Annex to declaration of accreditation (scope of accreditation)
Normative document: EN ISO/IEC 17025:2005
Registration number: **K 999**

of **VSL B.V.**

This annex is valid from: **24-01-2018** to **01-11-2021** Replaces annex dated: **03-10-2016**

Locations where activities are performed under accreditation

Location	Abbreviation/ location code
Thijsseweg 11 2629 JA Delft The Netherlands	Delft
Hugo de Grootplein 1 3314 EG Dordrecht The Netherlands	Dordrecht

HCS code	Quantity, Instrument, Measure		Nominal ambient temperature	Location
LF	LF 00	DC/LF Electricity	23 °C	Delft, on-site
RF	RF 00	High Frequency Electricity	23 °C	Delft
MQ	MQ 00	Magnetic Quantities	23 °C	Delft
TF	TF 00	Time and Frequency	23 °C	Delft
DM	DM 00	Dimensional Quantities	20 °C	Delft
MW	MW 10	Mass	20 °C	Delft
PV	PV 00	Pressure and Vacuum	20 °C	Delft, on-site
DV	DV 10	Density, Viscosity	20 °C	Delft, Dordrecht
VL	VL 10	Volume of flowing liquids	20 °C	Dordrecht, on-site
FG	FG 10	Flow of Gas	20 °C	Delft, on-site
FL	FL 10	Flow of Liquids	20 °C	Dordrecht, on-site
OQ	OQ 10	Optical Quantities	23 °C	Delft, on-site

This annex has been approved by the Board of the Dutch Accreditation Council, on its behalf,

J.A.W.M. de Haas
Director of Operations

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IR	IR 10	Ionising Radiation and Radioactivity	20 °C	Delft, on-site
TE	TE 10	Temperature	23 °C	Delft, on-site
RH	RH 00	Humidity	23 °C	Delft, on-site
CH	CH 00	Chemical Analysis	20 °C	Delft
RM	RM 00	Reference Materials	20 °C	Delft

Remarks

1) Calibration and Measurement Capability (CMC): Demonstrated measurement uncertainty, with coverage probability of 95%, in a given measurement point or measurement range. Measurement uncertainty, U, is calculated according to EA-4/02 "Expression of the Uncertainty of Measurement in Calibration" and/or GUM “Evaluation of measurement data - Guide to the Expression of Uncertainty in Measurement”.

2) VSL is appointed by Royal Decree as the national organisation responsible for the realisation and maintenance of the Dutch national measurement standards. As a member of BIPM, VSL is obliged to fulfil the requirements of the Mutual Recognition Arrangement (MRA) which has been signed by the members of BIPM. In order to fulfil the requirements of the MRA with respect to the quality system applied for the calibration and measurement services, VSL has chosen for a third party assessment by the Dutch Council for Accreditation (RvA).

3) Calibration on-site: The uncertainties achievable on a customer's site (on-site) can be expected to be larger than the Calibration and Measurement Capability (CMC) that the accredited laboratory has been assigned as the CMC on the RvA Scope. Allowance must be made for aspects such as the environment at the place of calibration and for other possible adverse effects such as those caused by transportation of the calibration equipment. The usual allowance for the uncertainty introduced by the item being calibrated, (e.g. resolution) must also be considered and this, on its own, could result in the calibration uncertainty being larger than the CMC. The instruction, General Instruction On-Site Calibrations VSL (VSL-Kal-Alg/IDS/005), describes additional requirements specifically applicable for performing calibrations outside of the permanent laboratories in Delft and Dordrecht.

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LF00	DC/LF Electricity			
HCS code	Measured quantity, Range	Frequency	CMC	Remarks
LF 11	Direct Voltage 1 V and 1.018 V		$1.0 \cdot 10^{-7} \cdot U$	Josephson standard
	10 V		$5 \cdot 10^{-8} \cdot U$	Josephson standard
	Gain -1 mV – +1 mV -10 mV – +10 mV -100 mV – +100 mV -1 V – +1 V Non linearity -1 mV – +1 mV -10 mV – +10 mV -100 mV – +100 mV -1 V – +1 V Voltage ratio -1 mV – +1 mV -10 mV – +10 mV -100 mV – +100 mV -1 V – +1 V		 $2.0 \cdot 10^{-6} \cdot U$ $4 \cdot 10^{-7} \cdot U$ $3 \cdot 10^{-7} \cdot U$ $2 \cdot 10^{-7} \cdot U$ 2 nV 3 nV 5 nV 10 nV $2.0 \cdot 10^{-6} \cdot U_1/U_2$ $3 \cdot 10^{-7} \cdot U_1/U_2$ $5 \cdot 10^{-8} \cdot U_1/U_2$ $1.0 \cdot 10^{-8} \cdot U_1/U_2$	 Gain of range of multimeter Josephson standard In steps of about 145 microvolt. Non-linearity of range of multimeter Josephson standard In steps of about 145 microvolt. Voltage ratio within range of multimeter Josephson standard In steps of about 145 microvolt. Uncertainty scales with ratio for U1 > U2
	1 V and 1.018 V		$5 \cdot 10^{-7} \cdot U$	Zener reference
	10 V		$3 \cdot 10^{-7} \cdot U$	Zener reference
	1 mV 10 mV 100 mV 1 V 10 V 100 V 1 000 V		$1.1 \cdot 10^{-4} \cdot U$ $1.1 \cdot 10^{-5} \cdot U$ $1.4 \cdot 10^{-6} \cdot U$ $1.7 \cdot 10^{-6} \cdot U$ $1.1 \cdot 10^{-6} \cdot U$ $1.6 \cdot 10^{-6} \cdot U$ $1.7 \cdot 10^{-6} \cdot U$	Measuring at multifunction facility
	100 µV – 100 mV 100 mV – 10 V 10 V – 1 100 V		$2.0 \cdot 10^{-4} \cdot U - 3 \cdot 10^{-6} \cdot U$ + 20 nV $3 \cdot 10^{-6} \cdot U - 2.0 \cdot 10^{-6} \cdot U$ $2.0 \cdot 10^{-6} \cdot U - 5 \cdot 10^{-6} \cdot U$	Measuring at multifunction facility

LF00	DC/LF Electricity			
HCS code	Measured quantity, Range	Frequency	CMC	Remarks
	1 mV 10 mV 100 mV 1 V 10 V 100 V 1 000 V		$2.1\cdot10^{-4}\cdot U$ $2.1\cdot10^{-5}\cdot U$ $2.7\cdot10^{-6}\cdot U$ $1.3\cdot10^{-6}\cdot U$ $6\cdot10^{-7}\cdot U$ $8\cdot10^{-7}\cdot U$ $1.2\cdot10^{-6}\cdot U$	Generating at multifunction facility
	100 µV – 1 mV 1 mV – 10 mV 10 mV – 100 mV 100 mV – 1 100 V		$3\cdot10^{-4}\cdot U$ $3\cdot10^{-4}\cdot U$ – $3\cdot10^{-5}\cdot U$ $3\cdot10^{-5}\cdot U$ – $3\cdot10^{-6}\cdot U$ $2.0\cdot10^{-6}\cdot U$	Generating at multifunction facility
LF 12	Direct Voltage Ratio 10V/V –$1\cdot10^{6}$ V/V		 $1.0\cdot10^{-5}$ V/V – $5\cdot10^{-5}$ V/V	 Input 1 kV – 200 kV
LF 13	Direct High Voltage 1 kV – 200 kV		 $1.0\cdot10^{-5}\cdot U$ – $5\cdot10^{-5}\cdot U$	
LF 21	Direct Current 0.01 pA – 1 pA 1 pA – 20 pA 20 pA – 200 pA 0.2 nA – 2 nA 2 nA – 20 nA 20 nA – 200 nA 0.2 µA – 2 µA 2 µA – 20 µA		 0.2 fA $5\cdot10^{-5}\cdot I$ – $2.0\cdot10^{-4}\cdot I$ $5\cdot10^{-5}\cdot I$ $3\cdot10^{-4}\cdot I$ – $1.0\cdot10^{-4}\cdot I$ $1.0\cdot10^{-4}\cdot I$ – $3\cdot10^{-5}\cdot I$ $3\cdot10^{-5}\cdot I$ $3\cdot10^{-5}\cdot I$ – $9\cdot10^{-6}\cdot I$ $7\cdot10^{-6}\cdot I$	 Measuring
	20 µA – 100 µA 0.1 µA – 100 mA 0.1 µA – 1 A		$7\cdot10^{-6}\cdot I$ – $5\cdot10^{-6}\cdot I$ $5\cdot10^{-6}\cdot I$ $8\cdot10^{-5}\cdot I$	Measuring at multifunction facility
	0.01 pA – 1 pA 1 pA – 20 pA 20 pA – 200 pA 0.2 nA – 2 nA 2 nA – 20 nA 20 nA – 200 nA		0.2 fA $5\cdot10^{-5}\cdot I$ – $2.0\cdot10^{-4}\cdot I$ $5\cdot10^{-5}\cdot I$ $3\cdot10^{-4}\cdot I$ – $1.0\cdot10^{-4}\cdot I$ $1.0\cdot10^{-4}\cdot I$ – $3\cdot10^{-5}\cdot I$ $3\cdot10^{-5}\cdot I$	Generating

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LF00	DC/LF Electricity			
HCS code	Measured quantity, Range	Frequency	CMC	Remarks
	0.2 µA – 2 µA 2 µA – 20 µA 20 µA – 100 µA 0.1 mA – 100 mA 0.1 A – 1 A 1 A – 10 A		$3\cdot10^{-5}\cdot I$ – $1.0\cdot10^{-5}\cdot I$ $1.0\cdot10^{-5}\cdot I$ $5\cdot10^{-6}\cdot I$ – $3\cdot10^{-6}$ I $3\cdot10^{-6}\cdot I$ $6\cdot10^{-5}\cdot I$ $1.0\cdot10^{-4}\cdot I$	Generating at multifunction facility
	10 A – 100 A		$7\cdot10^{-6}\cdot I$	Generating at DC ratio facility Currents up to 900 A possible with devices that allow multiple turns
	10 A – 900 A		$7\cdot10^{-6}\cdot I$	Measuring at DC ratio facility
LF 22	Direct Current Ratio $1\cdot10^{-4}$ – 1		$5\cdot10^{-6}$	Primary current 1 A – 600 A
LF 24	Direct Charge 10 pC – 200 pC 200 pC – 200 nC		$2.0\cdot10^{-3}\cdot Q$ – $4\cdot10^{-4}\cdot Q$ $4\cdot10^{-4}\cdot Q$ – $3\cdot10^{-4}\cdot Q$	
LF 31	Alternating Voltage 1 mV – 100 mV 100 mV – 200 mV 200 mV – 2 V 2 mV – 20 V 20 V – 30 V 30 V – 60 V 60 V – 200 V 200 V – 1 000 V	40 Hz – 100 kHz 10 Hz – 1 MHz 10 Hz – 1 MHz 10 Hz – 1 MHz 10 Hz – 500 kHz 10 Hz – 300 kHz 10 Hz – 100 kHz 10 Hz – 100 kHz	$2.5\cdot10^{-5}\cdot U$ – $3.0\cdot10^{-3}\cdot U$ $2.0\cdot10^{-5}\cdot U$ – $4\cdot10^{-4}\cdot U$ $9\cdot10^{-6}\cdot U$ – $4\cdot10^{-4}\cdot U$ $9\cdot10^{-6}\cdot U$ – $4\cdot10^{-4}\cdot U$ $1.3\cdot10^{-5}\cdot U$ – $4\cdot10^{-4}\cdot U$ $1.5\cdot10^{-5}\cdot U$ – $1.5\cdot10^{-4}\cdot U$ $1.5\cdot10^{-5}\cdot U$ – $9\cdot10^{-5}\cdot U$ $1.8\cdot10^{-5}\cdot U$ – $1.0\cdot10^{-4}\cdot U$	at multifunction facility
	1 mV – 130 mV	10 Hz – 100 kHz	$5\cdot10^{-7}\cdot U$ – $5\cdot10^{-4}\cdot U$	Josephson standard
LF 32	Alternating Voltage Ratio $1\cdot10^{-7}$ V/V – 1 V/V	400 Hz – 1.6 kHz 400 Hz – 1.6 kHz	$1.0\cdot10^{-7}$ V/V (in-phase) $1.0\cdot10^{-6}$ V/V (quadrature)	
	$1\cdot10^{-6}$ V/V – 1 V/V	50 Hz – 5 kHz 50 Hz – 5 kHz	$2.0\cdot10^{-6}$ V/V (in-phase) $1.0\cdot10^{-5}$ V/V (quadrature)	
	$1\cdot10^{-6}$ V/V – 0.1 V/V	45 Hz – 65 Hz	$2.0\cdot10^{-5}$ V/V	Input 1 kV – 100 kV On-site: Input 1 kV – 500 kV; for voltages > 100 kV, a HV capacitor with known voltage dependence needs to be supplied by the customer

