TURKISH STANDARD INSTITUTION
GEBZE CALIBRATION LABORATORY
ACCREDITATION SCOPE

Measurand / Device	Measuring range	Conditions	Measurement Capability / Uncertainty	Notes
ELECTRICAL CALIBRATION				
DC Voltage (≤1000 V) DC Voltage Sources DC Voltage Supply Calibrator: DC Voltage	100 µV ≤ U < 200 mV 200 mV ≤ U < 2 V 2 V ≤ U < 20 V 20 V ≤ U < 200 V 200 V ≤ U ≤ 1000 V	-	$6{,}0\cdot10^{-6}\cdot$U + 0,6µV $4{,}0\cdot10^{-6}\cdot$U + 0,8µV $4{,}0\cdot10^{-6}\cdot$U + 0,6µV $6{,}0\cdot10^{-6}\cdot$U + 0,2µV $6{,}0\cdot10^{-6}\cdot$U + 0,4µV	U = Measured Value with 8508A
DC Current (<100A) DC Current Sources: DC Current Source Calibrator: DC Current Transconductance Amplifier	10 µA ≤ I < 200µA 200 µA ≤ I < 2mA 2mA ≤ I < 20 mA 20 mA≤I<200mA 200 mA ≤ I < 2 A 2 A ≤ I ≤ 20 A	-	$14\cdot10^{-6}\cdot$I + 1,2 nA $14\cdot10^{-6}\cdot$I + 1,0 µA $16\cdot10^{-6}\cdot$I + 100 nA $4\cdot10^{-5}\cdot$I + 0,8 µA $18\cdot10^{-5}\cdot$I + 16 µA $4\cdot10^{-4}\cdot$I + 0,4 mA	U = Measured Value with 8508A
DC Resistance DC Resistance Standards and Sources DC Resistance standard Calibrator: Resistance Resistance Box	100 µΩ ≤ R < 1 mΩ 1 mΩ ≤ R < 10 mΩ 10 mΩ ≤ R < 100 mΩ 100 mΩ ≤ R < 1 Ω 1 Ω ≤ R < 10 Ω 10 Ω ≤ R < 100 Ω 100 Ω ≤ R < 1 kΩ 1 kΩ ≤ R < 10 kΩ 10 kΩ ≤ R ≤ 100 kΩ	Imax=60 A Imax=30 A Imax=20 A Imax=1 A Imax=0,32 A Imax=0,1 A Imax=32 mA Imax=10 mA Imax=3,2 mA	$7\cdot10^{-5}\cdot$R $3\cdot10^{-5}\cdot$R $2\cdot10^{-5}\cdot$R $3\cdot10^{-5}\cdot$R $5\cdot10^{-5}\cdot$R $1\cdot10^{-5}\cdot$R $2\cdot10^{-5}\cdot$R $5\cdot10^{-6}\cdot$R $5\cdot10^{-6}\cdot$R	R = Measured Value (4-Ended Reference with resistance comparison method)
DC Resistance DC Resistance Standards and Sources DC Resistance standard Calibrator: Resistance Resistance Box	10mΩ ≤R< 2Ω 2Ω ≤R< 20Ω 20Ω ≤R< 200Ω 200Ω ≤R< 2kΩ 2kΩ ≤R< 20kΩ 20kΩ ≤R< 200kΩ 200kΩ ≤R< 2MΩ 2MΩ ≤R< 20MΩ 20MΩ≤R<200MΩ 200MΩ≤R≤2GΩ 2MΩ ≤R< 20MΩ 20MΩ≤R<200MΩ 200MΩ≤R<2GΩ 2GΩ ≤R≤ 20GΩ	Normal Mode (200 mV / 2 V / 20 V Measuring Voltage) HIV Mode (200 V Measuring Voltage)	$18\cdot10^{-6}\cdot$R + 12 µΩ $10\cdot10^{-6}\cdot$R + 16 µΩ $8\cdot10^{-6}\cdot$R + 40 µΩ $8\cdot10^{-6}\cdot$R + 0,4 mΩ $10\cdot10^{-6}\cdot$R - 1 mΩ $10\cdot10^{-6}\cdot$R + 14 mΩ $12\cdot10^{-6}\cdot$R + 140 mΩ $2\cdot10^{-5}\cdot$R + 80 Ω $12\cdot10^{-5}\cdot$R + 10 kΩ $16\cdot10^{-4}\cdot$R + 1000 Ω $2\cdot10^{-5}\cdot$R + 6 Ω $6\cdot10^{-5}\cdot$R + 1000 Ω $2\cdot10^{-4}\cdot$R + 100 kΩ $16\cdot10^{-4}\cdot$R + 10 MΩ	R = Measured Value (8508 DMM with)

