

Mass and Related Quantities, Spain, CEM (Centro Español de Metrología)

| Calibration or Measurement Service | | | Measurand Level or Range | | | Measurement Conditions/Independent Variable | | Expanded Uncertainty | | | | | Comments | |
|------------------------------------|------------------------|---------------------------|--------------------------|---------------|-------|---|----------------|----------------------|-------|-----------------|---------------------|---|--|--------------------------|
| Class | Instrument or Artifact | Instrument Type or Method | Minimum value | Maximum value | Units | Parameter | Specifications | Value | Units | Coverage Factor | Level of Confidence | Is the expanded uncertainty a relative one? | | |
| Mass | Mass standards | Comparison in air | 1 | 100 | mg | | | 0.4 to 0.5 | µg | 2 | 95% | No | Uncertainty scales with measurand level. The volume of the mass standards is well known. | Approved on 02 July 2008 |
| Mass | Mass standards | Comparison in air | 0.1 | 1 | g | | | 0.5 to 1.6 | µg | 2 | 95% | No | Uncertainty scales with measurand level. The volume of the mass standards is well known. | Approved on 02 July 2008 |
| Mass | Mass standards | Comparison in air | 1 | 10 | g | | | 1.6 to 4 | µg | 2 | 95% | No | Uncertainty scales with measurand level. The volume of the mass standards is well known. | Approved on 02 July 2008 |
| Mass | Mass standards | Comparison in air | 10 | 100 | g | | | 4 to 6 | µg | 2 | 95% | No | Uncertainty scales with measurand level. The volume of the mass standards is well known. | Approved on 02 July 2008 |
| Mass | Mass standards | Comparison in air | 0.1 | 1 | kg | | | 6 to 35 | µg | 2 | 95% | No | Uncertainty scales with measurand level. The volume of the mass standards is well known. | Approved on 02 July 2008 |
| Mass | Mass standards | Comparison in air | 1 | 10 | kg | | | 35 to 600 | µg | 2 | 95% | No | Uncertainty scales with measurand level. The volume of the standards is well known. | Approved on 02 July 2008 |

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| Class | Instrument or Artifact | Instrument Type or Method | Minimum value | Maximum value | Units | Parameter | Specifications | Value | Units | Coverage Factor | Level of Confidence | Is the expanded uncertainty a relative one? | |
| Mass | Mass standards | Comparison in air | 10 | 50 | kg | | | 0.6 to 8 | mg | 2 | 95% | No | Approved on 23 September 2011 |
| Mass | Mass standards | Comparison in air | 50 | 100 | kg | | | 8 to 50 | mg | 2 | 95% | No | Approved on 23 September 2011 |
| Mass | Mass standards | Comparison in air | 100 | 500 | kg | | | 50 to 400 | mg | 2 | 95% | No | Approved on 23 September 2011 |
| Mass | Mass standards | Comparison in air | 500 | 1000 | kg | | | 0.4 to 1.6 | g | 2 | 95% | No | Approved on 23 September 2011 |
| Volume of solid | Solid density standard, mass: 0.1 kg to 1 kg | Hydrostatic weighing | 50 | 430 | cm ³ | Reference temperature | 20 °C | 1.5 to 0.5 | mm ³ | 2 | 95% | No | Approved on 02 July 2008 |
| Volume of solid | Mass standard: 0.1 g to 1 g | Hydrostatic weighing | 0.012 | 0.125 | cm ³ | Reference temperature | 20 °C | 0.2 | mm ³ | 2 | 95% | No | Approved on 02 July 2008 |
| Volume of solid | Mass standard: 1 g to 10 g | Hydrostatic weighing | 0.125 | 1.25 | cm ³ | Reference temperature | 20 °C | 0.2 to 0.3 | mm ³ | 2 | 95% | No | Approved on 02 July 2008 |
| Volume of solid | Mass standard: 10 g to 0.1 kg | Hydrostatic weighing | 1.25 | 12.5 | cm ³ | Reference temperature | 20 °C | 0.3 to 0.5 | mm ³ | 2 | 95% | No | Approved on 02 July 2008 |
| Volume of solid | Mass standard: 0.1 kg to 1 kg | Hydrostatic weighing | 12.5 | 125 | cm ³ | Reference temperature | 20 °C | 0.5 to 1.3 | mm ³ | 2 | 95% | No | Approved on 02 July 2008 |
| Volume of solid | Mass standard: 1 kg to 10 kg | Hydrostatic weighing | 125 | 1250 | cm ³ | Reference temperature | 20 °C | 1.3 to 40 | mm ³ | 2 | 95% | No | Approved on 02 July 2008 |