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LF00	DC/LF Electricity			
HCS code	Measured quantity, Range	Frequency	CMC	Remarks
	Phase displacement D (-π to +π) rad	45 Hz – 65 Hz	$0.9 \cdot 10^{-3}$ rad	Input 1 kV – 100 kV
	-0.1 rad – +0.1 rad	45 Hz – 65 Hz	$1.0 \cdot 10^{-5} \cdot$rad + $5 \cdot 10^{-3} \cdot D$ (D in rad)	Input 1 kV – 100 kV On-site: Input 1 kV – 500 kV; for voltages > 100 kV, a HV capacitor with known voltage dependence needs to be supplied by the customer
LF 33	Alternating High Voltage 1 kV – 100 kV	45 Hz – 65 Hz	$1 \cdot 10^{-4} \cdot U$	

LF00	DC/LF Electricity			
HCS code	Measured quantity, Range	Frequency	CMC	Remarks
LF 34	AV/DV Transfer			
	10 mV – 20 mV 20 mV – 100 mV 0.1 mV – 0.2 V 0.2 mV – 0.5 V 0.5 V – 1 V 1 V – 10 V 10 V – 30 V 30 V* – 60 V* 60 V – 100 V 100 V – 1 000 V	10 Hz – 1 MHz 10 Hz – 1 MHz 10 Hz – 1 MHz 10 Hz – 1 MHz 10 Hz – 1 MHz 10 Hz – 1 MHz 10 Hz – 1 MHz 10 Hz – 500 kHz 10 Hz – 300 kHz 10 Hz – 100 kHz	$4 \cdot 10^{-4} \cdot U – 8 \cdot 10^{-5} \cdot U$ $3 \cdot 10^{-4} \cdot U – 2.0 \cdot 10^{-5} \cdot U$ $2.0 \cdot 10^{-4} \cdot U – 1.5 \cdot 10^{-5} \cdot U$ $1.0 \cdot 10^{-4} \cdot U – 5 \cdot 10^{-6} \cdot U$ $4 \cdot 10^{-5} \cdot U – 2.0 \cdot 10^{-6} \cdot U$ $2.0 \cdot 10^{-6} \cdot U – 4 \cdot 10^{-5} \cdot U$ $5 \cdot 10^{-6} \cdot U – 6 \cdot 10^{-5} \cdot U$ $1.0 \cdot 10^{-5} \cdot U – 5 \cdot 10^{-5} \cdot U$ $1.0 \cdot 10^{-5} \cdot U – 4 \cdot 10^{-5} \cdot U$ $1.0 \cdot 10^{-5} \cdot U – 1.0 \cdot 10^{-4} \cdot U$	*) Max. 2.2 · 10^7 V·Hz
LF 41	Alternating Current			at multifunction facility
	200 µA	10; 20 Hz 40 Hz; 1; 5; 10 kHz	$1.0 \cdot 10^{-3} \cdot I$ $3 \cdot 10^{-5} \cdot I$	
	2 mA	10; 20 Hz 40 Hz; 1; 5; 10 kHz	$2.1 \cdot 10^{-4} \cdot I – 2.3 \cdot 10^{-4} \cdot I$ $5 \cdot 10^{-5} \cdot I$	
	20 mA	10; 20 Hz 40 Hz; 1; 5; 10 kHz	$2.1 \cdot 10^{-4} \cdot I – 2.3 \cdot 10^{-4} \cdot I$ $5 \cdot 10^{-5} \cdot I – 6 \cdot 10^{-5} \cdot I$	
	200 mA	10; 20 Hz 40 Hz; 1; 5; 10 kHz	$2.1 \cdot 10^{-4} \cdot I – 2.3 \cdot 10^{-4} \cdot I$ $6 \cdot 10^{-5} – 8 \cdot 10^{-5} \cdot I$	
	2 A	10; 20; 40 Hz; 1; 5; 10 kHz	$1.5 \cdot 10^{-4} \cdot I – 2.3 \cdot 10^{-4} \cdot I$	
	10 A	40 Hz; 1; 5; 10 kHz	$2.1 \cdot 10^{-4} \cdot I – 5 \cdot 10^{-4} \cdot I$	
	5 A – 5 000 A	45 Hz – 65 Hz	$20 \cdot 10^{-6} \cdot I$	at current ratio facility
LF 42	Alternating current ratio Magnitude ratio error 0 – 1	45 Hz – 65 Hz	$5 \cdot 10^{-6}$	Primary current from 5 A – 8 kA Increased uncertainty for other transducers (Rogowski coils, shunts)
	Phase displacement -π rad – +π rad	45 Hz – 65 Hz	$5 \cdot 10^{-6}$ rad	Primary current from 5 A – 8 kA
LF 44	AC/DC Transfer			
	10 mA – 500 mA 0.5 A – 5 A 5 A – 20 A	10 Hz – 100 kHz 10 Hz – 100 kHz 10 Hz – 100 kHz	$3 \cdot 10^{-5} \cdot I – 1.3 \cdot 10^{-4} \cdot I$ $4 \cdot 10^{-5} \cdot I – 2.5 \cdot 10^{-4} \cdot I$ $7 \cdot 10^{-5} \cdot I – 7 \cdot 10^{-4} \cdot I$	

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LF00	DC/LF Electricity			
HCS code	Measured quantity, Range	Frequency	CMC	Remarks
LF 50	Power quality			IEC 61000-4-30
	Voltage unbalance 0 % – 100 %	50 Hz or 60 Hz	0.03 %	
	Harmonics and interharmonics 0.1 V – 250 V 1 mA – 20 A	40 Hz – 5000 Hz	0.01 V – 0.03 V 0.1 mA – 2 mA	resolution 5 Hz resolution 5 Hz
	Total harmonic distortion 0.01 % – 100 %	40 Hz – 5000 Hz	0.001 % – 0.02 %	Voltage or current
	Voltage fluctuations 0.01 % – 10 %	50 Hz – 60 Hz	0.001 % – 0.003 %	10 mHz – 40 Hz modulation; P_{st} from 0.2 – 10 (IEC 61000-4-15)
LF 50	Active power 0 kW – 24 kW	45 Hz – 65 Hz	$1.5 \cdot 10^{-5}$ W/VA	1 V – 300 V 1 mA – 80 A 0 ≤ cos(φ) ≤ 1 inductive or capacitive
	(0 – 20) kW	20 Hz – 5 kHz	$2.0 \cdot 10^{-4}$ W/VA – $3 \cdot 10^{-3}$ W/VA	1 V – 1 000 V 10 mA – 20 A 0.866 ≤ cos(φ) ≤ 1 inductive or capacitive
	0 kW – 20 kW	20 Hz – 5 kHz	$3 \cdot 10^{-3}$ W/VA – $3 \cdot 10^{-2}$ W/VA	1 V – 1 000 V 10 mA – 20 A 0 ≤ cos(φ) ≤ 0.866 inductive or capacitive
	0 kW – 5 kW	5 kHz – 100 kHz	$4 \cdot 10^{-4}$ W/VA – $5 \cdot 10^{-3}$ W/VA	1 V – 1 000 V 10 mA – 5 A 0.866 ≤ cos(φ) ≤ 1 inductive or capacitive
	0 kW – 5 kW	5 kHz – 100 kHz	$5 \cdot 10^{-3}$ W/VA – $4 \cdot 10^{-2}$ W/VA	1 V – 1 000 V 10 mA – 5 A 0 ≤ cos(φ) ≤ 0.866 inductive or capacitive

LF00	DC/LF Electricity			
HCS code	Measured quantity, Range	Frequency	CMC	Remarks
	0 MW – 500 MW	45 Hz – 65 Hz	$5 \cdot 10^{-5}$ W/VA	Single phase 0.05 kV – 100 kV 0.1 A – 5 000 A 0 ≤ cos(φ) ≤ 1, inductive or capacitive
	0 GW – 1.5 GW	45 Hz – 65 Hz	$5 \cdot 10^{-5}$ W/VA	Three-phase 0.05 kV – 100 kV 0.1 A – 5 000 A 0 ≤ cos(φ) ≤ 1, inductive or capacitive
	0 MW – 200 MW	45 Hz – 65 Hz	$2.5 \cdot 10^{-5}$ W/VA	Single phase – Loss Power 0.1 kV – 100 kV 0.1 A – 2 000 A 0 ≤ cos(φ) ≤ 1, inductive or capacitive
	0 MW – 600 MW	45 Hz – 65 Hz	$2.5 \cdot 10^{-5}$ W/VA	Three-phase – Loss Power 0.1 kV – 100 kV 0.1 A – 2 000 A 0 ≤ cos(φ) ≤ 1, inductive or capacitive
	Apparent power 0 kVA – 24 kVA	45 Hz – 65 Hz	$2.0 \cdot 10^{-5}$ VA/VA	1 V – 300 V 1 mA – 80 A 0 ≤ cos(φ) ≤ 1 inductive or capacitive
	0 kVA – 20 kVA	20 Hz – 5 kHz	$2.0 \cdot 10^{-4}$ VA/VA – $3 \cdot 10^{-3}$ VA/VA	1 V – 1 000 V 10 mA – 20 A 0.866 ≤ cos(φ) ≤ 1 inductive or capacitive
	0 kVA – 20 kVA	20 Hz – 5 kHz	$3 \cdot 10^{-3}$ VA/VA – $3 \cdot 10^{-2}$ VA/VA	1 V – 1 000 V 10 mA – 20 A 0 ≤ cos(φ) ≤ 0.866 inductive or capacitive
	0 kVA – 5 kVA	5 kHz – 100 kHz	$4 \cdot 10^{-4}$ VA/VA – $5 \cdot 10^{-3}$ VA/VA	1 V – 1 000 V 10 mA – 5 A 0.866 ≤ cos(φ) ≤ 1 inductive or capacitive
	0 kVA – 5 kVA	5 kHz – 100 kHz	$5 \cdot 10^{-3}$ VA/VA – $4 \cdot 10^{-2}$ VA/VA	1 V – 1 000 V 10 mA – 5 A 0 ≤ cos(φ) ≤ 0.866 inductive or capacitive
	0 MVA – 500 MVA	45 Hz – 65 Hz	$5 \cdot 10^{-5}$ VA/VA	Single phase 0.05 Kv – 100 kV 0.1 A – 5 000 A 0 ≤ cos(φ) ≤ 1, inductive or capacitive

LF00	DC/LF Electricity			
HCS code	Measured quantity, Range	Frequency	CMC	Remarks
	0 GVA – 1.5 GVA	45 Hz – 65 Hz	$5\cdot10^{-5}$ VA/VA	Three-phase 0.05 kV – 100 kV 0.1 A – 5 000 A 0 ≤ cos(φ) ≤ 1, inductive or capacitive
	Energy			
	0 MWh – 4 MWh	45 Hz – 65 Hz	$5\cdot10^{-5}$ Wh/VAh – $3\cdot10^{-4}$ Wh/VAh	Single phase 30 V – 300 V 0.02 A – 80 A 0 ≤ cos(φ) ≤ 1, inductive or capacitive Measurement time 0 Week – 1 Week
	0 MWh – 12 MWh	45 Hz – 65 Hz	$5\cdot10^{-5}$ Wh/VAh – $3\cdot10^{-4}$ Wh/VAh	Three-phase 30 V – 300 V Line to Ground 0.02 A – 80 A per phase 0 ≤ cos(φ) ≤ 1, inductive or capacitive Measurement time 0 Week – 1 Week
	0 GWh – 84 GWh	45 Hz – 65 Hz	$5\cdot10^{-5}$ Wh/VAh – $3\cdot10^{-4}$ Wh/VAh	Single phase 0.05 kV – 100 kV 0.1 A – 5 000 A 0 ≤ cos(φ) ≤ 1, inductive or capacitive Measurement time 0 Week – 1 Week
	0 GWh – 252 GWh	45 Hz – 65 Hz	$5\cdot10^{-5}$ Wh/VAh – $3\cdot10^{-4}$ Wh/VAh	Three-phase 0.05 kV – 100 kV Line to Ground 0.1 A – 5 000 A per phase 0 ≤ cos(φ) ≤ 1, inductive or capacitive Measurement time 0 Week – 1 Week
LF 51	Power factor/cos(*φ*)			
	0 º – ±180 º	45 Hz – 65 Hz	0.1 mº – 1 mº	
	0 º – ±180 º	5 kHz – 100 kHz	0.001 º – 0.1º	
LF 62	DC Resistance 1 µΩ 10 µΩ 100 µΩ 1 mΩ 10 mΩ 100 mΩ		 $4\cdot10^{-5}\cdot R$ $4\cdot10^{-6}\cdot R$ $1.5\cdot10^{-6}\cdot R$ $1.0\cdot10^{-6}\cdot R$ $4\cdot10^{-7}\cdot R$ $2.0\cdot10^{-7}\cdot R$	
	1 Ω 10 Ω 25 Ω 100 Ω 1 kΩ 10 kΩ		$5\cdot10^{-8}\cdot R$ $3\cdot10^{-8}\cdot R$ $3\cdot10^{-8}\cdot R$ $2.0\cdot10^{-8}\cdot R$ $2.0\cdot10^{-8}\cdot R$ $2.0\cdot10^{-8}\cdot R$	