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AC Voltage	2mV≤ U <200mV	10 Hz ≤ f < 40 Hz	$15{,}8\cdot10^{-5}\cdot U$ +6µV	U = Measured Voltage
(≤1100V)	2mV≤ U <200mV	40 Hz ≤ f < 100 Hz	$13{,}4\cdot10^{-5}\cdot U$ +4,6µV	Value
AC Voltage Sources	2mV≤ U <200mV	100 Hz ≤ f ≤ 2 kHz	$12{,}8\cdot10^{-5}\cdot U$ +2,8µV	f = Adjusted
	2mV≤ U <200mV	2 kHz ≤ f < 10 kHz	$15{,}0\cdot10^{-5}\cdot U$ +4,4µV	Frequency Value
AC Voltage Source	2mV≤ U <200mV	10 kHz ≤ f < 30 kHz	$3{,}6\cdot10^{-4}\cdot U$ +2µV	
Calibrator: AC Voltage	2mV≤ U <200mV	30 kHz ≤ f < 100 kHz	$7{,}6\cdot10^{-4}\cdot U$ +22µV	with 8508A
AC Calibrator	200 mV ≤ U < 2 V	10 Hz ≤ f < 40 Hz	$12{,}0\cdot10^{-5}\cdot U$ +30µV	
	200 mV ≤ U < 2 V	40 Hz ≤ f < 100 Hz	$9{,}2\cdot10^{-5}\cdot U$ +19,8µV	
	200 mV ≤ U < 2 V	100 Hz ≤ f ≤ 2 kHz	$7{,}8\cdot10^{-5}\cdot U$ +19,6µV	
	200 mV ≤ U < 2 V	2 kHz ≤ f < 10 kHz	$11{,}2\cdot10^{-5}\cdot U$ +200µV	
	200 mV ≤ U < 2 V	10 kHz ≤ f < 30 kHz	$2{,}2\cdot10^{-5}\cdot U$ +40µV	
	200 mV ≤ U < 2 V	30 kHz ≤ f < 100 kHz	$5{,}8\cdot10^{-4}\cdot U$ +200µV	
	200 mV ≤ U < 2 V	100kHz ≤ f < 300kHz	$3{,}0\cdot10^{-3}\cdot U$ +2,2mV	
	200 mV ≤ U < 2 V	300 kHz ≤ f ≤ 1 MHz	$10{,}0\cdot10^{-3}\cdot U$ +20mV	
	2 V ≤ U < 20 V	10 Hz ≤ f < 40 Hz	$12{,}0\cdot10^{-5}\cdot U$ +0,24mV	
	2 V ≤ U < 20 V	40 Hz ≤ f < 100 Hz	$9{,}2\cdot10^{-5}\cdot U$ +0,26mV	
	2 V ≤ U < 20 V	100 Hz ≤ f ≤ 2 kHz	$7{,}8\cdot10^{-5}\cdot U$ +0,20mV	
	2 V ≤ U < 20 V	2 kHz ≤ f < 10 kHz	$11{,}2\cdot10^{-5}\cdot U$ +2,2mV	
	2 V ≤ U < 20 V	10 kHz ≤ f < 30 kHz	$2{,}2\cdot10^{-4}\cdot U$ +420µV	
	2 V ≤ U < 20 V	30 kHz ≤ f < 100 kHz	$5{,}8\cdot10^{-4}\cdot U$ +2mV	
	2 V ≤ U < 20 V	100kHz ≤ f < 300kHz	$3{,}0\cdot10^{-3}\cdot U$ +20mV	
	2 V ≤ U < 20 V	300 kHz ≤ f ≤ 1 MHz	$10{,}0\cdot10^{-3}\cdot U$ +0,2V	
	20 V ≤ U < 200 V	10 Hz ≤ f < 40 Hz	$12{,}2\cdot10^{-5}\cdot U$ +2mV	
	20 V ≤ U < 200 V	40 Hz ≤ f < 100 Hz	$9{,}4\cdot10^{-5}\cdot U$ +2,8mV	
	20 V ≤ U < 200 V	100 Hz ≤ f ≤ 2 kHz	$7{,}8\cdot10^{-5}\cdot U$ +2,2mV	
	20 V ≤ U < 200 V	2 kHz ≤ f < 10 kHz	$13{,}6\cdot10^{-5}\cdot U$ +16,8mV	
	20 V ≤ U < 200 V	10 kHz ≤ f < 30 kHz	$2{,}2\cdot10^{-4}\cdot U$ +4,2mV	
	20 V ≤ U < 200 V	30 kHz ≤ f < 100 kHz	$5{,}8\cdot10^{-4}\cdot U$ +20mV	