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|------------------------------------|-------------------------------|---------------------------|--------------------------|---------------|-----------------|---|----------------|---|-----------------|-----------------|---------------------|---|--|--------------------------|
| Class | Instrument or Artifact | Instrument Type or Method | Minimum value | Maximum value | Units | Parameter | Specifications | Value | Units | Coverage Factor | Level of Confidence | Is the expanded uncertainty a relative one? | Comments | |
| Volume of solid | Mass standard: 10 kg to 50 kg | Hydrostatic weighing | 1250 | 6500 | cm ³ | Reference temperature | 20 °C | 40 to 1150 | mm ³ | 2 | 95% | No | | Approved on 02 July 2008 |
| Absolute pressure | Vacuum gauge | | 1.00E-04 | 5.00E-02 | Pa | | | (3.5E-02 <i>p</i> + 9.1E-06), <i>p</i> pressure in Pa | Pa | 2 | 95% | No | Uncertainty values range from 1.3E-05 Pa to 1.8E-03 Pa | Approved on 02 July 2008 |
| Absolute pressure | Vacuum gauge | | 5.00E-02 | 1.00E-01 | Pa | | | 3.6E-02 <i>p</i> , <i>p</i> pressure in Pa | Pa | 2 | 95% | No | Uncertainty values range from 1.8E-03 Pa to 3.6E-03 Pa | Approved on 02 July 2008 |
| Absolute pressure | Vacuum gauge | | 1.00E-01 | 2.30E+01 | Pa | | | (8.2E-03 <i>p</i> + 1.8E-03), <i>p</i> pressure in Pa | Pa | 2 | 95% | No | Uncertainty values range from 2.6E-03 Pa to 1.9E-01 Pa | Approved on 02 July 2008 |
| Absolute pressure | Vacuum gauge | | 2.30E+01 | 1.00E+03 | Pa | | | (5.4E-03 <i>p</i> + 7.0E-02), <i>p</i> pressure in Pa | Pa | 2 | 95% | No | Uncertainty values range from 1.9E-01 Pa to 5.5 Pa | Approved on 02 July 2008 |
| Absolute pressure | Vacuum gauge | | 1.00E+03 | 3.50E+03 | Pa | | | 5.0 | Pa | 2 | 95% | No | | Approved on 02 July 2008 |
| Absolute pressure | Pressure balance | Gas medium | 3.50E+03 | 1.70E+05 | Pa | | | 3.1E-05 <i>p</i> , <i>p</i> pressure in Pa | Pa | 2 | 95% | No | Uncertainty values range from 1.1E-01 Pa to 5.3 Pa | Approved on 02 July 2008 |
| Absolute pressure | Pressure balance | Gas medium | 1.70E+05 | 7.00E+05 | Pa | | | 2.7E-05 <i>p</i> , <i>p</i> pressure in Pa | Pa | 2 | 95% | No | Uncertainty values range from 4.6 Pa to 1.9E+01 Pa | Approved on 02 July 2008 |
| Absolute pressure | Pressure balance | Gas medium | 7.00E+05 | 7.00E+06 | Pa | | | 3.0E-05 <i>p</i> , <i>p</i> pressure in Pa | Pa | 2 | 95% | No | Uncertainty values range from 2.1E+01 Pa to 2.1E+02 Pa | Approved on 02 July 2008 |
| Absolute pressure | Pressure balance | Gas medium | 7.00E+06 | 2.00E+07 | Pa | | | 3.0E-05 <i>p</i> , <i>p</i> pressure in Pa | Pa | 2 | 95% | No | Uncertainty values range from 2.1E+02 Pa to 6.0E+02 Pa | Approved on 02 July 2008 |
| Absolute pressure | Pressure gauge | Oil medium | 1.00E+05 | 5.00E+08 | Pa | | | (1.0E-04 <i>p</i> + 10), <i>p</i> pressure in Pa | Pa | 2 | 95% | No | Uncertainty values range from 20 Pa to 5.0E+04 Pa | Approved on 02 July 2008 |

