


Schedule of Accreditation

issued by

United Kingdom Accreditation Service

2 Pine Trees, Chertsey Lane, Staines-upon-Thames, TW18 3HR, UK

| | | |
|--|---|---|
|  <p>UKAS REFERENCE MATERIALS</p> <p>5710</p> <p>Accredited to ISO 17034:2016</p> | <p>EffecTech Limited</p> <p>Issue No: 002 Issue date: 03 March 2021</p> | |
| | <p>Dove House Dove Fields Uttoxeter Staffordshire ST14 8HU</p> | <p>Contact: Dr Gavin Squire Tel: +44 (0)1889 569229 E-Mail: gavin.squire@effectech.co.uk Website: www.effectech.co.uk</p> |
| <p>Reference material production at the above address</p> | | |

DETAIL OF ACCREDITATION

| Matrix / Artefact | Property Value(s) / Identity / Characterisation Range | Characterisation Procedure / Technique | Type* (CRM / RM) | |
|--------------------------------|---|--|---|-----|
| SYNTHETIC NATURAL GAS MIXTURES | amount fraction | (% mol/mol) | <p>In-house method TM001/UT</p> <p>Calibration of certified reference materials (CRM) by ISO 6143:2001 using gas chromatography.</p> | CRM |
| | nitrogen | (0.1 to 22) | | |
| | carbon dioxide | (0.05 to 15) | | |
| | methane | (34 to 100) | | |
| | ethane | (0.1 to 35) | | |
| | propane | (0.05 to 15) | | |
| | iso-butane | (0.01 to 2) | | |
| | n-butane | (0.01 to 2) | | |
| | neo-pentane | (0.002 to 0.35) | | |
| | iso-pentane | (0.005 to 0.35) | | |
| | n-pentane | (0.005 to 0.35) | | |
| | n-hexane | (0.001 to 0.35) | | |
| | 2-methylpentane | (0.001 to 0.35) | | |
| | 3-methylpentane | (0.001 to 0.35) | | |
| | 2,2-dimethylbutane | (0.001 to 0.35) | | |
| | benzene | (0.001 to 0.2) | | |
| | cyclohexane | (0.001 to 0.2) | | |
| | n-heptane | (0.001 to 0.2) | | |
| | toluene | (0.001 to 0.1) | | |
| | methylcyclohexane | (0.001 to 0.1) | | |
| n-octane | (0.0005 to 0.05) | | | |
| n-nonane | (0.0005 to 0.02) | | | |
| n-decane | (0.0005 to 0.005) | | | |
| helium | (0.005 to 0.2) | | | |
| hydrogen | (0.005 to 0.2) | | | |



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| SYNTHETIC NATURAL GAS MIXTURES (cont'd) | <p>amount fraction (% mol/mol)</p> <p>oxygen (0.001 to 22.5)</p> <p>superior calorific value molar basis (kJ.mol⁻¹) mass basis (MJ.kg⁻¹) volume basis (MJ.m⁻³)</p> <p>inferior calorific value molar basis (kJ.mol⁻¹) mass basis (MJ.kg⁻¹) volume basis (MJ.m⁻³)</p> <p>relative density density (kg.m⁻³)</p> <p>superior Wobbe index (MJ.m⁻³) inferior Wobbe index (MJ.m⁻³) molar mass (kg.kmol⁻¹) compression factor</p> <p>gross calorific value molar basis (kJ.mol⁻¹) mass basis (MJ.kg⁻¹) volume basis (MJ.m⁻³)</p> <p>net calorific value molar basis (kJ.mol⁻¹) mass basis (MJ.kg⁻¹) volume basis (MJ.m⁻³)</p> <p>relative density density (kg.m⁻³) gross Wobbe index (MJ.m⁻³) net Wobbe index (MJ.m⁻³) molar mass (kg.kmol⁻¹) compression factor</p> | <p>In-house method TM026/UT</p> <p>Calibration of certified reference materials (CRM) by ISO 12963:2017 using galvanic fuel cell sensors</p> <p>Values calculated by ISO 6976:1995 (including amendment No 1, May 1998) on a <i>real</i> or <i>ideal</i> gas basis assuming mixture is dry (free from water)</p> <p>Combustion properties can be expressed in units of the Joule (J) or in kilowatt hours (kWh)</p> <p>Values calculated by ISO 6976:2016 on a <i>real</i> or <i>ideal</i> gas basis assuming mixture is dry (free from water)</p> <p>Combustion properties can be expressed in units of the Joule (J) or in kilowatt hours (kWh)</p> | <p>CRM</p> |



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| SYNTHETIC NATURAL GAS MIXTURES (cont'd) | gross heating value net heating value relative density compressibility factor | Values calculated by methods given in GPA 2172-09 (2009) using data tables from GPA 2145-09 | CRM |
| | gross heating value net heating value relative density density compressibility factor | Values calculated by methods given in ASTM D3588-98 (2011) using data tables from GPA 2145-09 | |
| SULPHUR GAS MIXTURES | amount fraction (µmol/mol) | In-house method TM002/UT | CRM |
| | hydrogen sulphide (0.2 to 10) | Calibration of certified reference materials (CRM) using gas chromatography with sulphur chemiluminescence detection (GC-SCD) | |
| | carbonyl sulphide (0.2 to 10) | | |
| | methanethiol (methyl mercaptan) (0.2 to 10) | | |
| | ethanethiol (ethyl mercaptan) (0.2 to 10) | | |
| | dimethyl sulphide (0.2 to 10) | | |
| | 1-propanethiol (n-propyl mercaptan) (0.2 to 10) | | |
| | 2-propanethiol (iso-propyl mercaptan) (0.2 to 10) | | |
| | ethyl methyl sulphide (methyl ethyl sulphide) (0.2 to 10) | | |
| | 1-butanethiol (n-butyl mercaptan) (0.2 to 10) | | |
| | 2-methyl-2-propanethiol (tert-butyl mercaptan) (0.2 to 10) | | |
| | 2-methyl-1-propanethiol (iso-butyl mercaptan) (0.2 to 10) | | |
| | 1-methyl-1-propanethiol (sec-butyl mercaptan) (0.2 to 10) | | |
| | diethyl sulphide (0.2 to 10) | | |
| | n-hexyl mercaptan (0.2 to 10) | | |
| | tetrahydrothiophene (THT) (0.2 to 10) | | |



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| BINARY EMISSION GAS MIXTURES | amount fraction (% mol/mol) | In-house method TM014 Calibration of certified reference materials (CRM) by ISO 12963:2017 using dynamically generated reference gases in accordance with ISO 6145 Part 7: Thermal Mass Flow Controllers | CRM |
| | carbon dioxide (0.1 to 15) in nitrogen or synthetic air | | |
| | oxygen (0.5 to 25) in nitrogen | | |
| | methane (0.1 to 5) in nitrogen | | |
| | methane (0.1 to 2.5) in synthetic air | | |
| | amount fraction (µmol/mol) | | |
| | carbon monoxide (10 to 1000) in nitrogen or synthetic air | | |
| | nitric oxide (10 to 600) in nitrogen | | |
| | nitrogen dioxide (5 to 500) in synthetic air | | |
| | sulphur dioxide (10 to 1000) in nitrogen or synthetic air | | |
| amount fraction (% mol/mol) | In-house method TM026/UT Calibration of certified reference materials (CRM) by ISO 12963:2017 using galvanic fuel cell sensors | | |
| oxygen (0.001 to 22.5) in nitrogen | | | |
| END | | | |

*** Type**

CRM= Certified Reference Material(s)

RM = Reference Material(s)

Refer to ISO 17034 for full definitions