	20 V ≤ U < 200 V	100kHz ≤ f < 300kHz	$3{,}0\cdot10^{-3}\cdot U$ +0,22V	
	20 V ≤ U < 200 V	300 kHz ≤ f ≤ 1 MHz	$10{,}0\cdot10^{-3}\cdot U$ +2V	
	200 V ≤ U ≤ 1000 V	10 Hz ≤ f < 40 Hz	$13{,}2\cdot10^{-5}\cdot U$ +19,0mV	
	200 V ≤ U ≤ 1000 V	40 Hz ≤ f < 10 kHz	$12{,}6\cdot10^{-5}\cdot U$ +20mV	
	200 V ≤ U ≤ 1000 V	10 kHz ≤ f < 30 kHz	$2{,}4\cdot10^{-4}\cdot U$ +38mV	
AC Current (<100)	10 µA ≤ I < 200 µA	10 Hz ≤ f < 10 kHz	$5{,}4\cdot10^{-4}\cdot I$ + 20 nA	I = Measured
AC Current Sources	10 µA ≤ I < 200 µA	10 kHz ≤ f < 30 kHz	$7{,}8\cdot10^{-4}\cdot I$ + 20 nA	Current (with 8508A
	10 µA ≤ I < 200 µA	30 kHz ≤ f ≤ 100 kHz	$4{,}0\cdot10^{-3}\cdot I$ + 20 nA	DMM)
AC Current Source	200 µA ≤ I < 2 mA	10 Hz ≤ f < 10 kHz	$3{,}6\cdot10^{-4}\cdot I$ + 200 nA	
Calibrator: AC Current	200 µA ≤ I <2 mA	10 kHz ≤ f < 30 kHz	$7{,}4\cdot10^{-4}\cdot I$ + 200 nA	
Transconductance	200 µA ≤ I <2 mA	30 kHz ≤ f ≤ 100 kHz	$4{,}0\cdot10^{-3}\cdot I$ + 200 nA	
Amplifier	2 mA ≤ I < 20 mA	10 Hz ≤ f < 10 kHz	$3{,}2\cdot10^{-4}\cdot I$ + 2 µA	
	2 mA ≤ I < 20 mA	10 kHz ≤ f < 30 kHz	$7{,}4\cdot10^{-4}\cdot I$ + 2 µA	
	2 mA ≤ I < 20 mA	30 kHz ≤ f ≤ 100 kHz	$4{,}0\cdot10^{-3}\cdot I$ + 2 µA	
	20 mA ≤ I < 200 mA	10 Hz ≤ f < 10 kHz	$3{,}2\cdot10^{-4}\cdot I$ + 20 µA	
	20 mA ≤ I < 200 mA	10 kHz ≤ f < 30 kHz	$6{,}4\cdot10^{-4}\cdot I$ + 20 µA	
	20 mA ≤ I < 200 mA	30 kHz ≤ f ≤ 100 kHz	$6{,}4\cdot10^{-4}\cdot I$ + 20 µA	
	200 mA ≤ I < 2 A	10 Hz ≤ f < 2 kHz	$6{,}4\cdot10^{-4}\cdot I$ + 200 µA	
	200 mA ≤ I < 2 A	2 kHz ≤ f < 10 kHz	$3{,}0\cdot10^{-3}\cdot I$ + 200 µA	
	200 mA ≤ I < 2 A	10 kHz ≤ f ≤ 30 kHz	$3{,}0\cdot10^{-3}\cdot I$ + 200 µA	
	2 A ≤ I ≤ 20 A	10 Hz ≤ f < 2 kHz	$8{,}4\cdot10^{-4}\cdot I$ + 2 mA	
	2 A ≤ I ≤ 20 A	2 kHz ≤ f ≤ 10 kHz	$2{,}6\cdot10^{-3}\cdot I$ + 2 mA	
DC Voltage (≤1000 V)	100 µV ≤ U < 220 mV	-	$4{,}8\cdot10^{-6}\cdot U$ +1,4µV	U = Measured value
DC Voltage Monitors:	220 mV ≤ U < 2,2 V		$7{,}1\cdot10^{-6}\cdot U$ +1,0µV	(with 5700A
Multimeter:	2,2 V ≤ U < 11 V		$7{,}1\cdot10^{-6}\cdot U$ +3,5µV	Calibrator)
DC Voltage	11 V ≤ U < 22 V		$7{,}1\cdot10^{-6}\cdot U$ +6,5µV	
DC voltmeter	22 V ≤ U < 220 V		$8{,}1\cdot10^{-6}\cdot U$ +80µV	
	220 V ≤ U ≤1000 V		$9{,}1\cdot10^{-6}\cdot U$ +500µV	