LF00	DC/LF Electricity			
HCS code	Measured quantity, Range	Frequency	CMC	Remarks
	6.45 kΩ 12.9 kΩ 100 kΩ 1 MΩ		$3\cdot10^{-8}\cdot R$ $3\cdot10^{-8}\cdot R$ $4\cdot10^{-7}\cdot R$ $5\cdot10^{-7}\cdot R$	
	10 MΩ 100 MΩ 1 GΩ 10 GΩ 100 GΩ		$8\cdot10^{-7}\cdot R$ $2.0\cdot10^{-6}\cdot R$ $4\cdot10^{-6}\cdot R$ $1.0\cdot10^{-5}\cdot R$ $2.0\cdot10^{-5}\cdot R$	
	1 TΩ 10 TΩ 100 TΩ 1 PΩ 10 PΩ		$4\cdot10^{-5}\cdot R$ $1.0\cdot10^{-4}\cdot R$ $2.5\cdot10^{-4}\cdot R$ $1.0\cdot10^{-2}\cdot R$ $1.0\cdot10^{-1}\cdot R$	
	1 Ω 10 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ 100 MΩ		$7\cdot10^{-5}\cdot R$ $2.0\cdot10^{-5}\cdot R$ $1.5\cdot10^{-5}\cdot R$ $1.0\cdot10^{-5}\cdot R$ $1.0\cdot10^{-5}\cdot R$ $1.0\cdot10^{-5}\cdot R$ $1.5\cdot10^{-5}\cdot R$ $6\cdot10^{-5}\cdot R$ $6\cdot10^{-4}\cdot R$	Measuring at multifunction facility
	1 Ω – 10 kΩ 10 kΩ – 100 MΩ		$4\cdot10^{-5}\cdot R$ – $2.0\cdot10^{-5}\cdot R$ $2.0\cdot10^{-5}\cdot R$ – $7\cdot10^{-4}\cdot R$	Measuring at multifunction facility
	1 and 1.9 Ω 10 and 19 Ω 100 and 190 Ω 1 and 1.9 kΩ 10 and 19 kΩ 100 and 190 kΩ 1 and 1.9 MΩ 10 and 19 MΩ 100 MΩ		$1.8\cdot10^{-5}\cdot R$ $5\cdot10^{-6}\cdot R$ $1.7\cdot10^{-6}\cdot R$ $2.4\cdot10^{-6}\cdot R$ $2.4\cdot10^{-6}\cdot R$ $4\cdot10^{-6}\cdot R$ $7\cdot10^{-6}\cdot R$ $2.2\cdot10^{-5}\cdot R$ $1.0\cdot10^{-4}\cdot R$	Generating at multifunction facility

LF00	DC/LF Electricity			
HCS code	Measured quantity, Range	Frequency	CMC	Remarks
	Temperature coefficient			
	0 µΩ/Ω/K – 5 µΩ/Ω/K		0.015 µΩ/Ω/K	1 Ω – 10 kΩ 15 °C – 30 °C
	5 µΩ/Ω/K – 200 µΩ/Ω/K		0.015 µΩ/Ω/K – 0.3 µΩ/Ω/K	1 Ω – 10 kΩ 15 °C – 30 °C
	0 µΩ/Ω/K – 5 µΩ/Ω/K		0.1 µΩ/Ω/K	10 kΩ – 10 MΩ 15 °C – 30 °C
	5 µΩ/Ω/K – 200 µΩ/Ω/K		0.1 µΩ/Ω/K – 0.3 µΩ/Ω/K	10 kΩ 10 MΩ 15 °C – 30 °C

LF00	DC/LF Electricity			
HCS code	Measured quantity, Range	Frequency	CMC	Remarks
LF 63	AC Resistance Real component			
	10 Ω – 100 Ω 10 Ω – 100 Ω 100 Ω – 1 kΩ 100 Ω – 1 kΩ 1 kΩ – 10 kΩ 1 kΩ – 10 kΩ 10 kΩ – 100 kΩ 10 kΩ – 100 kΩ 100 kΩ – 1 MΩ 100 kΩ – 1 MΩ	50 Hz – 2 kHz 2 kHz – 10 kHz 50 Hz – 2 kHz 2 kHz – 10 kHz 50 Hz – 2 kHz 2 kHz – 10 kHz 50 Hz – 2 kHz 2 kHz – 10 kHz 50 Hz – 2 kHz 2 kHz – 10 kHz	$3{\cdot}10^{-5}{\cdot}R$ – $2.0{\cdot}10^{-4}{\cdot}R$ $6{\cdot}10^{-5}{\cdot}R$ – $1.0{\cdot}10^{-3}{\cdot}R$ $2.0{\cdot}10^{-5}{\cdot}R$ – $1.4{\cdot}10^{-4}{\cdot}R$ $4{\cdot}10^{-5}{\cdot}R$ – $7{\cdot}10^{-4}{\cdot}R$ $1.0{\cdot}10^{-5}{\cdot}R$ – $4{\cdot}10^{-5}{\cdot}R$ $1.4{\cdot}10^{-5}{\cdot}R$ – $5{\cdot}10^{-4}{\cdot}R$ $1.0{\cdot}10^{-5}{\cdot}R$ – $1.0{\cdot}10^{-4}{\cdot}R$ $1.4{\cdot}10^{-5}{\cdot}R$ – $1.6{\cdot}10^{-4}{\cdot}R$ $2.0{\cdot}10^{-5}{\cdot}R$ – $1.4{\cdot}10^{-4}{\cdot}R$ $4{\cdot}10^{-5}{\cdot}R$ – $7{\cdot}10^{-4}{\cdot}R$	
	AC Resistance Imaginary component			Values and uncertainties are given as relative values with respect to the nominal resistance value R_{nom}
	-1.0 mΩ/Ω – +1.0 mΩ/Ω for R_{nom} = 10 Ω – 100 Ω	50 Hz – 2 kHz 2 kHz – 10 kHz	$1.3{\cdot}10^{-4}{\cdot}R$ – $5{\cdot}10^{-4}{\cdot}R$ $3{\cdot}10^{-4}{\cdot}R$ – $1.4{\cdot}10^{-3}{\cdot}R$	
	-1.0 mΩ/Ω – +1.0 mΩ/Ω for R_{nom} = 100 Ω – 1 kΩ	50 Hz – 2 kHz 2 kHz – 10 kHz	$1.0{\cdot}10^{-4}{\cdot}R$ – $3{\cdot}10^{-4}{\cdot}R$ $2{\cdot}10^{-4}$ – $1.0{\cdot}10^{-3}{\cdot}R$	
	-1.0 mΩ/Ω – +1.0 mΩ/Ω for R_{nom} = 1 kΩ – 10 kΩ	50 Hz – 2 kHz 2 kHz – 10 kHz	$3{\cdot}10^{-5}{\cdot}R$ – $2.0{\cdot}10^{-4}{\cdot}R$ $6{\cdot}10^{-5}{\cdot}R$ – $7{\cdot}10^{-4}{\cdot}R$	
	-1.0 mΩ/Ω – +1.0 mΩ/Ω for R_{nom} = 10 kΩ – 100 kΩ	50 Hz – 2 kHz 2 kHz – 10 kHz	$3{\cdot}10^{-5}{\cdot}R$ – $2{\cdot}10^{-4}{\cdot}R$ $6{\cdot}10^{-5}{\cdot}R$ – $7{\cdot}10^{-4}{\cdot}R$	
	-1.0 mΩ/Ω – +1.0 mΩ/Ω for R_{nom} = 100 kΩ – 1 MΩ	50 Hz – 2 kHz 2 kHz – 10 kHz	$1.0{\cdot}10^{-4}{\cdot}R$ – $3{\cdot}10^{-4}{\cdot}R$ $1.4{\cdot}10^{-4}{\cdot}R$ – $1.0{\cdot}10^{-3}{\cdot}R$	
LF 64	Capacitance			For measurements made using a three terminal configuration. Measurements can also be made in a two terminal configuration over the same capacitance and frequency
	10 pF 100 pF 1 pF – 1 000 pF 10 nF – 1 µF	1 kHz; 1.592 kHz 1 kHz; 1.592 kHz 1 kHz 1 kHz	$3{\cdot}10^{-7}{\cdot}C$ $3{\cdot}10^{-7}{\cdot}C$ $5{\cdot}10^{-6}{\cdot}C$ $1.0{\cdot}10^{-5}{\cdot}C$ – $5{\cdot}10^{-5}{\cdot}C$	

LF00	DC/LF Electricity			
HCS code	Measured quantity, Range	Frequency	CMC	Remarks
	1 pF 1 pF 10 pf 10 pF 100 pF 100 pF 1 nF 1 nF 10 nF 10 nF 100 nF 100 nF 1 µF 1 µF	50 Hz – 1 kHz 1 kHz – 10 kHz 50 Hz – 1 kHz 1 kHz – 10 kHz 50 Hz – 1 kHz 1 kHz – 10 kHz 50 Hz – 1 kHz 1 kHz – 10 kHz 50 Hz – 1 kHz 1 kHz – 10 kHz 50 Hz – 1 kHz 1 kHz – 10 kHz 50 Hz – 1 kHz 1 kHz – 10 kHz	$1.0 \cdot 10^{-4} \cdot C$ – $5 \cdot 10^{-6} \cdot C$ $5 \cdot 10^{-6} \cdot C$ – $4 \cdot 10^{-5} \cdot C$ $8 \cdot 10^{-5} \cdot C$ – $3 \cdot 10^{-6} \cdot C$ $3 \cdot 10^{-6} \cdot C$ – $4 \cdot 10^{-5} \cdot C$ $8 \cdot 10^{-5} \cdot C$ – $3 \cdot 10^{-6} \cdot C$ $3 \cdot 10^{-6} \cdot C$ – $4 \cdot 10^{-5} \cdot C$ $8 \cdot 10^{-5} \cdot C$ – $5 \cdot 10^{-6} \cdot C$ $5 \cdot 10^{-6} \cdot C$ – $6 \cdot 10^{-5} \cdot C$ $1.5 \cdot 10^{-4} \cdot C$ – $1.0 \cdot 10^{-5} \cdot C$ $1.0 \cdot 10^{-5} \cdot C$ – $1.5 \cdot 10^{-4} \cdot C$ $3 \cdot 10^{-4} \cdot C$ – $2.0 \cdot 10^{-5} \cdot C$ $2.0 \cdot 10^{-5} \cdot C$ – $3.1 \cdot 10^{-4} \cdot C$ $6 \cdot 10^{-4} \cdot C$ – $5 \cdot 10^{-5} \cdot C$ $5 \cdot 10^{-5} \cdot C$ – $7 \cdot 10^{-4} \cdot C$	range but the uncertainties will be increased.
LF 65	10 pF – 100 nF	45 Hz – 65 Hz	$2.0 \cdot 10^{-5} \cdot C$	Input voltage 1 kV – 100 kV Current 5 µA – 10 A
LF 67	Inductance			
	100 µH	1 kHz	$3 \cdot 10^{-4} \cdot L$	
	1 mH	1 kHz	$2.0 \cdot 10^{-4} \cdot L$	
	10 mH	1 kHz	$2.0 \cdot 10^{-4} \cdot L$	
	100 mH	400 Hz 1 kHz 1.592 kHz	$1.5 \cdot 10^{-4} \cdot L$ $1.5 \cdot 10^{-4} \cdot L$ $1.5 \cdot 10^{-4} \cdot L$	
	1 H	100 Hz 200 Hz 400 Hz 1 kHz 1.592 kHz	$3 \cdot 10^{-4} \cdot L$ $2.0 \cdot 10^{-4} \cdot L$ $1.5 \cdot 10^{-4} \cdot L$ $1.5 \cdot 10^{-4} \cdot L$ $1.5 \cdot 10^{-4} \cdot L$	
	10 H	100 Hz 200 Hz 400 Hz 1 kHz	$3 \cdot 10^{-4} \cdot L$ $2.0 \cdot 10^{-4} \cdot L$ $1.5 \cdot 10^{-4} \cdot L$ $2.0 \cdot 10^{-4} \cdot L$	
LF 68	Dissipation factor *DF* -0.1 rad – +0.1 rad	45 Hz – 65 Hz	$1.0 \cdot 10^{-5}$ *rad* + $5 \cdot 10^{-3} \cdot DF$ (*DF* in rad)	Input voltage 1 kV – 100 kV Current 5 µA – 10 A

