

National Institute of Advanced Industrial Science and Technology

## National Metrology Institute of Japan



## Reference Material Certificate

NMIJ CRM 4065-a01



## Isobutane

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 intended for use in the calibration of instruments and source material of isobutane reference gas mixtures for natural gas analysis.

**Certified Value**

The certified value of this CRM is 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)	Cylinder Number
Isobutane (2-Methylpropane)	75-28-5	0.9990	0.0010	FVN55935

**Analysis**

The certified value was determined by the subtracting method which complies with requirement described in ISO 6142-1:2015. Impurities in this CRM were determined using a gas chromatograph with a thermal conductivity detector (GC-TCD), a gas chromatograph with a flame ionization detector (GC-FID), and a capacitance type hygrometer.

Impurities	Analytical Instruments
Nitrogen	Gas chromatograph with thermal conductivity detector (GC-TCD)
Oxygen	Gas chromatograph with thermal conductivity detector (GC-TCD)
Argon	Gas chromatograph with thermal conductivity detector (GC-TCD)
Carbon dioxide	Gas chromatograph with thermal conductivity detector (GC-TCD)
Propane	Gas chromatograph with flame ionization detector (GC-FID)
Butane	Gas chromatograph with flame ionization detector (GC-FID)
Isobutene (2-methylpropene)	Gas chromatograph with flame ionization detector (GC-FID)
<i>cis</i> -2-butene	Gas chromatograph with flame ionization detector (GC-FID)
<i>trans</i> -2-butene	Gas chromatograph with flame ionization detector (GC-FID)
Pentane	Gas chromatograph with flame ionization detector (GC-FID)
Water	Capacitance type hygrometer

**Metrological Traceability**

The gas chromatographs were calibrated using NMIJ reference gases prepared by the gravimetric method in accordance with ISO 6142-1:2015. The capacitance-type hygrometer was calibrated using a reference dew point meter traceable to the International System of Units (SI). Therefore, the certified value is traceable to the SI.

**Expiration of Certification**

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

**Sample Form**

This CRM is supplied in a manganese steel cylinder with an inner volume of approximately 3.4 L. The specification of the cylinder outlet is a W22.5-14threads left female.

**Instructions for Storage**

This CRM should be stored in compliance with high pressure gas regulations and other relevant laws. This CRM should not be exposed to sunlight and should be stored at 40 °C or less and in well-ventilated area. This CRM should be secured with a chain to prevent it falling. As isobutane is flammable, open flames or other ignition source should not be permitted near this CRM. Care should be taken to ensure that there are no isobutane leaks. Refer to the safety data sheet (SDS) on this CRM for storage.

**Instructions for Use**

The concentration of water, a major impurity in this CRM has been confirmed to decrease as the cylinder emptied. Therefore to avoid change in purity, do not use this CRM when residual amount is below 0.1 kg. This CRM should be used at 19 °C to 28 °C. There is a possibility that the stability of temperature of this cylinder. Pay attention to the stability of temperature of this cylinder. We recommend sufficient substitution of residual gas in regulators, valves, piping, measuring instruments, and other apparatus with this CRM before use. Operation for purge should be carried out using this CRM of 1.6 L or more. To avoid contamination, we recommend checking pipe joints for leaks. Do not elute this CRM in the liquid phase. The certification is not valid if this CRM is used as a liquid.

**Precautions for Handling**

This CRM should be handled in compliance with high pressure gas regulations and other relevant laws. This CRM is a simple asphyxiant that should only be handled in well-ventilated areas. Wear protective equipment when handling this CRM. As isobutane is flammable, open flames or other ignition source should not be permitted near this CRM. Care should be taken to ensure that there are no isobutane leaks. This CRM should be returned to Center for Quality Management of Metrology of AIST after use or after the expiry date. Refer to the SDS on this CRM before use.

**Preparation**

Isobutane purification and filling the cylinder with isobutane were conducted by Takachiho Chemical Industrial Co., Ltd.

**Technical Information**

The tare weight of the cylinder containing CRM is 5.9 kg, obtained from the initial net weight and initial filling amount of this CRM.

**NMIJ Analysts**

The technical manager for this CRM is SHIMOSAKA T., the production manager is WATANABE T., and the analysts are WATANABE T., MATSUMOTO N., and TAKADA K.