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DC Current (< 100) DC Current Monitors Multimeter: DC Current DC Clamp ammeter Ammeter	100 µA ≤ I < 220 µA 220 µA ≤ I < 2,2 mA 2,2 mA ≤ I < 22 mA 22 mA ≤ I < 220 mA 220 mA ≤ I < 2,2 A	-	$5{,}1 \cdot 10^{-5} \cdot I + 8$ nA $5 \cdot 10^{-5} \cdot I + 12$ nA $5 \cdot 10^{-5} \cdot I + 120$ nA $6{,}1 \cdot 10^{-5} \cdot I + 0{,}8$ µA $8{,}2 \cdot 10^{-5} \cdot I + 25$ µA	I = Measured Values (with 5700A Calibrator)
DC Current (< 100) DC Current Monitors: Multimeter: DC Current DC Clamp ammeter Ammeter	10 A ≤ I ≤ 1000 A	-	$5 \cdot 10^{-3} \cdot I$	I = The current measured by Clamp Meter
DC Resistance DC Resistance Measuring Instruments Multimeter: Resistance Mikroohmmeter Earth Resistance Meter	100 µΩ 1 mΩ 10 mΩ 100 mΩ 1 Ω 10 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ	Imax = 60 A Imax = 30 A Imax = 20 A Imax = 1 A Imax = 0,32 A Imax = 0,1 A Imax = 32 mA Imax = 10 mA Imax = 3,2 mA Imax = 1 mA	$1 \cdot 10^{-3} \cdot R$ $3 \cdot 10^{-4} \cdot R$ $3 \cdot 10^{-4} \cdot R$ $1 \cdot 10^{-4} \cdot R$ $5 \cdot 10^{-5} \cdot R$ $5 \cdot 10^{-5} \cdot R$ $5 \cdot 10^{-5} \cdot R$ $5 \cdot 10^{-5} \cdot R$ $5 \cdot 10^{-5} \cdot R$ $1 \cdot 10^{-4} \cdot R$	R = Measured Value
DC Resistance DC Resistance Measuring Instruments Multimeter: Resistance Mikroohmmeter Ground / Earth Resistance Measuring Instruments	0 Ω 1 Ω 1,9 Ω 10 Ω 19 Ω 100 Ω 190 Ω 1 kΩ 1,9 kΩ 10 kΩ 19 kΩ 100 kΩ 190 kΩ 1 MΩ 1,9 MΩ 10 MΩ 19 MΩ 100 MΩ	Imax=500mA Imax=700mA Imax=500mA Imax=220mA Imax=160mA Imax=70mA Imax=50mA Imax=22mA Imax=16mA Imax=7mA Imax=5mA Imax=1mA Imax=500µA Imax=100µA Imax=50µA Imax=10µA Imax=5µA Imax=1µA	60 µΩ $1{,}2 \cdot 10^{-4} \cdot R$ $1{,}2 \cdot 10^{-4} \cdot R$ $3{,}5 \cdot 10^{-5} \cdot R$ $3 \cdot 10^{-5} \cdot R$ $2 \cdot 10^{-5} \cdot R$ $2 \cdot 10^{-5} \cdot R$ $1{,}5 \cdot 10^{-5} \cdot R$ $1{,}5 \cdot 10^{-5} \cdot R$ $1{,}5 \cdot 10^{-5} \cdot R$ $1{,}5 \cdot 10^{-5} \cdot R$ $2 \cdot 10^{-5} \cdot R$ $2 \cdot 10^{-5} \cdot R$ $2{,}5 \cdot 10^{-5} \cdot R$ $2{,}5 \cdot 10^{-5} \cdot R$ $4{,}5 \cdot 10^{-5} \cdot R$ $5{,}5 \cdot 10^{-5} \cdot R$ $1{,}2 \cdot 10^{-4} \cdot R$	R = Measured Value (with 5700A Calibrator)