RF 00	High Frequency Electricity			
HCS code	Measured quantity, Range	Frequency	CMC*	Remarks
RF 21	Impedance (reflection factor) $\|\rho\| \leq 1$	9 kHz – 18 GHz 9 kHz – 18 GHz 9 kHz – 33 GHz 9 kHz – 40 GHz 9 kHz – 50 GHz	$0.002 + 0.001 \cdot \rho^2$ – $0.003 + 0.001 \cdot \rho^2$ $0.003 + 0.001 \cdot \rho^2$ – $0.004 + 0.001 \cdot \rho^2$ $0.003 + 0.001 \cdot \rho^2$ – $0.004 + 0.002 \cdot \rho^2$ $0.005 + 0.003 \cdot \rho^2$ – $0.012 + 0.004 \cdot \rho^2$ $0.003 + 0.003 \cdot \rho^2$ – $0.005 + 0.004 \cdot \rho^2$	GPC7 (50 Ω) Type-N (50 Ω) 3.5 mm (50 Ω) Type-K 2.92 mm (50 Ω) 2.40 mm (50 Ω)
RF 22	Attenuation			
	L = 0 dB – 50 dB *L* = 50 dB – 60 dB *L* = 60 dB – 70 dB *L* = 70 dB – 80 dB	50 kHz – 18 GHz	$(0.010 + 0.001 \cdot L)$ dB 0.080 dB – 0.090 dB 0.180 dB – 0.220 dB 0.550 dB – 0.680 dB	GPC7, Type-N (50 Ω)
	L = 0 dB – 50 dB *L* = 50 dB – 60 dB	50 kHz – 33 GHz	$(0.010 + 0.001 \cdot L)$ dB 0.080 dB – 0.120 dB	3.5 mm (50 Ω)
	L = 0 dB – 50 dB *L* = 50 dB – 60 dB	50 kHz – 40 GHz	$(0.010 + 0.001 \cdot L)$ dB 0.080 dB – 0.120 dB	Type-K 2.92 mm (50 Ω)
	L = 0 dB – 50 dB *L* = 50 dB – 60 dB	50 kHz – 50 GHz	$(0.010 + 0.001 \cdot L)$ dB 0.080 dB – 0.120 dB	2.40 mm (50 Ω)
RF 30	RF Power			
	Calibration Factor 0-1	9 kHz – 18 GHz 9 kHz – 33 GHz 9 kHz – 50 GHz	$0.005\ cf \cdot – 0.015 \cdot cf$ $0.005 \cdot cf – 0.020 \cdot cf$ $0.005 \cdot cf – 0.030 \cdot cf$	GPC7, Type-N (50 Ω) 3.5 mm (50 Ω) 2.40 mm (50 Ω) *cf* = Calibration factor *P* = 1 µW – 10 mW
	Absolute Power 1 µW – 10 mW	9 kHz – 18 GHz 9 kHz – 33 GHz 9 kHz – 50 GHz	$0.005 \cdot P – 0.015 \cdot P$ $0.005 \cdot P – 0.020 \cdot P$ $0.005 \cdot P – 0.030 \cdot P$	GPC7, Type-N (50 Ω) 3.5 mm (50 Ω) 2.40 mm (50 Ω)
RF 50	Electrical/magnetic field quantities			
	DC to LF electric field strength 0.001 kV/m – 20 kV/m	0 Hz – 10 kHz	$0.5 \cdot 10^{-2} \cdot E – 1.5 \cdot 10^{-2} \cdot E$	Generating between parallel plates
	ELF/VLF magnetic field strength 0.01 kA/m – 15 kA/m	10 Hz – 100 kHz	$5 \cdot 10^{-2} \cdot H – 3 \cdot 10^{-2} \cdot H$	Generating by 3D Helmholtz coil

RF 00	High Frequency Electricity			
HCS code	Measured quantity, Range	Frequency	CMC*	Remarks
	RF electrical field strength			
	sensors up to 0.5 m 0.01 V/m – 100 V/m	1 kHz – 100 MHz	$5 \cdot 10^{-2} \cdot E$	Radiant Flux Density in TEM cells, Crawford type
	sensors up to 30 mm 0.05 V/m – 350 V/m	100 MHz – 500 MHz	$3 \cdot 10^{-2} \cdot E$	
	sensors up to 3 mm 1 V/m – 100 V/m	1 MHz – 1 300 MHz	$2.0 \cdot 10^{-2} \cdot E$ – $3 \cdot 10^{-2} \cdot E$	
	+ corresponding values expressing the magnetic field strength, H in [A/m] or the power flux density, S in [W/m^2]			$H = E/(120 \cdot \pi)$ [A/m] $S = E^2 / (120 \cdot \pi)$ [W/m^2]
	in tapered cell 1 V/m – 30 V/m	0.6 GHz – 2 GHz	$5 \cdot 10^{-2} \cdot E$ – $10 \cdot 10^{-2} \cdot E$	

MQ 00	Magnetic Quantities			
HCS code	Quantity, Instrument, Measure	Measuring range	Best measurement capability (k=2)	Remarks
MQ 10	Magnetic flux density	5 µT – 50 mT (generating)	$2.0 \cdot 10^{-2} \cdot B$ – $0.1 \cdot 10^{-2} \cdot B$	Hall probes, fluxgate
		50 mT – 2 T (generating)	$2.0 \cdot 10^{-4} \cdot B$	NMR probes
		1 mT – 2 T (measuring)	$2.0 \cdot 10^{-2} \cdot B$ – $0.1 \cdot 10^{-2} \cdot B$	air coils; reference magnets
		+ corresponding values expressing the magnetic field strength [A/m]		

TF 00	Time and Frequency			
HCS code	Measured quantity, Range	Frequency	CMC	Remarks
TF 11	UTC-time			
	Local clock versus UTC (VSL) 0 ns – 1 s		1.0 ns	2 U_m = 0.1 V – 10 V $t_{avg} \geq$ 10 ks
	Local clock versus UTC 0 ns – 1 s		10 ns	2 U_m = 0.1 V – 10 V $t_{avg} \geq$ 10 ks
TF 21	Frequency			
	Frequency measurement	5; 10 MHz	$2.0 \cdot 10^{-13} \cdot f$	2 U_m = 0.1 V – 1 V $t_{avg} \geq$ 10 ks

TF 00	Time and Frequency			
HCS code	Measured quantity, Range	Frequency	CMC	Remarks
		1 mHz – 1.3 GHz	$2.0 \cdot 10^{-10} \cdot f /$ (gate time s)	2 U_m = 0.1 V – 1 V gate time = 1 µs – 10 ks
		1.3 GHz – 26 GHz	1.0 Hz	level: -10 dBm – +7 dBm
	Frequency difference	(0.1; 1; 2.5; 5; 10) MHz	$1.0 \cdot 10^{-11} \cdot f / \sqrt{(t_{avg} \text{ in s})}$	2 U_m = 0.1 V – 1 V t_{avg} = 0.1 s – 10 ks
	Frequency generation	1, 5, 10 MHz	$2.0 \cdot 10^{-13} \cdot f$	U_{eff} ≥1 V t_{avg} ≥ 10 ks
		1 kHz – 4.3 GHz	$1.0 \cdot 10^{-11} \cdot f / \sqrt{(t_{avg} \text{ in s})}$	level: -140 dBm – +13 dBm t_{avg} = 0.1s – 10 ks
		4 GHz – 26 GHz	1 Hz	level: -60 dBm – +13 dBm
TF 22	Time interval			
	Single shot 0 ns – 1 000 s		1.0 ns + trigger error	2 U_m = 0.1 V – 10 V
	Period 0 ns – 1 000 s		100 ps	2 U_m = 0.1 V – 10 V periodic signals
	Stopwatches, time base 0.01 s/d – 300 s/d		0.010 s/d	
	Oscilloscopes, time base		$1.0 \cdot 10^{-7}$ s/s	
TF 24	Rise time			
	10 ps – 1 ns 1 ns – 1 µs		2.5 ps – 0.035 ns 0.035 ns – 0.035 µs	U_m = 0.01 V – 0.25 V t_{rep} < 200 kHz U_{gen} terminated in 50 Ω
	0.1 ns – 10 ns 10 ns – 1 µs		0.035 ns – 0.22 ns 0.22 ns – 21 ns	U_m = 0.25 V – 5 V U_{gen} terminated in 50 Ω

DM 00	Dimensional Quantities			
HCS code	Quantity, Instrument, Measure	Measuring range	CMC[1]	Remarks *
	* $Q[X\,;\,Y] = \sqrt{X^2 + Y^2}$			
DM 01	Laser wavelength			
	vacuum wavelength absolute frequency	633 nm 474 THz	0.04 fm 24 kHz	Stabilised laser of the "mise en pratique". Optical beat frequency
	vacuum wavelength, λ_0	633 nm	$1{\cdot}10^{-9}{\cdot}\lambda_0$	Stabilised laser. Optical beat frequency
	Laser interferometer counting system	0 m – 50 m	$Q[0.015\ \mu m\ ;\ 2{\cdot}10^{-8}{\cdot}L]$	Comparison with reference interferometer Environmental sensors and optics of laser interferometer not taken into account
	Laser frequency	474 THz	4 kHz	Stabilized laser of Mise en Pratique with optical femtosecond comb generator; sample time 10 s
	Laser vacuum wavelength	633 nm	5.4 am	Stabilized laser of Mise en Pratique with optical femtosecond comb generator; sample time 10 s
	Laser frequency	563 THz	4.4 kHz	Stabilized laser of Mise en Pratique with optical femtosecond comb generator; sample time 10 s
	Laser vacuum wavelength	532 nm	4.2 am	Stabilized laser of Mise en Pratique with optical femtosecond comb generator; sample time 10 s
	laser frequency, ν_0	330 THz – 577 THz	$1{\cdot}10^{-9}{\cdot}\nu_0$	Stabilized laser with optical femtosecond comb generator; sample time 10 s
	laser vacuum wavelength, λ_0	530 nm – 1 000 nm	$1{\cdot}10^{-9}{\cdot}\lambda_0$	Stabilized laser with optical femtosecond comb generator; sample time 10 s
DM 10	Gauge blocks central length steel tungsten carbide	 0.1 mm – 100 mm 0.1 mm – 100 mm	 $Q[20\ nm\ ;\ 2.2{\cdot}10^{-7}{\cdot}L]$ $Q[20\ nm\ ;\ 1.5{\cdot}10^{-7}{\cdot}L]$	Interferometry, exact fractions
	Gauge blocks central length steel tungsten carbide	 100 mm – 1 000 mm 100 mm – 1 000 mm	 $Q[20\ nm\ ;\ 2.0{\cdot}10^{-7}{\cdot}L]$ $Q[20\ nm\ ;\ 1.3{\cdot}10^{-7}{\cdot}L]$	Interferometry, exact fractions

DM 00	Dimensional Quantities			
HCS code	Quantity, Instrument, Measure	Measuring range	CMC[1]	Remarks *
	Gauge blocks central length steel tungsten carbide	 0.1 mm – 100 mm 0.1 mm – 100 mm	 $Q[0.044\ \mu m; 0.91\cdot10^{-6}\cdot L]$ $Q[0.044\ \mu m; 0.91\cdot10^{-6}\cdot L]$	Mechanical comparison with reference gauges of the same nominal length and the same material
	Gauge blocks coefficient of thermal expansion	$-5\cdot10^{-6} \leq \alpha \leq +30\cdot10^{-6}\ K^{-1}$	$\geq 5.5\cdot10^{-8}\ K^{-1}$	Interferometry, exact fractions Length artefact: 150 mm – 1 000 mm Temperature range: 18 °C – 22 °C
	Length bar (circular cross section): central length	100 mm – 1 000 mm	$Q[0.22\ \mu m; 1.18\cdot10^{-6}\cdot L]$	CMM and laser Interferometer
	Gauge blocks central length	100 mm – 1 000 mm	$Q[0.22\ \mu m ; 1.18\cdot10^{-6}\cdot L]$	CMM and laser Interferometer
	Gauge blocks central length	100 mm – 500 mm	$Q[0.056\ \mu m; 0.82\cdot10^{-6}\cdot L]$	Mechanical comparison
DM 10	Step gauges Front faces Rear faces Parallelism	0 mm – 1 100 mm	$Q[0.12\ \mu m ; 0.65\cdot10^{-6}\cdot L]$ $Q[0.12\ \mu m ; 0.65\cdot10^{-6}\cdot L]$ $Q[0.15\ \mu m]$	CMM and laserinterferometer
	Depth (groove) standard (ISO 5436-1 (1985) type A): step height (depth) H	0 nm – 3 000 nm	$Q[1.4\ nm ; 14\cdot10^{-3}\cdot H]$	Interference microscope Minimum groove width: 100 µm
	Thermal expansion artefact (step gauges and others): coefficient of thermal expansion	$-5\cdot10^{-6} \leq \alpha \leq +30\cdot10^{-6}\ K^{-1}$	$1.5\cdot10^{-7}\ K^{-1}$	CMM, laser interferometer with plane mirror Cross section: (5 × 5) mm to (50 × 100) mm Length artefact: 25 mm – 1000 mm Temp range: 16 °C – 26 °C
	Thermal expansion artefact: coefficient of thermal expansion	$-5\cdot10^{-6} \leq \alpha \leq +30\cdot10^{-6}\ K^{-1}$	$5.5\cdot10^{-8}\ K^{-1}$	Interferometry, exact fractions Cross section: (5 × 5) to (20 × 35) mm^2 Length artefact: 150 mm – 1 000 mm Temp range: 18 °C – 22 °C

