



National  
Metrology  
Institute

# Measure Your Performance

## VSL interlaboratory comparisons, a basis to reliable measurement results

*Measurement accuracy is a hidden quality at all laboratories. It usually only attracts attention if measurements fail to match those of other laboratories, indicating that there may be some kind of problem. Prior to that, no news is good news.*

*Affirmation of accuracy does, however, help to keep lab staff sharp and motivated. Interlaboratory comparisons provide this affirmation.*

As a permanent aspect of its operations, VSL continuously improves the quality of its processes. Accreditations are maintained for these. In addition, VSL participates in international comparisons, to underpin the equivalence of its own measurement standards.

VSL has the following accreditations:

- ✓ K999: General requirements for the competence of testing and calibration laboratories (ISO/IEC 17025:2017)
- ✓ P002: General requirements for the competence of reference material producers (ISO 17034:2016)
- ✓ R006: General requirements for proficiency testing (ISO/IEC 17043:2010)



VSL's proficiency testing program for gas analysis guarantees the quality of chemical analyses in the gas and petrochemical industry. For calibration and testing laboratories, participation in a program like this is a precondition for accreditation in accordance with ISO/IEC 17025:2017. For other participants, such as refineries, participation is important for trading products and customer confidence. Accurate gas analysis is of vital importance. The slightest systematic error in the registered composition of natural gas or stack gas may have major financial consequences. For more than 30 years, VSL offers proficiency tests, enabling laboratories to compare their results and to verify their own standards through easy comparison with national standards.

VSL organizes 3 to 6 different gas mixtures Proficiency Tests every year. Components and composition vary from each year. Participants for these PT's are typically specialty gas producers and (Calibration) laboratories performing calibration of analysers in the laboratory or in the field.

Chemistry: Gas Analysis				
Description	Round	Scheduled	Remarks	ISO/IEC 17043 Accredited
On Demand (see K999 scope)	-	On request		Yes
Composition of Siloxanes	2	2023		Yes
	23	2023		Yes
	24	2024	ASTM D1945, GPA2261, GPA2286, ISO 6974, ISO 17023, DIN 51666, CSN EN 15984	Yes
Composition of Refinery Gas	25	2025		Yes
	26	2026		Yes

Chemistry: Gas Analysis				
Description	Round	Scheduled	Remarks	ISO/IEC 17043 Accredited
	47 & 48	2022		Yes
Composition of (Liquefied) Natural Gas	49	2023 Autumn	ASTM D1945, GPA2261, GPA2286, ISO 6974, ISO 17023, DIN 51666, CSN EN 15984	Yes
	50	2024 Autumn		Yes
	51	2025 Autumn		Yes
Energy gas/Bio NGA+	1	2023 spring		Yes



The metrological basis of all electrical measurements are the primary standards for voltage and resistance that are based on intrinsically stable and accurate quantum effects (the Josephson effect and the Quantum Hall effect respectively).

All other electrical quantities are derived from these quantum standards with the aid of special scaling and conversion equipment. In this way, a measurement range is realised that reaches from micro- to tera-ohms and femto- to kilo-amps over a frequency range that runs from DC to 50 GHz.

VSL regularly organises (international) comparisons (ILCs) in compliance with ISO/IEC 17043:2015 in the field of electrical quantities. Within an ILC the laboratory's measurement results are compared anonymously with those from VSL as reference laboratory and other participating laboratories, if applicable. The reference values are directly traceable to VSL's national standards and thus traceable to SI.

Electrical DC/LF & Frequency				
Description	Round	Scheduled	Remarks	ISO/IEC 17043 Accredited
On Demand (see K999 scope)	-	On request		Yes
Multifunction calibrator	3	2023		Yes
Resistance GOhm	1	2022/2023		Yes
Resistance (High)	Continues rounds @ 5 participants (Round period with 5 participants – 16 weeks or 24 weeks)			Yes
Resistance (Low)	Continues rounds @ 5 participants (Round period with 5 participants – 16 weeks or 24 weeks)			Yes
Capacitance and Inductance	Continues rounds @ 5 participants (Round period with 5 participants – 16 weeks or 24 weeks)			Yes

Electrical DC/LF & Frequency				
Description	Round	Scheduled	Remarks	ISO/IEC 17043 Accredited
Digital Multimeter (DMM) 8.5 digit			Continues rounds @ 5 participants (Round period with 5 participants – 16 weeks or 24 weeks)	Yes
Digital Multimeter (DMM) 6.5 digit			Continues rounds @ 5 participants (Round period with 5 participants – 16 weeks or 24 weeks)	Yes
LF power	3	2022/2023		Yes
LCR meter	2	2023		Yes
S-parameters				Yes
Frequency	4	2022		Yes
HF-Power			Continues rounds	Yes
Low alternating voltage			on request	Yes*
Transformers to 5 kA			on request	Yes



VSL organizes different Proficiency Tests every year for environmental analysis. Components and composition vary from each year e.g.: Asbestos, Indoor air quality etc. Participants for these PT's are typically testing laboratories in the field (chemical) environmental analysis.