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DC Resistance DC Resistance Measuring Instruments Multimeter: Resistance Mikroohmmeter Ground / Earth Resistance Measuring Instruments	0 Ω ≤ R < 11 Ω 11 Ω ≤ R < 33Ω 33 Ω ≤ R < 110Ω 110 Ω ≤ R < 330Ω 330 Ω ≤ R < 1,1kΩ 1,1 kΩ ≤ R < 3,3kΩ 3,3 kΩ ≤ R < 11kΩ 11 kΩ ≤ R < 33kΩ 33 kΩ ≤ R < 110kΩ 110 kΩ ≤ R < 190kΩ 190 kΩ ≤ R < 330kΩ 330 kΩ ≤ R < 1,1MΩ 1,1 MΩ ≤ R < 1,9MΩ 1,9 MΩ ≤ R < 3,3MΩ 3,3 MΩ ≤ R < 11MΩ 11 MΩ ≤ R < 19MΩ 19 MΩ ≤ R < 33MΩ 33MΩ ≤ R < 110MΩ 110 MΩ ≤ R < 330MΩ	1 mA ≤ Imax ≤ 125 mA 1 mA ≤ Imax ≤ 125 mA 1 mA ≤ Imax ≤ 70 mA 1 mA ≤ Imax ≤ 40 mA 1 mA ≤ Imax ≤ 18 mA 100 µA ≤ Imax ≤ 5 mA 100 µA ≤ Imax ≤ 1,8 mA 10 µA ≤ Imax ≤ 0,5 mA 10 µA ≤ Imax ≤ 0,18 mA 10 µA ≤ Imax ≤ 50 µA 10 µA ≤ Imax ≤ 50 µA 1 µA ≤ Imax ≤ 50 µA 250 nA ≤ Imax ≤ 5 µA 250 nA ≤ Imax ≤ 5 µA 25 nA ≤ Imax ≤ 1,8 µA 25 nA ≤ Imax ≤ 500 nA 25 nA ≤ Imax ≤ 500 nA 2,5 nA ≤ Imax ≤ 180 nA 2,5 nA ≤ Imax ≤ 50 na	$8{,}0\cdot10^{-6}\cdot$R +8mΩ $1{,}2\cdot10^{-5}\cdot$R +15mΩ $1{,}2\cdot10^{-5}\cdot$R +15mΩ $1{,}4\cdot10^{-5}\cdot$R +14,6mΩ $1{,}2\cdot10^{-5}\cdot$R +60mΩ $1{,}8\cdot10^{-5}\cdot$R +60mΩ $1{,}2\cdot10^{-5}\cdot$R +600mΩ $1{,}8\cdot10^{-5}\cdot$R +600mΩ $1{,}2\cdot10^{-4}\cdot$R +6Ω $5\cdot10^{-5}\cdot$R +2Ω $1{,}8\cdot10^{-5}\cdot$R +8Ω $2{,}0\cdot10^{-5}\cdot$R +60Ω $2{,}0\cdot10^{-4}\cdot$R +200Ω $6{,}0\cdot10^{-5}\cdot$R +160Ω $8{,}0\cdot10^{-5}\cdot$R +600Ω $1{,}4\cdot10^{-3}\cdot$R +15,4kΩ $6{,}0\cdot10^{-4}\cdot$R +1,2kΩ $8{,}0\cdot10^{-4}\cdot$R +4,6kΩ $4{,}0\cdot10^{-4}\cdot$R +56kΩ	R = Measured Value (with 5500 A)
DC Resistance DC Resistance Measuring Instruments Insulation Testing Instruments	1 MΩ ≤ R ≤ 10MΩ 10 MΩ ≤ R ≤ 100 MΩ 100 MΩ ≤ R ≤ 1 GΩ 1 GΩ ≤ R ≤ 10 GΩ 10 GΩ ≤ R ≤ 100 GΩ	Vmax=2500V Vmax=5000V Vmax=5000V Vmax=5000V Vmax=5000V	$7{\cdot}0\ 10^{-4}\cdot$R $7{\cdot}0\ 10^{-4}\cdot$R $7{\cdot}0\ 10^{-4}\cdot$R $2{,}0\ {\cdot}10^{-3}\cdot$R $1{,}5\cdot10^{-2}\cdot$R	R = Measured Value (with high Resistance decade)
DC Resistance Multimeter: Mikroohmmeter Earth / Ground Resistance Measuring Instruments	10 mΩ ≤ R < 100 Ω 0,1 Ω ≤ R ≤ 1 Ω 1 Ω ≤ R ≤ 10 Ω 10 Ω ≤ R ≤ 100 Ω 100 Ω ≤ R ≤ 1000 Ω 1 kΩ ≤ R ≤ 10 kΩ 10 kΩ ≤ R ≤ 100 kΩ	Imax = 2000 mA Imax = 2000 mA Imax = 600 mA Imax = 200 mA Imax = 60 mA Imax = 20 mA Imax = 6 mA	60 µΩ 0,6 mΩ 6 mΩ 0,06 Ω 0,6 Ω 6 Ω 60 Ω	R = Measured Value (with Resistance decade)

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AC Current	9 µA ≤ I < 220 µA	10 Hz ≤ f < 20 Hz	$7{,}2\cdot10^{-4}\cdot$I +26 nA	I = Measured
AC Current	9 µA ≤ I < 220 µA	20 Hz ≤ f < 40 Hz	$3{,}8\cdot10^{-4}\cdot$I +20 nA	Value