DM 00	Dimensional Quantities			
HCS code	Quantity, Instrument, Measure	Measuring range	CMC[1]	Remarks *
DM 20	Precision line scales: line spacing	Up to 1020 mm expansion coefficient $\alpha = 8 \cdot 10^{-6}\ K^{-1}$ $\alpha = 3 \cdot 10^{-8}\ K^{-1}$	 Q[0.03 µm ; $5 \cdot 10^{-7} \cdot L$] Q[0.03 µm ; $1.7 \cdot 10^{-7} \cdot L$]	1-D measuring machine, CCD microscope, laser interferometer
	Precision line scales: line spacing	0 m – 2 m 0 m – 3 m 0 m – 4 m	Q[0.62 µm ; $3.0 \cdot 10^{-6} \cdot L$] Q[0.80 µm ; $3.0 \cdot 10^{-6} \cdot L$] Q[0.98 µm ; $3.0 \cdot 10^{-6} \cdot L$]	1-D measuring machine, CCD microscope, laser interferometer
	Levelling rod: line spacing	0 m – 3 m	Q[20 µm ; $5 \cdot 10^{-6} \cdot L$]	1-D measuring machine, optical sensor, line scale
	Levelling rod: spacing between reference line and support	0 mm – 100 mm	20 µm	1-D measuring machine, optical microscope, line scale
DM 30	Length measuring instrument displacement *L*	0 m – 20 m	Q[0.2 µm ; $1.0 \cdot 10^{-6} \cdot L$]	Laser interferometer
	Height measuring instrument: error of indicated displacement *L*	0 m – 2 m	Q[0.22 µm ; $17 \cdot 10^{-7} \cdot L$]	Laser interferometer
	Displacement transducers (inductive, incremental e.g.): displacement *L*	0 µm – 12 µm	8 nm	Digital piezo transducer
	Displacement transducers (inductive, incremental e.g.): displacement *L*	0 mm – 100 mm	Q[0.06 µm ; $1.0 \cdot 10^{-6} \cdot L$]	1D measuring machine with laser interferometer. resolution: 0.01 µm displacement: 100 mm
	1D displacement actuator (dial gauge tester): displacement	0 mm – 25 mm	Q[0.09 µm ; $1.4 \cdot 10^{-6} \cdot L$]	Laser interferometer
	Measuring projector: error of indicated length error of indicated angle squareness of measurement axis	 10 mm – 200 mm 0 ° – 360 ° 3 ° – 3 600 °	 Q[0.4 µm ; $2.2 \cdot 10^{-6} \cdot L$] 2.6 ’ 19 ”	Grid plate Max. area: (200 × 200) mm
	Gauge block mechanical comparator: error of indicated difference *D*	-6 µm – +6 µm	17 nm	Gauge block set Max gauge block length 100 mm

DM 00	Dimensional Quantities			
HCS code	Quantity, Instrument, Measure	Measuring range	CMC[1]	Remarks *
	Laser distance meter (EDM) error of indicated distance *L*	500 mm – 50 000 mm	Q[0.7 mm ; $1.5{\cdot}10^{-2}\cdot L$]	50 m measuring bench with laserinterferometer. *L* in mm
DM 40	Diameter			
	External cylinders (plug gauge, piston): diameter *D*	2.5 mm – 400 mm	*Q*[0.20 µm ; $0.88{\cdot}10^{-6}\cdot D$]	CMM and laser interferometer
	External cylinders (wires, pin): diameter *D*	0.1 mm – 100 mm	Q[0.20 µm;$1.07{\cdot}10^{-6}{\cdot}D$]	1-D measuring machine with laser interferometer. Repeatability ≤ 0.05 µm Influence roundness deviation ≤ 0.03 µm
	Internal cylinders (ring): diameter *D*	1.5 mm – 4 mm	*Q*[0.20 µm ; $0.88{\cdot}10^{-6}{\cdot}D$]	CMM, laser interferometer with plane mirror
	Internal cylinders (ring): diameter *D*	4 mm – 400 mm	*Q*[0.10 µm ; $1.1{\cdot}10^{-6}{\cdot}D$]	CMM, laser interferometer with plane mirror
	Spheres (ball): diameter *D*	12 mm – 60 mm	*Q*[0.10 µm ; $0.8{\cdot}10^{-6}{\cdot}D$]	CMM, laser interferometer with plane mirror
	Diameter standards (ball): diameter *D*	0.5 mm – 12 mm	0.030 µm	Interferometry exact fractions, indentation correction Uncertainty in nm D: Diameter in mm
	Spheres (ball): diameter *D*	0.5 mm – 1.5 mm 1.5 mm – 15 mm	0.30 µm 0.28 µm	1D measuring machine with laser interferometer, reference ball
DM 50	Form error			
	90° steel/granite square: squareness straightness	90 ° 0 µm – 500 µm	1 µm 0.2 µm	Reversal technique on a CMM Orientation: horizontal Max. size: 1 200 mm × 400 mm
	90° cylinder square: Squareness	90 °	0.5 µm (1.5 ")	Reversal technique on a CMM Orientation: horizontal Max. length: 1 200 mm Diameter: 50 mm – 300 mm
	90° cylinder square: Straightness	0 µm – 500 µm	0.2 µm	Reversal technique on a CMM Orientation: horizontal Max. length: 1 200 mm Diameter: 50 mm – 300 mm
	Optical flat: Flatness	0 µm – 0.3 µm	22 nm	Fizeau interferometer Diameter: 10 mm – 100 mm

DM 00	Dimensional Quantities			
HCS code	Quantity, Instrument, Measure	Measuring range	CMC[1]	Remarks *
	Optical flat: Flatness	0 µm – 25 µm	$Q[0.032\ \mu m\ ;\ 1.8\cdot10^{-10}\cdot D]$	CMM with electronic levels Diam.: 100 mm – 400 mm D = diameter
	Optical flats: combined parallelism/flatness	0 µm – 12 µm	0.044 µm	Gauge block comparator Diameter: 10 mm – 60 mm
	Surface plate: Flatness	0 µm – 250 µm	$Q[0.32\ \mu m\ ;\ 6\cdot10^{-8}\cdot L]$	Electronic levels Minimum size L × L: 0.1 m × 0.1 m L = length of the longest side of the surface plate
	Cylindrical artefacts + spheres (ball): roundness deviation R	0 µm – 2 µm	60 nm + 0.03·*R*	Roundness measuring machine, spindle correction. Diameter external cylinders (plugs): 2.5 mm – 160 mm Diameter internal cylinders (rings): 4 mm – 160 mm
	Sphere (hemispheres): roundness deviation R	0 µm – 1 µm	10 nm + 0.030·*R*	Roundness measuring machine, error separation Diameter: 2.5 mm – 160 mm
	Straightness artefacts: straightness deviation	0 µm – 500 µm	0.2 µm	Electronic levels; Cylindrical artefacts: Length: 100 mm – 1 100 mm Diameter: 20 mm – 300 mm Cubic artefacts, length: 100 mm – 3 000 mm Width: ≥ 25 mm
	Levelling rod: form deviation of support	0 µm – 1 mm	20 µm	CMM
DM 90	Angle			
	Autocollimator: error of indicated angle	-425” – +425 ”	0.5 ”	Sine bar, dial gauge tester
	Electronic level: error of indicated inclination angle	-2 500 µm/m – +2 500 µm/m	0.94 µm/m	Sine bar, dial gauge tester
	Clinometers: error of indicated inclination angle	0 ° – 360 °	0.012 °	Index table
	Theodolite	0 GON – 400 GON 0 ° – 360 °	0.5 mGON	

DM 00	Dimensional Quantities			
HCS code	Quantity, Instrument, Measure	Measuring range	CMC[1]	Remarks *
DM100	Angle gauges: included angle	0 ° – 180 °	0.5 ”	Autocollimator and rotary table
	Optical polygons: face angle	5 ° – 120 °	0.2 ”	2 autocollimators, full closure No. of faces: 3 – 72
	Optical square (pentaprism): deviation angle	90 °	0.2 ”	2 autocollimators, full closure

Annex to ISO/IEC 17025:2005 declaration of accreditation for registration number: **K 999**

of **VSL B.V.**

This annex is valid from: **24-01-2018** to **01-11-2021** Replaces annex dated: **03-10-2016**

MW 10	Mass			
HCS code	Quantity, Instrument, Measure	Measuring range	CMC*	Remarks
MW 11	Mass	1 mg – 100 mg 0.1 g – 1 g 1 g – 10 g 10 g – 100 g 0.1 kg – 1 kg 1 kg – 10 kg 10 kg – 20 kg	0.6 μg – 1.5 μg 1.5 μg – 3 μg 3 μg – 6 μg 6 μg – 15 μg 15 μg – 100 μg 0.1 mg – 1.5 mg 1.5 mg – 10 mg	stainless steel mass standards

PV 00	Pressure and Vacuum			
HCS code	Quantity, Instrument, Measure	Measuring range	CMC*	Remarks
PV 11	Absolute pressure	5 kPa – 350 kPa 350 kPa – 7 000 kPa 7 MPa* – 20 MPa*	0.019 Pa + $15 \cdot 10^{-6} \cdot p$ 0.08 Pa + $15 \cdot 10^{-6} \cdot p$ 0.1 Pa + $38 \cdot 10^{-6} \cdot p$	Gas Gas Gas
PV 12	Gauge pressure	0 kPa – 500 kPa 0.5 MPa – 20 MPa	0.019 Pa + $15 \cdot 10^{-6} \cdot p_e$ 0.06 Pa + $15 \cdot 10^{-6} \cdot p_e$	Gas Gas
	Differential pressure	0 MPa – 10 MPa	4Pa + $4 \cdot 10^{-5} \cdot p_d$ + $1{,}2 \cdot 10^{-6} \cdot p_l$	Gas, max. Line pressure 10 MPa p_d= differential pressure p_l = Line pressure
	Negative Gauge pressure	-0.5 kPa – -100 kPa	$5 \cdot 10^{-5} \cdot p_e$	Gas
PV 21	Absolute pressure	1 MPa* – 80 MPa* 80 MPa* – 500 MPa*	6 Pa + $4 \cdot 10^{-5} \cdot p$ 25 Pa + $65 \cdot 10^{-6} \cdot p$	Oil Oil
PV 22	Gauge pressure	1 MPa – 80 MPa 80 MPa – 500 MPa	0.18 Pa +$15 \cdot 10^{-6} \cdot p_e$ 27 Pa + $54 \cdot 10^{-6} \cdot p_e$	Oil Oil $p_e = p – p_{amb}$; p_e = gauge pressure, p_{amb} = ambient pressure * Pressure balance + barometer

DV 10	Density, Viscosity			
HCS code	Quantity, Instrument, Measure	Measuring range	CMC*	Remarks
DV 10	Density and viscosity			
DV 11	Density of liquids	998 kg/m^3	0.001 %	Liquids, water
DV 12	Viscosity of liquids Kinematic and dynamic Viscosity	0.6 mm^2/s – 80 000 mm^2/s	0.1 % – 0.5 %	Newtonian liquids, 15 °C – 100 °C

VL 10	Volume of flowing liquids			
HCS code	Quantity, Instrument, Measure	Measuring range	CMC*	Remarks
VL 11	Volume capacity measures	0.001 L – 3 000 L 10 L – 3 000 L 0.5 L – 200 L	0.02 % – 0.01 % 0.02 % 0.02 %	Dordrecht, on location Weighing method Master meter Volumetric method
	Pipettes	1 mL – 25 L	0.005 % – 0.02 %	Weighing method
	Burettes	1 mL – 1 L	0.005 % – 0.02 %	Weighing method
	Provers (water + mineral products)	1 L – 650 L 10 L – 650 L 100 L – 30 000 L	0.01 % – 0.02 % 0.02 % – 0.04 % 0.02 % – 0.04 %	Weighing method Reference volume Master meter
	Sinkers (water)	10 cm^3 – 200 cm^3	0.01 % – 0.02 %	Weighing method
	Pyknometers (water)	10 cm^3 – 200 cm^3	0.01 % – 0.02 %	Weighing method