### Chemistry: Environmental

Description	Round	Scheduled	Remarks	ISO/IEC 17043 Accredited
On Demand (see K999 scope)	-	On request		Yes
Hg in sorbent tubes	1	Pending		Yes
Volatile Organic Compounds in sorbent tubes	18	2023		Partial
	19	2024		Partial
	20	2025		Partial
	21	2026		Partial
ROAS - Asbestos fibre counting	46	2022		Yes
	47	2023 Spring	(1 or 2 rounds per year)	Yes
	48	2023 Autumn		Yes

## Chemistry: Environmental

Description	Round	Scheduled	Remarks	ISO/IEC 17043 Accredited
RIAB - Asbestos Identification in Raw Materials	89-92	2022	(4 rounds per year)	No
	93-96	2023		No
Determination of numerical concentration of inorganic fibrous particles — SEM	Pilot	Pending	Under investigating (ISO 14966:2019)	No
Determination of settled fibrous dust on surfaces	Pilot	Pending	Under investigating (ISO 16000-27:2014)	No
PFAS in soil or sediment	Pilot	Pending	Under investigating	No



Mass was the last quantity with a tangible standard until 2019<sup>1</sup>. This was the International Kilogram (Grand K) made of platinum-iridium kept in Paris. VSL manages the Dutch kilogram (Ptlr53), which is directly traceable to the Grand K. To calibrate clients' standard weights, VSL uses high class mass standards that are directly derived from the Dutch kilogram. This short traceability chain and the use of weighing robots guarantee a very low measurement uncertainty.

VSL provides Proficiency tests in the mass field for manufacturers of balances and calibration laboratories.

Mass				ISO/IEC 17043 Accredited
Description	Round	Scheduled	Remarks	
On Demand (see K999 scope)	-	On request		Yes
Weights of OIML Class E2		Continues rounds @ 5 participants (Round period with 5 participants – 16 weeks or 24 weeks)		Yes
Weights of OIML Class F1		Continues rounds @ 5 participants (Round period with 5 participants – 16 weeks or 24 weeks)		Yes
Weights of OIML Class M1		Continues rounds @ 5 participants (Round period with 5 participants – 16 weeks or 24 weeks)		Yes
NAWI - Calibration of a balance	3	2022/2023		No
	4	2025		No

<sup>1</sup>In 2019, four of the seven SI base units specified in the International System of Quantities were redefined in terms of natural physical constants, rather than human artifacts such as the standard kilogram. Effective 20 May 2019, the 144th anniversary of the Metre Convention, the kilogram, ampere, kelvin, and mole are now defined by setting exact numerical values, when expressed in SI units, for the Planck constant ( $h$ ), the elementary electric charge ( $e$ ), the Boltzmann constant ( $k_B$ ), and the Avogadro constant ( $N_A$ ), respectively.





All VSL's measurements are traceable to the metre, which is defined as the 1/299,792,458th part of the distance light travels in vacuum in one second. The Dutch 'metre' is a special iodine-stabilised Helium Neon laser: the standard laser. A distance measured is directly or indirectly compared to the wavelength of a laser interferometer whose frequency is in turn compared to that of the standard laser. For the micro and nano ranges, VSL possesses a special micro-CMM (coordinate measuring machine) and a scanning probe microscope (SPM) among other things.

The calibration of geometric quantities, such as length, diameter, roundness, and flatness, demands great care. Calibration instruments and artefacts are susceptible to change resulting from material properties, ambient conditions, and wear. Furthermore, measurement procedures and methods may be subject to systematic errors. Participation in interlaboratory comparisons helps to ensure your quality of measurement.