Measuring Instruments	9 µA ≤ I < 220 µA	40 Hz ≤ f < 1 kHz	$1{,}8\cdot10^{-4}\cdot$I +15,8 nA	f = Adjusted
	9 µA ≤ I < 220 µA	1 kHz ≤ f < 5 kHz	$6{,}2\cdot10^{-4}\cdot$I +40 nA	value
Multimeter:	9 µA ≤ I < 220 µA	5 kHz ≤ f < 10 kHz	$1{,}6\cdot10^{-3}\cdot$I +80 nA	(with 5700A
AC Current	220 µA ≤ I < 2,2 mA	10 Hz ≤ f < 20 Hz	$7\cdot10^{-4}\cdot$I +40 nA	Calibrator)
	220 µA ≤ I < 2,2 mA	20 Hz ≤ f < 40 Hz	$3{,}6\cdot10^{-4}\cdot$I +36 nA	
Ammeter	220 µA ≤ I < 2,2 mA	40 Hz ≤ f < 1 kHz	$1{,}54\cdot10^{-4}\cdot$I +34 nA	
	220 µA ≤ I < 2,2 mA	1 kHz ≤ f < 5 kHz	$6{,}0\cdot10^{-4}\cdot$I +400 nA	
	220 µA ≤ I < 2,2 mA	5 kHz ≤ f < 10 kHz	$1{,}6\cdot10^{-3}\cdot$I +800 nA	
	2,2 mA ≤ I < 22 mA	10 Hz ≤ f < 20 Hz	$7\cdot10^{-4}\cdot$I +400 nA	
	2,2 mA ≤ I < 22 mA	20 Hz ≤ f < 40 Hz	$3{,}6\cdot10^{-4}\cdot$I +360 nA	
	2,2 mA ≤ I < 22 mA	40 Hz ≤ f < 1 kHz	$1{,}48\cdot10^{-4}\cdot$I +340 nA	
	2,2 mA ≤ I < 22 mA	1 kHz ≤ f < 5 kHz	$6\cdot10^{-4}\cdot$I + 4,0 µA	
	2,2 mA ≤ I < 22 mA	5 kHz ≤ f < 10 kHz	$1{,}6\cdot10^{-3}\cdot$I +8 µA	
	22 mA ≤ I < 220 mA	10 Hz ≤ f < 20 Hz	$7\cdot10^{-4}\cdot$I +4 µA	
	22 mA ≤ I < 220 mA	20 Hz ≤ f < 40 Hz	$3{,}6\cdot10^{-4}\cdot$I +3,6 µA	
	22 mA ≤ I < 220 mA	40 Hz ≤ f < 1 kHz	$1{,}52\cdot10^{-4}\cdot$I + 3,4 µA	
	22 mA ≤ I < 220 mA	1 kHz ≤ f < 5 kHz	$6\cdot10^{-4}\cdot$I + 40 µA	
	22 mA ≤ I < 220 mA	5 kHz ≤ f < 10 kHz	$1{,}6\cdot10^{-3}\cdot$I +80 µA	
	220 mA ≤ I < 2,2 A	10 Hz ≤ f < 20 Hz	$6{,}6\cdot10^{-4}\cdot$I +36 µA	
	220 mA ≤ I < 2,2 A	20 Hz ≤ f < 40 Hz	$6{,}6\cdot10^{-4}\cdot$I +36 µA	
	220 mA ≤ I < 2,2 A	40 Hz ≤ f < 1 kHz	$6{,}6\cdot10^{-4}\cdot$I + 36 µA	
	220 mA ≤ I < 2,2 A	1 kHz ≤ f < 5 kHz	$7{,}4\cdot10^{-4}\cdot$I + 80 µA	
	220 mA ≤ I <2,2 A	5 kHz ≤ f < 10 kHz	$8{,}6\cdot10^{-3}\cdot$I + 160 µA	
AC Current	1 A ≤ I ≤ 20 A	1 kHz ≤ f < 5 kHz	$1{,}52\cdot10^{-3}\cdot$I + 1400 µA	I = Measured
AC Current Measuring				Current
Instruments	10 A ≤ I ≤ 1000 A	45 Hz ≤ f ≤ 65 Hz	$6\cdot10^{-3}\cdot$I	With 5700A and
	10 A ≤ I < 16,5 A	65 Hz ≤ f ≤ 440 Hz	$1{,}3\cdot10^{-2}\cdot$I	5220A
Multimeter:	16,5 A ≤ I ≤ 1000 A	65 Hz ≤ f ≤ 440 Hz	$1\cdot10^{-2}\cdot$I	
AC Current				Clamp Ammeter
Ammeter				calibration

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Measurand / Device	Measuring range	Conditions	Measurement Capability / Uncertainty	Notes