FG 10		Flow of Gas		
HCS code	Quantity, Instrument, Measure	Measuring range	CMC*	Remarks
FG 11	Gas Flow rate			Delft
	Low Pressure Gas			
		$2{\cdot}10^{-5}$ m^3/h – $18{\cdot}10^{-3}$ m^3/h	0.40 %	Displacement prover system
		$18{\cdot}10^{-3}$ m^3/h – 3.5 m^3/h	0.20 %	Displacement prover system
		1 m^3/h – 400 m^3/h	0.09 %	Displacement prover system
		$16{\cdot}10^{-3}$ m^3/h – 16 m^3/h	0.2 % – 0.4 %	Master meter method
		15 m^3/h – 15 000 m^3/h	0.15 %	Master meter method
	High Pressure Gas	5 m3/h – 230 m3/h	0.29 % – 0.06 %	Gas Oil Piston Prover
	High Pressure Natural Gas	5 m3/h – 20 m3/h 20 m3/h – 2 000 m3/h	0.30 % – 0.1 % 0.1 %	VSL Traceability System (2 mobile transfer units)
FG 13	Velocity of gases			
	Air velocity	0.1 m/s – 1.0 m/s	3.2/v – 12.2 %	Delft
		1 m/s – 2 m/s	2 %	Delft
		21 m/s – 35 m/s	1 %	Delft

FL 10	Flow of Liquids			
HCS code	Quantity, Instrument, Measure	Measuring range	CMC*	Remarks
FL 11	Mass flow rate	0.25 g/h – 5 g/h	0.10 % – 1.4 %	Delft
		5 g/h – 100 g/h	0.10 %	
		100 g/h – 200 g/h	0.05 %	
				Dordrecht
	Mass flow meters (water)	0.001 t/h – 400 t/h	0.02 % – 0.025 %	Weighing method
	Mass flow meters (water)	0.8 t/h – 400 t/h	0.02 % – 0.025 %	Pipe prover method
	Mass flow meters (water)	0.1 t/h – 400 t/h	0.04 % – 0.045 %	Master meter method
FL12	Volume flow rate			Dordrecht
	flow meters (water)	0.001 m^3/h – 400 m^3/h	0.02 % – 0.025 %	Weighing method
	flow meters (water)	0.8 m^3/h – 400 m^3/h	0.02 % – 0.025 %	Pipe prover method
	flow meters (water)	0.1 m^3/h – 400 m^3/h	0.04 % – 0.045 %	Master meter method

OQ 10	Optical Quantities			
HCS code	Quantity, Instrument, Measure	Measuring range	CMC*	Remarks
OQ 11	Radiometric quantities			
	Responsivity, laser power	< 1 mW 1 mW – 10 mW	0.5 % 0.8 %	488, 532, 543, 633 nm Reference Detector
	Responsivity, spectral, irradiance	100 µW/cm^2 – 10 mW/cm^2	10 %	365 nm Reference Detector
	Responsivity, spectral, irradiance	AW^{-1}m^2, VW^{-1}m^2	0.3 %	400 nm – 950 nm, Reference detector, Scanning spot method
	Responsivity, spectral	< 1 mW 300 nm – 380 nm 380 nm – 450 nm 450 nm – 900 nm 900 nm – 950 nm 950 nm – 1000 nm 1000 nm – 1250 nm 1250 nm – 1500 nm 1500 nm – 1600 nm	 0.38 % – 0.29 % 0.29 % – 0.07 % 0.07 % 0.07 % – 0.11 % 0.11 % – 0.43 % 0.9 % – 0.4 % 0.4 % 0.4 % – 1.5 %	Reference detector
	Radiant flux, spectral	380 nm – 780 nm	1.4% – 5.3%	Integrating sphere, Tungsten Source, LED Source

OQ 10	Optical Quantities			
HCS code	Quantity, Instrument, Measure	Measuring range	CMC*	Remarks
	Irradiance, spectral	250 nm – 400 nm	3.2 % – 1.6 %	(0.000 1 – 0.25) $Wm^{-2}nm^{-1}$ Tungsten Source, Spectroradiometer
		400 nm – 700 nm	1.6 % – 0.8 %	
		700 nm – 1000 nm	0.8 % – 1 %	
		1000 nm – 2000 nm	1 % – 4.2 %	
OQ 12	Photometric quantities			
	Gloss	0 – 100	1	Calibration of gloss meters or tablets in combination with a gloss meter. Reference plate
	Illuminance	0.03 lx – 20 lx	2.0 % – 1 %	Tungsten Source, Reference photometer
	Illuminance	20 lx – 7000 lx	1 %	Reference photometer
	Luminance	20 cd m^{-2} – 1000 cd m^{-2}	1.4 %	Reference photometer
	Luminous intensity	20 cd – 5000 cd	1 %	Reference photometer and reference ruler.
	Correlated colour temperature	2856 K – 3100 K	8 K	Spectroradiometer
		2500 K – 3200 K	10 K	Reference filter-radiometer.

OQ 10	Optical Quantities			
HCS code	Quantity, Instrument, Measure	Measuring range	CMC*	Remarks
	Luminous efficacy	0 W – 3000 W 15 lm – 4000 lm	1.1 %	Photogoniometer Tungsten Source, LED Source, Including power factor
	Luminous flux	15 lm – 4000 lm	1 %	Photogoniometer Tungsten Source base down, LED Source,
	Luminous efficacy	0 W – 3000 W 30 lm – 30000 lm	1.6 %	Integrating sphere, Tungsten Source, LED Source, Including power factor
	Luminous flux	30 lm – 30000 lm	1.5 %	
	Illuminance responsivity	A lx^{-1}, V lx^{-1}	0.3 %	Against illuminant A for x, y, and z photopic response
	Colour, emitted, x, y	0 – 0.9	0.0004	Based on spectral irradiance
	Colour, emitted, u, v	0 – 0.9	0.0001 – 0.0004 varies with measurand	Based on spectral irradiance
	Colour, emitted, u', v'	0 – 0.9	0.0002 – 0.0003 varies with measurand	Based on spectral irradiance
	Colour rendering, Ra	0 – 100	0.24	Based on spectral irradiance
OQ 13	Optical system properties			Properties of materials
	Absorption filters	1 – 0.00001	0.3 % – 1.7 % 0.07 % – 1.7 %	200 nm – 380 nm 380 nm – 1000 nm Relative measurement
	Spectral filters	1 – 0.00001	0.3 % – 1.7 % 0.07 % – 1.7 %	200 nm – 400 nm 380 nm – 1000 nm Relative measurement

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This annex is valid from: **24-01-2018** to **01-11-2021** Replaces annex dated: **03-10-2016**

IR 10	Ionising Radiation and Radioactivity			
HCS code	Quantity, Instrument, Measure	Measuring range**	CMC*	Remarks
IR 12	Dosimetric Quantities			
	Air kerma rate	0.05 nGy/s – 0.3 nGy/s	6 %	^{137}Cs
		0.3 nGy/s – 3 µGy/s	3 %	^{137}Cs
		1 nGy/s – 3 µGy/s	3 %	^{60}Co
		0.3 mGy/s – 20 mGy/s	0.48 %	^{60}Co
		3 µGy/s – 200 µGy/s	0.82 %	^{137}Cs
		30 nGy/s – 3 mGy/s	1.1 %	x-rays W -anode 20 kV – 50 kV
		30 nGy/s – 3 mGy/s	0.66 %	x-rays W-anode 50 kV – 320 kV
		60 µGy/s – 3 mGy/s	1.2 %	^{192}Ir based on calibration coefficients for x-ray W-anode 250 kV / 2.94 mm Cu and ^{137}Cs (Med. Phys.. 31, 2004 (2826))
	Reference Air Kerma Rate	10 nGy/s – 20 µGy/s	1.2 %	^{192}Ir
	Absorbed dose rate to water	0.3 mGy/s – 20 mGy/s	0.84 %	^{60}Co
		0.3 mGy/s – 400 mGy/s	0.84 %	1 – 25 MV photon beams
		0.3 mGy/s – 400 mGy/s	3.6 %	4 – 25 MeV electron beams based on ^{60}Co $N_{D,w}$ with NCS-18, IAEA TRS-398 or equivalent.

This annex is valid from: **24-01-2018** to **01-11-2021** Replaces annex dated: **03-10-2016**

IR 10	Ionising Radiation and Radioactivity			
HCS code	Quantity, Instrument, Measure	Measuring range**	CMC*	Remarks
IR 13	Radioprotection Quantities			
	Ambient dose equivalent / rate (ISO 4037)	0.2 µSv/h – 1 µSv/h	7 %	^{137}Cs
		1 µSv/h – 600 mSv/h	5 %	^{137}Cs
		4 µSv/h – 10 mSv/h	5 %	^{60}Co
		0.1 mSv/h – 600 mSv/h	5 %	x-rays W-anode 50 kV –320 kV
	Personal dose equivalent / rate (ISO 4037)	0.2 µSv/h – 1 µSv/h	7 %	^{137}Cs
		1 µSv/h – 600 mSv/h	5 %	^{137}Cs
		4 µSv/h – 10 mSv/h	5 %	^{60}Co
		0.1 mSv/h – 600 mSv/h	5 %	x-rays W-anode 50 kV – 320 kV
	Directional dose equivalent / rate (ISO 4037)	0.2 µSv/h – 1 µSv/h	7 %	^{137}Cs
		1 µSv/h – 600 mSv/h	5 %	^{137}Cs
		4 µSv/h – 10 mSv/h	5 %	^{60}Co
		0.1 mSv/h – 600 mSv/h	5 %	x-rays W-anode 50 kV – 320 kV

** Depends on actual dose rate of radioactive sources.

TE 10		Temperature		
HCS code	Quantity, Instrument, Measure	Measuring range	CMC*	Remarks
TE 10	Resistance thermometer			
	SPRT's and HT-SPRT's	-189.344 2 °C (Ar) -38.8344 °C (Hg) 0.01 °C (TPW) 29.764 6 °C (Ga) 156.598 5 °C (In) 231.928 °C (Sn) 419.527 °C (Zn) 660.323 °C (Al) 961.78 °C (Ag)	0.5 mK 0.25 mK 0.12 mK 0.31 mK 0.53 mK 0.6 mK 0.9 mK 3.4 mK 6 mK	On fixed points
	Resistance thermometer	-195 °C – -80 °C -80 °C – 0 °C 0 °C – 30 °C 30 °C – 70 °C 70 °C – 120 °C 120 °C – 300 °C 300 °C – 650 °C 650 °C – 850 °C	6 mK 4 mK 0.7 mK 0.9 mK 4 mK 6 mK 14 mK 0.2 °C	By comparison (including resistance thermometers with transmitter)
TE 30	Thermocouples			
	Thermocouples type S and R	419.527 °C (Zn) 660.323 °C (Al) 961.78 °C (Ag) 1 084.62 °C (Cu)	0.2 °C 0.15 °C 0.15 °C 0.21 °C	On fixed points and secondary fixed points
	Thermocouples type B	419.527 °C (Zn) 660.323 °C (Al) 961.78 °C (Ag) 1 084.62 °C (Cu)	0.25 °C 0.25 °C 0.25 °C 0.25 °C	On fixed points and secondary fixed points
	Thermocouples	-195 °C – -80 °C -80 °C – 650 °C 650 °C – 1 050 °C 1 050 °C – 1 550 °C	70 mK 60 mK 0.3 °C 1.3 °C – 3.5 °C	By comparison (including thermocouples with transmitter)

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TE 10	Temperature			
HCS code	Quantity, Instrument, Measure	Measuring range	CMC*	Remarks
TE 41	Self-indicating thermometers			
	Indicating thermometers	-195 °C – -80 °C -80 °C – 0 °C 0 °C – 30 °C 30 °C – 70 °C 70 °C – 120 °C 120 °C – 300 °C 300 °C – 650 °C 650 °C – 1 050 °C 1 050 °C – 1 550 °C	6 mK 4 mK 0.7 mK 0.9 mK 4 mK 6 mK 14 mK 0.3 °C 1.3 °C – 3.5 °C	By comparison (including liquid-in-glass thermometers)
	Dry block calibrator	-50 °C – 50 °C 50 °C – 250 °C 250 °C – 450 °C 450 °C – 800 °C 800 °C – 1 100 °C	0.05 °C 0.03 °C 0.05 °C 0.5 °C 1 °C	
	Ice point references	0 °C / room temperature	10 mK	
TE 91	Resistance thermometer	-200 °C – 850 °C	0.05 °C	Electrical calibration
TE 92	Thermocouples	over total range Base metals: J, L, K, T, U, N, E Noble metals: R, S, B	4 µV	Electrical calibration CMC in degrees Celsius depends on Seebeck coefficient of thermocouple type
TE 100	Contact thermometry			
TE 101	Primary references Fixed point cells	-189.344 2 °C (Ar) -38.8344 °C (Hg) 0.01 °C (TPW) 29.764 6 °C (Ga) 156.598 5 °C (In) 231.928 °C (Sn) 419.527 °C (Zn) 660.323 °C (Al) 961.78 °C (Ag)	0.5 mK 0.25 mK 0.1 mK 0.26 mK 0.4 mK 0.6 mK 0.9 mK 2.4 mK 5 mK	Direct comparison