Geometry				
Description	Round	Scheduled	Remarks	ISO/IEC 17043 Accredited
On Demand (see K999 scope)	-	On request		Yes
Gauge Blocks to 100 mm		Continues rounds @ 5 participants (Round period with 5 participants – 16 weeks or 24 weeks)		Yes
Gauge Blocks > 100 mm	1	2022/2023		Yes
Laser Distance Measurer		Continues rounds @ 5 participants (Round period with 5 participants – 16 weeks or 24 weeks)		Yes
(Digital) micrometer	1	Pending		Yes
Ring & plug gauge (roundness, diameter)	1	Pending		Yes



# Interlaboratory Comparison & Proficiency Testing Program

ComPass - Comparison and Proficiency Assessment Services



Geometry				
Description	Round	Scheduled	Remarks	ISO/IEC 17043 Accredited
Displacement transducers	1	Pending		Yes
Line scales	1	Pending		Yes
Angle Gauge	1	Pending		Yes



The primary national reference standard for humidity is a primary humidity generator. In the generator, a gas stream is completely saturated with water vapour at an accurately fixed temperature and pressure. Air, nitrogen and methane are used as gases. The primary reference standard is directly traceable to the SI units.

VSL regularly organises (international) interlaboratory comparisons, through which your laboratory's measurement results are compared anonymously to those from VSL as primary standards laboratory and those from other participating laboratories.

Humidity				
Description	Round	Scheduled	Remarks	ISO/IEC 17043 Accredited
On Demand (see K999 scope)	-	On request		Yes
Humidity transmitter	Continues rounds @ 5 participants (Round period with 5 participants – 16 weeks or 24 weeks)			Yes
Dewpoint	2	2022/2023		Yes
Data logger (Relative humidity & temperature)	Continues rounds @ 5 participants (Round period with 5 participants – 16 weeks or 24 weeks)			Yes



VSL realises the international temperature scale (ITS-90) from -272.5°C to +3000°C with the aid of standards based on the phase transitions of very pure materials. One of these points is the triple point of water: the state in which water exists simultaneously as a gas (water vapour), a liquid (water) and as a solid (ice).

To ensure optimum quality of their measurements, laboratories frequently hold in-house quality checks. However, over time deviations in the measurement equipment can occur that cannot be detected by these checks. Participation in these PT schemes is an essential investment in dependability, operational security and trust in one's own abilities

### Temperature

Description	Round	Scheduled	Remarks	ISO/IEC 17043 Accredited
On Demand (see K999 scope)	-	On request		Yes
Pt-100 sensor (Range -50 °C:150 °C)	Continues rounds @ 5 participants (Round period with 5 participants – 16 weeks or 24 weeks)			Yes
Thermocouple (Type R, S or N)	3	2022/2023		Yes
Combination of a digital unit & Pt100 (Range -80 °C:200 °C)	Continues rounds @ 5 participants (Round period with 5 participants – 16 weeks or 24 weeks)			Yes
Temperature Block Calibrator	Continues rounds @ 5 participants (Round period with 5 participants – 16 weeks or 24 weeks)			Yes



The primary standard for pressure is a pressure balance with a piston-cylinder combination (PCC) as pressure generating element. The PCC whose effective area is accurately known and which is directly traceable to the Dutch standards for mass, length and time. With this primary standard, the effective areas of other piston-cylinder combinations are determined, from the lowest (5 kPa/kg) up to the highest sensitivity (5 MPa/kg). These measurements are done using the cross-float method.

Participating in VSL Interlaboratory comparisons provides more knowledge about repeatability and reproducibility standard deviations; bias of the laboratory, all sources of uncertainties together whatever known or unknown.

## Pressure

Description	Round	Scheduled	Remarks	ISO/IEC 17043 Accredited
On Demand (see K999 scope)	-	On request		Yes
Calibration of a barometer		Continues rounds @ 5 participants (Round period with 5 participants – 16 weeks or 24 weeks)		Yes
(0 - 5) MPa		Continues rounds @ 5 participants (Round period with 5 participants – 16 weeks or 24 weeks)		Yes
Calibration of a pressure gauge (0 - 70) MPa		Continues rounds @ 5 participants (Round period with 5 participants – 16 weeks or 24 weeks)		Yes
(10 - 100) MPa g		Continues rounds @ 5 participants (Round period with 5 participants – 16 weeks or 24 weeks)		Yes



As a basis for our light measurements, VSL possesses an Absolute Cryogenic Radiometer (ACR). Using this instrument, the optical power of a light beam of a specific wavelength is measured based on an electrical substitution method. Optical detectors can next be calibrated against the ACR in terms of spectral responsivity. The detectors are then used for various measurements on light sources. In this way, VSL realises the national standard for the candela and other units derived from it.