**Information**

If substantive technical changes occur that affect the certification before the expiration of this certificate, NMIJ will notify the registered customers. 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

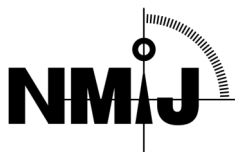
National Institute of Advanced Industrial Science and Technology

If you have any questions about this CRM, please contact:  
National Institute of Advanced Industrial Science and Technology,  
National Metrology Institute of Japan,  
Center for Quality Management of Metrology, Reference Materials Office,  
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/>

Sample

National Institute of Advanced Industrial Science and Technology

## National Metrology Institute of Japan



## Reference Material Certificate

NMIJ CRM 4065-a02



## Isobutane

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 intended for use in the calibration of instruments and source material of isobutane reference gas mixtures for natural gas analysis.

**Certified Value**

The certified value of this CRM is 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)	Cylinder Number
Isobutane (2-Methylpropane)	75-28-5	0.9995	0.0010	FVN55948

**Analysis**

The certified value was determined by the subtracting method which complies with requirement described in ISO 6142-1:2015. Impurities in this CRM were determined using a gas chromatograph with a thermal conductivity detector (GC-TCD), a gas chromatograph with a flame ionization detector (GC-FID), and a capacitance type hygrometer.

Impurities	Analytical Instruments
Nitrogen	Gas chromatograph with thermal conductivity detector (GC-TCD)
Oxygen	Gas chromatograph with thermal conductivity detector (GC-TCD)
Argon	Gas chromatograph with thermal conductivity detector (GC-TCD)
Carbon dioxide	Gas chromatograph with thermal conductivity detector (GC-TCD)
Propane	Gas chromatograph with flame ionization detector (GC-FID)
Butane	Gas chromatograph with flame ionization detector (GC-FID)
Isobutene (2-methylpropene)	Gas chromatograph with flame ionization detector (GC-FID)
<i>cis</i> -2-butene	Gas chromatograph with flame ionization detector (GC-FID)
<i>trans</i> -2-butene	Gas chromatograph with flame ionization detector (GC-FID)
Pentane	Gas chromatograph with flame ionization detector (GC-FID)
Water	Capacitance type hygrometer

**Metrological Traceability**

The gas chromatographs were calibrated using NMIJ reference gases prepared by the gravimetric method in accordance with ISO 6142-1:2015. The capacitance-type hygrometer was calibrated using a reference dew point meter traceable to the International System of Units (SI). Therefore, the certified value is traceable to the SI.

**Expiration of Certification**

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

**Sample Form**

This CRM is supplied in a manganese steel cylinder with an inner volume of approximately 3.4 L. The specification of the cylinder outlet is a W22.5-14threads left female.

**Instructions for Storage**

This CRM should be stored in compliance with high pressure gas regulations and other relevant laws. This CRM should not be exposed to sunlight and should be stored at 40 °C or less and in well-ventilated area. This CRM should be secured with a chain to prevent it falling. As isobutane is flammable, open flames or other ignition source should not be permitted near this CRM. Care should be taken to ensure that there are no isobutane leaks. Refer to the safety data sheet (SDS) on this CRM for storage.

**Instructions for Use**

The concentration of water, a major impurity in this CRM has been confirmed to decrease as the cylinder emptied. Therefore to avoid change in purity, do not use this CRM when residual amount is below 0.1 kg. This CRM should be used at 19 °C to 28 °C. There is a possibility that the stability of temperature of this cylinder. Pay attention to the stability of temperature of this cylinder. We recommend sufficient substitution of residual gas in regulators, valves, piping, measuring instruments, and other apparatus with this CRM before use. Operation for purge should be carried out using this CRM of 1.6 L or more. To avoid contamination, we recommend checking pipe joints for leaks. Do not elute this CRM in the liquid phase. The certification is not valid if this CRM is used as a liquid.

**Precautions for Handling**

This CRM should be handled in compliance with high pressure gas regulations and other relevant laws. This CRM is a simple asphyxiant that should only be handled in well-ventilated areas. Wear protective equipment when handling this CRM. As isobutane is flammable, open flames or other ignition source should not be permitted near this CRM. Care should be taken to ensure that there are no isobutane leaks. This CRM should be returned to Center for Quality Management of Metrology of AIST after use or after the expiry date. Refer to the SDS on this CRM before use.

**Preparation**

Isobutane purification and filling the cylinder with isobutane were conducted by Takachiho Chemical Industrial Co., Ltd.

**Technical Information**

The tare weight of the cylinder containing CRM is 5.9 kg, obtained from the initial net weight and initial filling amount of this CRM.

**NMIJ Analysts**

The technical manager for this CRM is SHIMOSAKA T., the production manager is WATANABE T., and the analysts are WATANABE T., MATSUMOTO N., and TAKADA K.