RH 00	Humidity			
HCS code	Quantity, Instrument, Measure	Measuring range	CMC*	Remarks
RH 10	Dew point meters	-85 °C – -75 °C 0.1 MPa – 1 MPa	0.10 °C (0,1 – 0,04)°C	Against primary generator in two pressure mode with air and nitrogen
		-70 °C – -41 °C 0.1 MPa – 0.8 MPa	0.04 °C	Against primary generator in single pressure mode with air and nitrogen
		-41 °C – +15 °C 0.1 MPa – 6.0 MPa	0.04 °C	
		15 °C – 50 °C 0.1 Mpa	0.04 °C	
		50 °C – 95 °C 0.1 Mpa	0.05 °C	
		-50 °C – -15 °C 0.1 MPa - 0.5 MPa	0.04 °C	Against primary generator in single pressure mode with methane as carrier gas
		-15 °C – +8 °C 0.1 MPa – 3.0 MPa	0.04 °C	
		8 °C - 15 °C 0.1 MPa – 6.0 MPa	0.04 °C	
RH 13	Relative Humidity sensors	10 %rh – 95 %rh	0.3 %rh – 0.8 %rh	By comparison in climatic chamber at atmospheric pressure with air -10 °C < T < 0 °C
		10 %rh – 95 %rh	0.2 %rh – 0.6 %rh	0 °C <T < +70 °C
		1 %rh – 97 %rh	0.4 %rh – 0.8+ (5- t)/45x0.8) %rh	By comparison in climatic chamber between 50 kPa(a) and 600 kPa(a) with air -40 °C < T < 5 °C
		1 %rh – 97 %rh, $t_{d,max}$ = 150 °C	0.4 %rh – 0.8 %rh	5 °C < T < 180 °C
RH 14	Trace humidity meters	0.3 µmol/mol – 10 000 µmol/mol 0.1 Mpa	0.3 % – 2.0 %	Against primary generator in two pressure mode with air and nitrogen
RH 20	Other instruments for humidity			

RH 00	Humidity			
HCS code	Quantity, Instrument, Measure	Measuring range	CMC*	Remarks
	Air temperature	(-40 to -10) °C (-10 to 18) °C (18 to 25) °C (25 to 70) °C (70 to 180) °C	(0.13 to 0.11) °C (0.048 to 0.025) °C 0.025 °C (0.025 to 0.081) °C (0.10 to 0.16) °C	By comparison in climatic chamber at atmospheric pressure with air
RH 30	Generators for humidity	(-10 to 70) °C	(0.3 to 0.8) %rh	By comparison with dew point meter and air temperature sensor at atmospheric pressure
RH 36	Trace humidity in air and nitrogen	(10 to 1000) µmol/mol	1.3 %	By comparison with dewpoint meter

CH 00	Chemical Analysis			
HCS code	Quantity, Instrument, Measure	Measuring range	CMC*	Remarks
CH 01	Analytical instruments/monitors			Calibration of gas monitors and gas diluters
	Gas monitors-for the following components	Mole fractions	0.5 % – 5 % relative	Gas monitor calibration normally consists of zero and span adjustments and linearity check, using certified gas mixtures.
	CO in N_2	$1 \cdot 10^{-6} – 10 \cdot 10^{-2}$		
	CO_2 in N_2	$10 \cdot 10^{-6} – 20 \cdot 10^{-2}$		
	NO in N_2	$1 \cdot 10^{-6} – 1 \cdot 10^{-2}$		
	NO_2 in N_2	$1 \cdot 10^{-6} – 1 \cdot 10^{-3}$		
	SO_2 in N_2	$10 \cdot 10^{-6} – 1 \cdot 10^{-2}$		
	C_3H_8 in N_2	$10 \cdot 10^{-6} – 5 \cdot 10^{-2}$		
	O_2 in N_2	$100 \cdot 10^{-6} – 22 \cdot 10^{-2}$		
	C_2H_5OH in N_2	$100 \cdot 10^{-6} – 1 \cdot 10^{-3}$		
	H_2S in N_2	$10 \cdot 10^{-6} – 10 \cdot 10^{-3}$		
	SF_6 in N_2	$1 \cdot 10^{-9} – 1 \cdot 10^{-3}$		
	CH_4 in N_2	$1 \cdot 10^{-6} – 100 \cdot 10^{-6}$		
	N_2O in N_2	$0.3 \cdot 10^{-6} – 30 \cdot 10^{-6}$		
	NH_3 in N_2	$30 \cdot 10^{-6} – 300 \cdot 10^{-6}$		
	O_3 in purified air	$20 \cdot 10^{-9} – 500 \cdot 10^{-9}$	(2 - 1.6) %	Calibration of monitors and ozone generators
CH 02	Gas analysers			Performance evaluation according to ISO 10723:2012. Reference materials are the PSM's of VSL or CGM's traceable to VSL

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RM 00	Reference Materials

[1] PRM's are primary realizations of calibration gases produced and certified by VSL. (P002 scope)
[2] CGM's are produced by industry and certified by VSL. (K999 scope)

HCS code	Quantity, Instrument, Measure	Measuring range	CMC*	Remarks
RM 20	Gas mixtures			CGM's Analysed Gas Mixtures Conform ISO 6143
	CO in N_2	$1{\cdot}10^{-6}$ – $10{\cdot}10^{-2}$	1 % – 0.1 %	
	CO in synth. air	$1{\cdot}10^{-6}$ – $100{\cdot}10^{-6}$	1 % – 0.2 %	
	CO_2 in synth. air	$100{\cdot}10^{-6}$ – $1000{\cdot}10^{-6}$	0.4 % – 0.2 %	
	CO_2 in N_2	$10{\cdot}10^{-6}$ – $20{\cdot}10^{-2}$	0.8 % – 0.2 %	
	CH_4 in N_2	$0.1{\cdot}10^{-6}$ – $1{\cdot}10^{-6}$	5 % – 3 %	
	CH_4 in N_2	$1{\cdot}10^{-6}$ – $10{\cdot}10^{-2}$	1.5 % – 0.1 %	
	CH_4 in synth. air	$1{\cdot}10^{-6}$ – $1000{\cdot}10^{-6}$	3 % – 0.5 %	
	C_3H_8 in N_2	$1{\cdot}10^{-6}$ – $10{\cdot}10^{-6}$	1 % – 0.5 %	
	C_3H_8 in N_2	$10{\cdot}10^{-6}$ – $5{\cdot}10^{-2}$	0.7 % – 0.2 %	
	C_3H_8 in synth. air	$1{\cdot}10^{-6}$ – $10{\cdot}10^{-6}$	1 % – 0.5 %	
	C_3H_8 in synth. air	$10{\cdot}10^{-6}$ – $1000{\cdot}10^{-6}$	0.5 % – 0.2 %	
	O_2 in N_2	$1{\cdot}10^{-6}$ – $50{\cdot}10^{-2}$	5 % – 0.1 %	
	NO in N_2	$0.1{\cdot}10^{-6}$ – $1{\cdot}10^{-2}$	3.6 % – 0.2 %	
	NO_2 in synth. air or N_2	$0.1{\cdot}10^{-6}$ – $10{\cdot}10^{-6}$	3 % – 2%	
	NO_2 in synth. air or N_2	$10{\cdot}10^{-6}$ – $1000{\cdot}10^{-6}$	2 % – 1 %	
	N_2O in synth. air or N_2	$0.3{\cdot}10^{-6}$ – $1000{\cdot}10^{-6}$	3 % – 0.5 %	
	SO_2 in synth. air or N_2	$0.1{\cdot}10^{-6}$ – $2{\cdot}10^{-6}$	3% – 2%	
	SO_2 in N_2	$1{\cdot}10^{-6}$ – $10{\cdot}10^{-2}$	2 % – 0.2 %	
	SO_2 in synth. air	$1{\cdot}10^{-6}$ – $1000{\cdot}10^{-6}$	2 % – 0.5 %	
	H_2S in N_2	$1{\cdot}10^{-6}$ – $10{\cdot}10^{-6}$	4 % – 2 %	
	H_2S in N_2	$10{\cdot}10^{-6}$ – $1000{\cdot}10^{-6}$	2 % – 1 %	
	H_2S in CH_4	$10{\cdot}10^{-6}$ – $100{\cdot}10^{-6}$	3 % – 2 %	
	C_2H_5OH in synth. air or N_2	$75{\cdot}10^{-6}$ – $800{\cdot}10^{-6}$	1 % – 0.5 %	
	1-C_4H_9OH in N_2	$56{\cdot}10^{-6}$ – $64{\cdot}10^{-6}$	1.0 %	

RM 00	Reference Materials

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HCS code	Quantity, Instrument, Measure	Measuring range	CMC*	Remarks
	SF_6 in synth. air or N_2	$1·10^{-9}$ – $1000·10^{-9}$	3 % – 1 %	
	NH_3 in N_2	$30·10^{-6}$ – $300·10^{-6}$	5 %	
	H_2O in N_2 and CH_4	$10·10^{-6}$ – $100·10^{-6}$	5 %	H_2O in CH_4 has been measured for a long time and VSL has CMCs for this matrix gas. The actual measurement is performed in the same manner as the measurement in N_2
	HCl in N_2 or in synthetic air	$10·10^{-6}$ – $300·10^{-6}$	5 % – 2.4 %	Analysed Gas Mixtures
RM 20	**Natural gas** Methane Ethane Propane n-Butane i-Butane n-Pentane i-Pentane neo-Pentane n-Hexane Nitrogen Carbon dioxide Helium Hydrogen	 60 % – 99.9 % 0.1 % – 14 % 0.05 % – 10 % 0.01 % – 3 % 0.01 % – 3 % 0.01 % – 0.8 % 0.01 % – 0.8 % 0.01 % – 0.8 % 0.01 % – 0.4 % 0.1 % – 20 % 0.05 % – 20 % 0.05 % – 0.4 % 3.5 % – 15 %	 0.2 % 0.5 % – 0.2 % 0.5 % – 0.3 % 0.6 % – 0.2 % 0.6 % – 0.2 % 1 % – 0.4 % 1 % – 0.4 % 2 % – 1 % 1 % – 0.4 % 1.5 % – 0.2 % 1 % – 0.2 % 1 % – 0.4 % 0.4 % – 0.2 %	Analysed Gas Mixtures
RM 20	**Propane** Ethane *i*-Butane *n*-Butane *i*-Pentane *n*-Pentane Nitrogen Propane	 0.25 % mol/mol – 3 % mol/mol 0.03 % mol/mol – 0.7 % mol/mol 0.03 % mol/mol – 0.7 % mol/mol 0.02 % mol/mol – 0.08 % mol/mol 0.02 % mol/mol – 0.08 % mol/mol 0.1 % mol/mol – 2 % mol/mol 93 % mol/mol – 99 % mol/mol	 1 % 1 % 1 % 1 % 1 % 1 % 0.5 %	Analysed Gas Mixtures
RM 20	**Main refrigerant (MR)** Ethane Propane Nitrogen Methane	 20 % mol/mol – 35 % mol/mol 5 % mol/mol – 15 % mol/mol 8 % mol/mol – 16 % mol/mol 45 % mol/mol – 90 % mol/mol	 0.5 % 0.5 % 0.5 % 0.5 %	Analysed Gas Mixtures

RM 00	Reference Materials

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[2] CGM's are produced by industry and certified by VSL. (K999 scope)