AC Voltage (≤1100 V) AC Voltage Gauges AC VoltageSource Calibrator: AC Voltage AC Calibrator	2mV ≤U< 2,2mV 2mV ≤U< 2,2mV 2mV ≤U< 2,2mV 2mV ≤U< 2,2mV 2mV ≤U< 2,2mV 2mV ≤U< 2,2mV 2mV ≤U< 2,2mV 2mV ≤U< 2,2mV 2,2mV ≤ U < 22mV 2,2mV ≤ U < 22mV 2,2mV ≤ U < 22mV 2,2mV ≤ U < 22mV 2,2mV ≤ U < 22mV 2,2mV ≤ U < 22mV 2,2mV ≤ U < 22mV 2,2mV ≤ U < 22mV 22mV ≤ U < 220mV 22mV ≤ U < 220mV 22mV ≤ U < 220mV 22mV ≤ U < 220mV 22mV ≤ U < 220mV 22mV ≤ U < 220mV 22mV ≤ U < 220mV 22mV ≤ U < 220mV	10 Hz ≤ f < 20 Hz 20 Hz ≤ f < 40 Hz 40 Hz ≤ f < 20 kHz 20 kHz ≤ f < 50 kHz 50 kHz ≤ f < 100 kHz 100 kHz ≤ f < 300 kHz 300 kHz ≤ f < 500 kHz 500 kHz ≤ f ≤1 MHz 10 Hz ≤ f < 20 Hz 20 Hz ≤ f < 40 Hz 40 Hz ≤ f < 20 kHz 20 kHz ≤ f < 50 kHz 50 kHz ≤ f < 100 kHz 100 kHz ≤ f < 300 kHz 300 kHz ≤ f < 500 kHz 500 kHz ≤ f ≤1 MHz 10 Hz ≤ f < 20 Hz 20 Hz ≤ f < 40 Hz 40 Hz ≤ f < 20 kHz 20 kHz ≤ f < 50 kHz 50 kHz ≤ f < 100 kHz 100 kHz ≤ f < 300 kHz 300 kHz ≤ f < 500 kHz 500 kHz ≤ f ≤1 MHz	$6{,}8.10^{-4}$. U +4,8µV $3{,}4.10^{-4}$. U +4,8µV $2{,}4.10^{-4}$. U +4,8µV $5{,}0.10^{-4}$. U +4,6µV $9{,}2.10^{-4}$. U +7,2µV $1{,}2.10^{-3}$. U +13,2µV $1{,}7.10^{-3}$. U +26µV $3{,}6.10^{-3}$. U +26µV $5{,}6.10^{-4}$. U +5,2µV $2{,}4.10^{-4}$. U +5,2µV $1{,}3.10^{-4}$. U +5,2µV $3{,}8.10^{-4}$. U +5,2µV $8{,}6.10^{-4}$. U +5,2µV $1{,}2.10^{-3}$. U +12,2µV $1{,}7.10^{-3}$. U +52µV $3{,}6.10^{-3}$. U +26µV $5{,}6.10^{-4}$. U +12,2µV $2{,}2.10^{-4}$. U +8µV 11.10^{-4}. U +8µV $3{,}2.10^{-4}$. U +8µV $8{,}6.10^{-4}$. U +26µV 11.10^{-4}. U +26µV $1{,}7.10^{-3}$. U +36µV $3{,}4.10^{-3}$. U +80µV	U = measured value f = the set value (with 5700A Calibrator)
AC Voltage (≤1100 V) AC Voltage Gauges AC Voltage Source Calibrator: AC Voltage AC Calibrator	220 mV ≤ U < 2,2 V 220 mV ≤ U < 2,2 V 220 mV ≤ U < 2,2 V 220 mV ≤ U < 2,2 V 220 mV ≤ U < 2,2 V 220 mV ≤ U < 2,2 V 220 mV ≤ U < 2,2 V 2,2 V ≤ U < 22 V 2,2 V ≤ U < 22 V 2,2 V ≤ U < 22 V 2,2 V ≤ U < 22 V 2,2 V ≤ U < 22 V 2,2 V ≤ U < 22 V 2,2 V ≤ U < 22 V 22 V ≤ U < 220 V 22 V ≤ U < 220 V 22 V ≤ U < 220 V 22 V ≤ U < 220 V 22 V ≤ U < 220 V 220 V ≤ U ≤ 1000 V 220 V ≤ U ≤ 1000 V	10 Hz ≤ f < 20 Hz 20 Hz ≤ f < 40 Hz 40 Hz ≤ f < 20 kHz 20 kHz ≤ f < 50 kHz 50 kHz ≤ f < 100 kHz 100 kHz ≤ f < 300 kHz 300 kHz ≤ f < 500 kHz 500 kHz ≤ f ≤ 1 MHz 10 Hz ≤ f < 20 Hz 20 Hz ≤ f < 40 Hz 40 Hz ≤ f < 20 kHz 20 kHz ≤ f < 50 kHz 50 kHz ≤ f < 100 kHz 100 