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| Class | Instrument or Artifact | Instrument Type or Method | Minimum value | Maximum value | Units | Parameter | Specifications | Value | Units | Coverage Factor | Level of Confidence | Is the expanded uncertainty a relative one? | | |
| Negative gauge mode | Pressure gauge | Gas medium | 3.50E+03 | 1.00E+05 | Pa | | | $3.1E-05p$, p pressure in Pa | Pa | 2 | 95% | No | Uncertainty values range from 1.1E-01 Pa to 3.1 Pa | Approved on 02 July 2008 |
| Negative gauge mode | Pressure gauge | Gas medium | 2.00E+01 | 3.50E+03 | Pa | | | $(2.0E-04p + 9.0E-02)$, p pressure in Pa | Pa | 2 | 95% | No | Uncertainty values range from 9.4E-02 Pa to 7.9E-01 Pa | Approved on 02 July 2008 |
| Gauge pressure | Pressure gauge | Gas medium | 2.00E+01 | 3.50E+03 | Pa | | | $(2.0E-04p + 9.0E-02)$, p pressure in Pa | Pa | 2 | 95% | No | Uncertainty values range from 9.4E-02 Pa to 7.9E-01 Pa | Approved on 02 July 2008 |
| Gauge pressure | Pressure balance | Gas medium | 3.50E+03 | 5.00E+04 | Pa | | | $3.0E-05p$, p pressure in Pa | Pa | 2 | 95% | No | Uncertainty values range from 1.1E-01 Pa to 1.5 Pa | Approved on 02 July 2008 |
| Gauge pressure | Pressure balance | Gas medium | 5.00E+04 | 2.00E+06 | Pa | | | $1.6E-05p$, p pressure in Pa | Pa | 2 | 95% | No | Uncertainty values range from 8.0E-01 Pa to 3.2E+01 Pa | Approved on 02 July 2008 |
| Gauge pressure | Pressure balance | Gas medium | 2.00E+06 | 2.00E+07 | Pa | | | $2.4E-05p$, p pressure in Pa | Pa | 2 | 95% | No | Uncertainty values range from 4.8E+01 Pa to 4.8E+02 Pa | Approved on 02 July 2008 |
| Gauge pressure | Pressure balance | Gas medium | 2.00E+07 | 5.00E+07 | Pa | | | $4.0E-05p$, p pressure in Pa | Pa | 2 | 95% | No | Uncertainty values range from 8.0E+02 Pa to 2.0E+03 Pa | Approved on 02 July 2008 |
| Gauge pressure | Pressure balance | Gas medium | 5.00E+07 | 7.00E+07 | Pa | | | $5.0E-05p$, p pressure in Pa | Pa | 2 | 95% | No | Uncertainty values range from 2.5E+03 Pa to 3.5E+03 Pa | Approved on 02 July 2008 |
| Gauge pressure | Pressure balance | Oil medium | 1.00E+05 | 5.00E+05 | Pa | | | $(8.0E-05p + 10)$, p pressure in Pa | Pa | 2 | 95% | No | Uncertainty values range from 18 Pa to 50 Pa | Approved on 02 July 2008 |
| Gauge pressure | Pressure balance | Oil medium | 5.00E+05 | 2.00E+06 | Pa | | | $(3.5E-05p + 10)$, p pressure in Pa | Pa | 2 | 95% | No | Uncertainty values range from 27 Pa to 80 Pa | Approved on 02 July 2008 |