HCS code	Quantity, Instrument, Measure	Measuring range	CMC*	Remarks
RM 20	**Coke oven gas**			Analysed Gas Mixtures
	Hydrogen	0.2 % – 70 %	1 % – 0.5 %	
	Methane	4 % – 35 %	1 % – 0.5 %	
	Carbon monoxide	3 % – 70 %	1 % – 0.5 %	
	Carbon dioxide	1 % – 25 %	1 % – 0.5 %	
	Nitrogen	3 % – 45 %	1 % – 0.5 %	
RM 20	**Refinery gas A**			Analysed Gas Mixtures
	Methane	10 % – 13 %	0.4 % – 0.2 %	
	Ethane	1 % – 3 %	0.6 % – 0.3 %	
	Ethene	12 % – 16 %	0.6 % – 0.3 %	
	Propane	0.4 % – 0.7 %	0.6 % – 0.3 %	
	Propene	3 % – 5 %	0.6 % – 0.3 %	
	1,3-Butadiene	0.75 % – 1.5 %	2 % – 1 %	
	1-Butene	0.4 % – 0.65 %	2 % – 1 %	
	i-Butene	0.4 % – 0.65 %	2 % – 1 %	
	Hydrogen	7 % – 9 %	1 % – 0.5 %	
	Nitrogen	3.5 % – 4.5 %	1 % – 0.5 %	
	Helium	50 % – 60 %	1 % – 0.5 %	
RM 20	**Refinery gas B**			Analysed Gas Mixtures
	Methane	10 % – 13 %	0.15 %	
	Ethane	1.5 % – 2.5 %	0.3 %	
	Propane	0.4 % – 0.6 %	0.3 %	
	Hydrogen	7 % – 8 %	0.15 %	
	n–Butane	0.8 % – 4.2 %	0.3 %	
	i-Pentane	0.5 % – 1 %	0.5 %	
	n-Pentane	0.5 % – 1 %	0.5 %	
	n-Hexane	0.01 % – 0.1 %	0.5 %	
	Carbon monoxide	1 % – 4 %	0.4 %	
	Carbon dioxide	0.4 % – 0.8 %	0.4 %	
	Hydrogen sulphide	1 % – 4 %	0.5 %	
	Nitrogen	60 % – 80 %	0.3 %	
RM 20	**Automotive gas**			Analysed Gas Mixtures
	O2	0.1 % – 21 %	0.6 % – 0.3 %	
	CO	0.5 % – 9 %	0.3 %	
	CO2	3.6 % – 18 %	0.3 %	
	C_3H_8	0.01 % – 0.4 %	0.5 % – 0.3 %	
RM 20	**Sulphur in Methane**			Analysed Gas Mixtures
	Hydrogen sulphide Methyl mercaptane Ethyl mercaptane Carbonyl sulphide Dimethyl sulphide	$10 \cdot 10^{-6} – 50 \cdot 10^{-6}$	3 %	

RM 00 Reference Materials

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HCS code	Quantity, Instrument, Measure	Measuring range	CMC*	Remarks
RM 20	**Stack gas** Carbon monoxide Carbon dioxide Nitrogen monoxide Sulphur dioxide Propane	 $10 \cdot 10^{-6}$ – $1\,000 \cdot 10^{-6}$ $1 \cdot 10^{-2}$ – $20 \cdot 10^{-2}$ $10 \cdot 10^{-6}$ – $1\,000 \cdot 10^{-6}$ $10 \cdot 10^{-6}$ – $1\,000 \cdot 10^{-6}$ $3 \cdot 10^{-6}$ – $1\,000 \cdot 10^{-6}$	 1 % – 0.15 %	Analysed Gas Mixtures
RM 20	**VOC (in cylinders)** ethane, ethene, Ethyne, propene, propane, 1-Butene, i-Butene, 1,3-Butadiene, n-Butane, i-Butane, cis-2-Butene, trans-2-Butene, 2-methyl-1,3-Butadiene, n-Pentane, i-Pentane, 1-Pentene, trans-2-Pentene, cis-2-Pentene,n-Hexane, n-Heptane, n-Octane, iso-Octane, 3-methyl-Pentane, 2-methyl-pentane, Benzene, Toluene, Ethylbenzene, o-Xyelene, m-Xylene, p-Xylene, 1,3,5-Trimethylbenzene, 1,2,4-Trimethylbenzene in nitrogen	 $2 \cdot 10^{-9}$ – $1\,000 \cdot 10^{-9}$	 5 % – 2 %	Analysed Gas Mixtures including cis-2 Pentene and/or 3 methyl-Pentane only as CGM
RM 20	**BTEX** benzene, toluene, ethylbenzene, o-xylene, m-xylene, p-xylene in nitrogen	 $2 \cdot 10^{-9}$ – $1\,000 \cdot 10^{-9}$	 5 % – 2 %	Analysed Gas Mixtures

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HCS code	Quantity, Instrument, Measure	Measuring range	CMC*	Remarks
RM 20	**Energy gases**			Analysed Gas Mixtures
	Helium	0.025 % – 1 %	1 % – 0.5 %	
	Hydrogen	0.2 % – 70 %	0.8 % – 0.2 %	
	Methane	1 % – 99.9 %	0.3 % – 0.15 %	
	Nitrogen	0.1 % – 70 %	0.7 % – 0.2 %	
	Carbon monoxide	1 % – 70 %	1 % – 0.5 %	
	Carbon dioxide	0.05 % – 45 %	0.5 % – 0.2 %	
	Ethene	1.0 % – 16 %	0.5 % – 0.2 %	
	Ethane	0.2 % – 14 %	0.5 % – 0.2 %	
	Propene	0.05 % – 5 %	0.5 % – 0.2 %	
	Propane	0.05 % – 10 %	0.5 % – 0.2 %	
	n-Butane	0.01 % – 3 %	0.5 % – 0.2 %	
	i-Butane	0.01 % – 3 %	0.5 % – 0.2 %	
	1,3-Butadiene	0.5 % – 1.5 %	0.5 % – 0.2 %	
	1-Butene	0.2 % – 0.8 %	0.5 % – 0.2 %	
	i-Butene	0.2 % – 0.8 %	0.5 % – 0.2 %	
	n-Pentane	0.01 % – 1 %	0.5 % – 0.2 %	
	i-Pentane	0.01 % – 1 %	0.5 % – 0.2 %	
RM 20	**OVOC in nitrogen**			Analysed Gas Mixtures Preparation by a single reference procedure (gravimetry) Verification method: GC-FID
	Methanol	$1 \cdot 10^{-6}$ – $10 \cdot 10^{-6}$ mol/mol	3 %	
	Ethanol	$1 \cdot 10^{-6}$ – $10 \cdot 10^{-6}$ mol/mol	3 %	
	Acetone	$1 \cdot 10^{-6}$ – $10 \cdot 10^{-6}$ mol/mol	2 %	

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HCS code	Quantity, Instrument, Measure	Measuring range	CMC*	Remarks
RM20	**Gas mixtures:** Dynamic generation of standard atmospheres for calibration purposes (air measurements)			Analysed Gas Mixtures Gaseous components with Vapour pressure < 20 Pa
RM20	**VOC (ISO 6145-8/-10)** Benzene, toluene, ethylbenzene, m-xylene, o-xylene, p-xylene, 1,3,5-trimethylbenzene, 1,2,4-trimethylbenzene, n-hexane, n-heptane, n-octane, dichloromethane, trichloromethane, 1,1,1-trichloroethane, 1,1,2-trichloroethane, 1,1-dichloroethane, 1,2-dichloroethane, trichloroethene, tetrachloroethene, ethyl acetate, 2-butanone, 1-butanol, methyl-t-butyl ether	$1{\cdot}10^{-9} – 1{\cdot}10^{-6}$	2 %	Analysed Gas Mixtures Preparation by diffusion / permeation (ISO 6145, parts 8 and 10)
	Hexachloro-1,3-butadiene, formaldehyde, acetaldehyde, acrolein, hexanal, decanal, furfural, cyclohexanone 1,1-dichloroethene, Cis-1,2-dichloroethene in air	$1{\cdot}10^{-9} – 1{\cdot}10^{-6}$	4 %	Analysed Gas Mixtures Preparation by diffusion / permeation (ISO 6145, parts 8 and 10)
RM20	**VOC (ISO 6145-4)** Benzene, toluene, m-xylene, Ethylbenzene, styrene, 1,1,1-trichloroethane, trichloroethene, tetrachloroethene, halothane, acetone, methanol, ethanol, n-propanol in air	$1{\cdot}10^{-6} – 1{\cdot}10^{-3}$	3 %	Analysed Gas Mixtures Preparation by continuous injection (ISO 6145, part 4)

Annex to ISO/IEC 17025:2005 declaration of accreditation for registration number: **K 999**

of **VSL B.V.**

This annex is valid from: **24-01-2018** to **01-11-2021** Replaces annex dated: **03-10-2016**

RM 00	Reference Materials

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HCS code	Quantity, Instrument, Measure	Measuring range	CMC*	Remarks
RM20	**VOC (ISO 6145-4/-7)** 1,3-Butadiene Vinyl chloride in air	 $40 \cdot 10^{-9}$ – $100 \cdot 10^{-9}$ $0.1 \cdot 10^{-6}$ – $10 \cdot 10^{-6}$	 3 % 5 % – 3 %	Analysed Gas Mixtures Preparation by diffusion / permeation (ISO 6145, parts 4 and 7)

RM 00	Reference Materials

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HCS code	Quantity, Instrument, Measure	Measuring range	CMC*	Remarks
				CGM's
RM 20	High purity Hydrogen CO CO_2 N_2 O_2 hydrocarbons H_2O	 $5 \cdot 10^{-9}$ – $500 \cdot 10^{-9}$ $1 \cdot 10^{-9}$ – $500 \cdot 10^{-9}$ $0.1 \cdot 10^{-6}$ – $10 \cdot 10^{-6}$ $100 \cdot 10^{-9}$ – $1\,000 \cdot 10^{-9}$ $10 \cdot 10^{-9}$ – $1\,000 \cdot 10^{-9}$ $1 \cdot 10^{-6}$ – $100 \cdot 10^{-6}$	 30 % – 5 % 30 % – 5 % 30 % – 5 % 30 % – 5 % 30 % – 5 % 30 % – 5 %	Purity analyses of high purity gases
	High purity Nitrogen CO CO_2 Ar O_2 hydrocarbons H_2O	 $5 \cdot 10^{-9}$ – $500 \cdot 10^{-9}$ $1 \cdot 10^{-9}$ – $500 \cdot 10^{-9}$ $100 \cdot 10^{-9}$ – $1\,000 \cdot 10^{-9}$ $100 \cdot 10^{-9}$ – $1\,000 \cdot 10^{-9}$ $10 \cdot 10^{-9}$ – $1\,000 \cdot 10^{-9}$ $1 \cdot 10^{-6}$ – $100 \cdot 10^{-6}$	 30 % – 5 % 30 % – 5 % 30 % – 5 % 30 % – 5 % 30 % – 5 % 30 % – 5 %	Purity analyses of high purity gases
RM20	High purity Helium CO CO_2 N_2 O_2 hydrocarbons H_2O	 $5 \cdot 10^{-9}$ – $500 \cdot 10^{-9}$ $1 \cdot 10^{-9}$ – $500 \cdot 10^{-9}$ $0.1 \cdot 10^{-6}$ – $10 \cdot 10^{-6}$ $100 \cdot 10^{-9}$ – $1\,000 \cdot 10^{-9}$ $10 \cdot 10^{-9}$ – $1\,000 \cdot 10^{-9}$ $1 \cdot 10^{-6}$ – $100 \cdot 10^{-6}$	 30 % – 5 % 30 % – 5 % 30 % – 5 % 30 % – 5 % 30 % – 5 % 30 % – 5 %	Purity analyses of high purity gases
RM20	High purity Synthetic air CO CO_2 NO_x SO_2 hydrocarbons H_2O	 $5 \cdot 10^{-9}$ – $500 \cdot 10^{-9}$ $1 \cdot 10^{-9}$ – $500 \cdot 10^{-9}$ $50 \cdot 10^{-9}$ – $1\,000 \cdot 10^{-9}$ $50 \cdot 10^{-9}$ – $1\,000 \cdot 10^{-9}$ $10 \cdot 10^{-9}$ – $1\,000 \cdot 10^{-9}$ $1 \cdot 10^{-6}$ – $100 \cdot 10^{-6}$	 30 % – 5 % 30 % – 5 % 30 % – 5 % 30 % – 5 % 30 % – 5 % 30 % – 5 %	Purity analyses of high purity gases

RM 20	High purity Methane CO_2 N_2 O_2 H_2O C_2H_6 Higher hydrocarbons	 $1{\cdot}10^{-9}$ – $500{\cdot}10^{-9}$ $0.1{\cdot}10^{-6}$ – $10{\cdot}10^{-6}$ $100{\cdot}10^{-9}$ – $1\ 000{\cdot}10^{-9}$ $1{\cdot}10^{-6}$ – $100{\cdot}10^{-6}$ $1{\cdot}10^{-6}$ – $100{\cdot}10^{-6}$ $10{\cdot}10^{-9}$ – $1\ 000{\cdot}10^{-9}$	 30 % – 5 % 30 % – 5 % 30 % – 5 % 30 % – 5 % 30 % – 5 % 30 % – 5 %	Purity analyses of high purity gases