicative value is the half-width of the expanded uncertainty interval calculated using a coverage factor ( $k$ ) of 2, which gives a level of confidence of approximately 95 %.

	CAS No.	Indicative value, Mass fraction (kg/kg)	Expanded uncertainty Mass fraction (kg/kg)
Toluene	108-88-3	0.9997	0.0003

**Mutual Recognition Arrangement under Meter Convention**

This certificate is consistent with the calibration and measurement capabilities (CMCs) that are included in Appendix C of the Mutual Recognition Arrangement (MRA) drawn up by the International Committee for Weights and Measures (CIPM). Under the MRA, all participating institutes recognize the validity of each other's calibration and measurement certificates for the quantities, ranges and measurement uncertainties specified in Appendix C (as for Appendix C of MRA, see

<http://kcdb.bipm.org/AppendixC/default.asp>).

### Expiration of Certification

This certificate is valid for one year from the date of shipment, provided that the material remains unopened and is stored in accordance with the instructions given in this certificate.

### Sample Form

This CRM is in the form of a colorless and clear liquid at room temperature. This CRM of 15 mL in net volume is kept in an amber glass ampoule with argon gas.

### Homogeneity

Ten ampoules were sampled from 200 subdivided ampoules with almost same intervals in order of subdivision for homogeneity tests by gas chromatography and Karl-Fischer titrimetry. Area percentages of toluene by gas chromatography and water content by Karl-Fischer titrimetry were measured and evaluated as homogeneity tests. The evaluated variation of purity (amount of substance fraction) between the ampoules due to inhomogeneity were taken into account for the uncertainty of the certified value and this CRM is homogeneous within the range of the uncertainty of the certified value.

### Instructions for Storage

This CRM should be stored at a temperature between 2 °C and 10 °C and shielded from lights.

### Instructions for Use

This CRM is for laboratory use only. The bottles should be allowed to warm to room temperature before opening. This CRM should be used promptly once the ampule is opened.

### Precautions for Handling

Keep away from heat and ignition sources. Wear personal protective equipment such as safety glasses, safety mask, and safety gloves in handling. Refer to the safety data sheet (SDS) on this CRM before use.

### Preparation

This CRM was purified and subdivided by KANTO CHEMICAL CO., INC. This CRM was purified by distillation and drying. Fifteen mL each of toluene was filled into an amber glass ampoule in argon atmosphere.

### NMIJ Analysts

Technical manager for this CRM is KATO K. The person responsible for production is SHIMIZU Y. Production analysts are SHIMIZU Y., KITAMAKI Y., YOSHIMURA E., FUJIKI N. and BAO X.

### Information

If substantive technical changes occur that affect the certification before the expiration of this certificate, NMIJ will notify the registered customer. Customer registration on the NMIJ Website (given below) will facilitate notification. Technical reports regarding this CRM can be obtained from the contact details given below.

### Reproduction of Certificate

In reproducing this certificate, it should be clearly indicated that the document is a copy.

April 1, 2020

ISHIMURA Kazuhiko  
President

National Institute of Advanced Industrial Science and Technology

If you have any questions about this CRM, please contact:  
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National Metrology Institute of Japan,  
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1-1-1 Umezono, Tsukuba, Ibaraki 305-8563, Japan  
Phone: +81-29-861-4059; Fax: +81-29-861-4009, <https://unit.aist.go.jp/nmij/english/refmate/>

Revision history

April 1, 2015: “Metrology Management Center” was renamed to “Center for Quality Management of Metrology.”

November 16, 2018: The description in “Expiration of Certification” was changed to “one year from the date of shipment”

The descriptions in “Instructions for storage” was changed.

Sample