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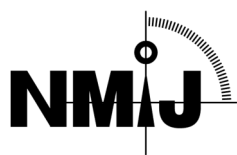
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Sample

National Institute of Advanced Industrial Science and Technology

## National Metrology Institute of Japan



## Reference Material Certificate

NMIJ CRM 4065-a03



## Isobutane

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 intended for use in the calibration of instruments and source material of isobutane reference gas mixtures for natural gas analysis.

**Certified Value**

The certified value of this CRM is 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)	Cylinder Number
Isobutane (2-Methylpropane)	75-28-5	0.9990	0.0015	FVN55990

**Analysis**

The certified value was determined by the subtracting method which complies with requirement described in ISO 6142-1:2015. Impurities in this CRM were determined using a gas chromatograph with a thermal conductivity detector (GC-TCD), a gas chromatograph with a flame ionization detector (GC-FID), and a capacitance type hygrometer.

Impurities	Analytical Instruments
Nitrogen	Gas chromatograph with thermal conductivity detector (GC-TCD)
Oxygen	Gas chromatograph with thermal conductivity detector (GC-TCD)
Argon	Gas chromatograph with thermal conductivity detector (GC-TCD)
Carbon dioxide	Gas chromatograph with thermal conductivity detector (GC-TCD)
Propane	Gas chromatograph with flame ionization detector (GC-FID)
Butane	Gas chromatograph with flame ionization detector (GC-FID)
Isobutene (2-methylpropene)	Gas chromatograph with flame ionization detector (GC-FID)
<i>cis</i> -2-butene	Gas chromatograph with flame ionization detector (GC-FID)
<i>trans</i> -2-butene	Gas chromatograph with flame ionization detector (GC-FID)
Pentane	Gas chromatograph with flame ionization detector (GC-FID)
Water	Capacitance type hygrometer

**Metrological Traceability**

The gas chromatographs were calibrated using NMIJ reference gases prepared by the gravimetric method in accordance with ISO 6142-1:2015. The capacitance-type hygrometer was calibrated using a reference dew point meter traceable to the International System of Units (SI). Therefore, the certified value is traceable to the SI.

**Expiration of Certification**

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

**Sample Form**

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**Instructions for Storage**

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**Instructions for Use**

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**Precautions for Handling**

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**Preparation**

Isobutane purification and filling the cylinder with isobutane were conducted by Takachiho Chemical Industrial Co., Ltd.

**Technical Information**

The tare weight of the cylinder containing CRM is 6.0 kg, obtained from the initial net weight and initial filling amount of this CRM.

**NMIJ Analysts**

The technical manager for this CRM is SHIMOSAKA T., the production manager is WATANABE T., and the analysts are WATANABE T., MATSUMOTO N., and TAKADA K.

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NMIJ CRM 4065-a04



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	CAS No.	Certified value, Amount-of-substance fraction (mol/mol)	Expanded uncertainty, Amount-of-substance fraction (mol/mol)	Cylinder Number
Isobutane (2-Methylpropane)	75-28-5	0.9995	0.0010	KDB8772

**Analysis**

The certified value was determined by the subtracting method which complies with requirement described in ISO 6142-1:2015. Impurities in this CRM were determined using a gas chromatograph with a thermal conductivity detector (GC-TCD), a gas chromatograph with a flame ionization detector (GC-FID), and a capacitance type hygrometer.

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Isobutene (2-methylpropene)	Gas chromatograph with flame ionization detector (GC-FID)
<i>cis</i> -2-butene	Gas chromatograph with flame ionization detector (GC-FID)
<i>trans</i> -2-butene	Gas chromatograph with flame ionization detector (GC-FID)
Pentane	Gas chromatograph with flame ionization detector (GC-FID)
Water	Capacitance type hygrometer

**Metrological Traceability**

The gas chromatographs were calibrated using NMIJ reference gases prepared by the gravimetric method in accordance with ISO 6142-1:2015. The capacitance-type hygrometer was calibrated using a reference dew point meter traceable to the International System of Units (SI). Therefore, the certified value is traceable to the SI.

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**Precautions for Handling**

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**Preparation**

Isobutane purification and filling the cylinder with isobutane were conducted by Takachiho Chemical Industrial Co., Ltd.

**Technical Information**

The tare weight of the cylinder containing CRM is 6.2 kg, obtained from the initial net weight and initial filling amount of this CRM.

**NMIJ Analysts**

The technical manager for this CRM is SHIMOSAKA T., the production manager is WATANABE T., and the analysts are WATANABE T., MATSUMOTO N., and TAKADA K.

**Information**

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Sample