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| Class | Instrument or Artifact | Instrument Type or Method | Minimum value | Maximum value | Units | Parameter | Specifications | Value | Units | Coverage Factor | Level of Confidence | Is the expanded uncertainty a relative one? | | |
| Gauge pressure | Pressure balance | Oil medium | 2.00E+06 | 1.00E+08 | Pa | | | 3.5E-05 <i>p</i> , <i>p</i> pressure in Pa | Pa | 2 | 95% | No | Uncertainty values range from 7.0E+01 Pa to 3.5E+03 Pa | Approved on 02 July 2008 |
| Gauge pressure | Pressure balance | Oil medium | 1.00E+08 | 2.00E+08 | Pa | | | 4.0E-05 <i>p</i> , <i>p</i> pressure in Pa | Pa | 2 | 95% | No | Uncertainty values range from 4.0E+03 Pa to 8.0E+03 Pa | Approved on 02 July 2008 |
| Gauge pressure | Pressure balance | Oil medium | 2.00E+08 | 5.00E+08 | Pa | | | 9.5E-05 <i>p</i> , <i>p</i> pressure in Pa | Pa | 2 | 95% | No | Uncertainty values range from 1.9E+04 Pa to 4.8E+04 Pa | Approved on 02 July 2008 |
| Gauge pressure | Pressure multiplier | Oil medium | 5.00E+08 | 1.00E+09 | Pa | | | 2.3E-04 <i>p</i> , <i>p</i> pressure in Pa | Pa | 2 | 95% | No | Uncertainty values range from 1.2E+05 Pa to 2.3E+05 Pa | Approved on 02 July 2008 |
| Differential pressure | Pressure gauge | Gas medium | 1.00E+02 | 5.00E+06 | Pa | Differential mode | line pressure from 0 MPa to 20 MPa | (1 + 5.00E-05 <i>p</i>), <i>p</i> pressure in Pa | Pa | 2 | 95% | No | Uncertainty values range from 1.0 Pa to 2.5E+02 Pa | Approved on 02 July 2008 |
| Force: tension and compression | Force measuring device | Deadweight | 10 | 1000 | N | | | 0.002 | % | 2 | 95% | Yes | | Approved on 02 July 2008 |
| Force: tension and compression | Force measuring device | Deadweight | 200 | 20000 | N | | | 0.002 | % | 2 | 95% | Yes | | Approved on 02 July 2008 |
| Force: tension and compression | Force measuring device | Deadweight | 5 | 500 | kN | | | 0.002 | % | 2 | 95% | Yes | | Approved on 02 July 2008 |
| Force: compression | Force measuring device | Build-up system | 100 | 1500 | kN | | | 0.02 | % | 2 | 95% | Yes | | Approved on 02 July 2008 |
| Torque | Torque measuring device | EURAMET /cg-14 | 1 | 1000 | N m | Mode | clockwise, anticlockwise | 2.0E-05 | | 2 | 95% | Yes | | Approved on 22 October 2009 |

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|------------------------------------|--|---------------------------|--------------------------|---------------|-------|---|--------------------------|----------------------|-------|-----------------|---------------------|---|-------------------------------|
| Class | Instrument or Artifact | Instrument Type or Method | Minimum value | Maximum value | Units | Parameter | Specifications | Value | Units | Coverage Factor | Level of Confidence | Is the expanded uncertainty a relative one? | |
| Torque | Torque measuring device | EURAMET /cg-14 | 1000 | 5000 | N m | Mode | clockwise, anticlockwise | 2.0E-04 | | 2 | 95% | Yes | Approved on 22 October 2009 |
| Torque | Reference torque wrench | Reference method | 2 | 1000 | N m | Mode | clockwise, anticlockwise | 2.0E-04 | | 2 | 95% | Yes | Approved on 23 September 2011 |
| Volume of liquid | Glassware, vessels, burettes, pipettes | Gravimetric | 0.001 | 50 | L | Liquid | water | 0.02 | % | 2 | 95% | Yes | Approved on 10 November 2011 |
| | | | | | | Reference temperature | 20 °C | | | | | | |
| Volume of liquid | Proving tanks, standard test measures | Gravimetric | 50 | 500 | L | Liquid | water | 0.01 | % | 2 | 95% | Yes | Approved on 10 November 2011 |
| | | | | | | Reference temperature | 20 °C | | | | | | |
| Volume of liquid | Proving tanks | Volumetric | 1 | 5000 | L | Liquid | water | 0.03 to 0.02 | % | 2 | 95% | Yes | Approved on 10 November 2011 |
| | | | | | | Reference temperature | 20 °C | | | | | | |