Optica					
Description	Round	Scheduled	Remarks	ISO/IEC 17043 Accredited	
On Demand (see K999 scope)	-	On request		Yes	
Luxmeter	1	On request		Yes	
Optical filter	1	On request		Yes	



The primary standard for dosimetry is the water calorimeter. The central part of this standard is a cell of ultra-pure water which is kept at a temperature of 4 °C. The increase in the water temperature due to the radiation is directly related to the Gray (Gy, energy absorbed per unit mass). A typical dose of 1 Gy is equivalent to a 0.00024 °C temperature rise. This standard is used to measure the absolute dose to water both in-house in the VSL <sup>60</sup>Co beam and on-site in the clinical linear accelerator beams. Besides the water calorimeter VSL maintains several free air standards to realize the quantity air kerma for a wide range of X-ray qualities (10 – 320 keV) and for <sup>137</sup>Cs and <sup>60</sup>Co beams.

### Ionising radiation and radioactivity

Description	Round	Scheduled	Remarks	ISO/IEC 17043 Accredited
On Demand (see K999 scope)	-	On request		Yes
Photon beam (1-25 MV)	Continues	On request	On site	Yes
Radio chromic film and phantom	Continues	On request	On site	Yes
Personal dose meter	1	On request		Yes
Handheld Detector	1	On request		Yes



The Dutch measurement standards for flow are based on the quantities mass, length, density and time. The standards in VSL's liquid and gas laboratories are regularly compared to those of other National Metrology Institutes (NMIs), so that international recognition is guaranteed. For liquid volume measures, the density and mass of the liquid are determined; these are traceable to the respective national measurement standards.

Through our extensive knowledge and experience, VSL has built up a very good reputation in the oil and gas industry. VSL supplies various services in the area of flow and liquid volume measurements to clients including suppliers of measurement equipment, oil and gas producers, utility companies and gas transport and distribution companies all over the world.

## Flow of Liquids

Description	Round	Scheduled	Remarks	ISO/IEC 17043 Accredited
On Demand (see K999 scope)	-	On request		Yes
Schedule under review				

## Gas Flow

Description	Round	Scheduled	Remarks	ISO/IEC 17043 Accredited
On Demand (see K999 scope)	-	On request		Yes
Rotary Gas Flowmeter	Pilot	Pending		Yes



Volume				
Description	Round	Scheduled	Remarks	ISO/IEC 17043 Accredited
On Demand (see K999 scope)	-	On request		Yes
Micropipettes	8	2022		No
Pycnometer	1	On request		Yes
Volumetric flask	1	On request		Yes



## Interlaboratory Comparison & Proficiency Testing Program

ComPass - Comparison and Proficiency Assessment Services



### Our approach

The participating laboratories receive each a sample, an artefact, or a measurement instrument on which measurements have to be performed or deviations have to be determined using their standard procedures. An  $E_n$  value is then calculated for each laboratory, based on comparison of the lab's measurements with reference values ( $Y_{lab}$  and  $Y_{ref}$ ), in combination with the reported uncertainties for these two values ( $U_{lab}$  and  $U_{ref}$ ).

$$E_n = \frac{x_{Lab} - X_{Ref}}{\sqrt{U_{Lab}^2 + U_{Ref}^2}}$$

If the absolute value of  $E_n$  is less than or equal to 1, the lab's results are in agreement with the reference values. However, if the absolute value of  $E_n$  is greater than 1, the laboratory must determine the cause of the systematic deviations, which may arise from improper standards, instruments or procedures.

In some comparisons, a  $Z$ -score is calculated in addition to the  $E_n$  value. The reference values are directly traceable to VSL's national standards and thus traceable to SI.

### Scope

Our PT accreditation scope includes all of our calibration capabilities across all technological fields which are listed in our very extensive calibration scope, which is ISO/IEC 17025:2017 accredited (reg.nr. K999). This means that VSL is accredited by the Dutch Accreditation Council (RvA) to organize proficiency testing schemes from pressure, mass and viscosity to chemical analysis, and from temperature and humidity to electricity, length and gas flow.

Furthermore VSL can also offer customized service at an unprecedented level.

### Participation benefits

Laboratories that consider quality to be of paramount importance attach great value to participation in ILCs (PT-Schemes) because:

- ✓ It provides either confirmation of their satisfactory performance or an alert that potential problems within their laboratory require investigation.
- ✓ They consider PTs as a quality and risk management tool.
- ✓ They recognise the educational role of PTs.
- ✓ Successful performance provides added confidence to individual staff, management and internal and/or external clients.
- ✓ It satisfies the requirements of regulatory and accreditation bodies.
- ✓ ComPass offers reference values that are traceable to SI.
- ✓ It offers a valuable contribution to the strategic marketing decisions of their laboratory, as it indicates the performance of the laboratory when compared to other laboratories

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