kHz ≤ f < 300 kHz 300 kHz ≤ f < 500 kHz 500 kHz ≤ f ≤ 1 MHz 10 Hz ≤ f < 20 Hz 20 Hz ≤ f < 40 Hz 40 Hz ≤ f < 20 kHz 20 kHz ≤ f < 50 kHz 50 kHz ≤ f ≤ 100 kHz 15 Hz ≤ f ≤ 50 Hz 50 Hz ≤ f ≤ 1 kHz	$5{,}0.10^{-4}$. U +82µV $1{,}6.10^{-3}$.U +26µV $8{,}0.10^{-5}$.U +6µV $1{,}2.10^{-4}$.U +16µV $2{,}6.10^{-4}$.U +70µV $4{,}4.10^{-4}$.U +130µV 1.10^{-3}.U +36µV $2{,}2.10^{-3}$.U +0,8mV $5{,}0.10^{-4}$.U +0,8mV $1{,}6.10^{-4}$.U +260µV $1{,}6.10^{-4}$.U +120µV $2{,}4.10^{-4}$.U +340µV $2{,}6.10^{-4}$.U +360µV $5{,}0.10^{-4}$.U +1,5mV $1{,}2.10^{-3}$.U +4,4mV $2{,}8.10^{-3}$.U +8,6mV $4{,}0.10^{-4}$.U +16mV $1{,}6.10^{-4}$.U +2,6mV $8{,}8.10^{-5}$.U +0,75mV $2{,}2.10^{-4}$.U +3,6mV $5{,}0.10^{-4}$.U +8mV $4{,}0.10^{-4}$.U +16mV $9{,}0.10^{-5}$.U +3,2mV	U = Measured value f = Adjusted value (with 5700A Calibrator)
DC Power DC Power Meter DC Wattmeter	0,1 W ≤ P ≤ 20 kW	0,1 A ≤ I ≤ 20 A 1 V ≤ V ≤ 1000 V	$1{,}2 \cdot 10^{-3} \cdot P$	PA = Measured Power V = DC Voltage I = DC current

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Measurand / Device	Measuring range	Conditions	Measurement Capability / Uncertainty	Notes
AC Power and Energy Active Power: One phase Power Meter, Watttmeter	0,1 W ≤ P ≤ 20 kW	1 V ≤ U ≤ 1000 V 0,1 A ≤ I ≤ 20 A PF: (1-0) i/k 50 Hz ≤ f ≤ 1 kHz	$2 . 10^{-3} . P$	U: AC Voltage U: AC Current f: Frequency P: Measured AC ctive Power
AC Power and Energy Active Power: Three phase Power Meter, Watttmeter	0 W ≤ P ≤ 36 kW	40 V ≤ U ≤ 300 V 50 mA ≤ I ≤ 120 A PF: (1-0) i/k 45 Hz ≤ f ≤ 65 Hz	$0,15 . 10^{-3} . P$	Q: Measured AC Reactive Power EP: Measured AC Active Energy EQ: Measured AC
AC Power & Energy Reactive Power: Three-phase Power Meter, Watttmeter	0 W ≤ Q ≤ 36 kVar	40 V ≤ U ≤ 300 V 50 mA ≤ I ≤ 120 A PF: (1-0) i/k 45 Hz ≤ f ≤ 65 Hz	$0,15 . 10^{-3} . Q$	Reactive Energy 3 Phases : with COM 3003
AC Power and Energy Active Energy: Three Phase AC Active Energy Meter AC Power Energy	500 mWh ≤ EP ≤ 3000Wh	40 V ≤ U ≤ 300 V 50 mA ≤ I ≤ 120 A PF: (1-0) i/k 45 Hz ≤ f ≤ 65 Hz t: (1-300)sn	$0,20 . 10^{-3} . EP$	
Reactive Energy: 3 Phase AC Reagent	500 mVarh ≤ EQ ≤ 3000 Varh	40 V ≤ U ≤ 300 V 50 mA ≤ I ≤ 120 A PF: (1-0) i/k 45 Hz ≤ f ≤ 65 Hz t: (1-300)sn	0,20 . 10-3 . EQ	

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Measurand / Device	Measuring range	Conditions	Measurement Capability / Uncertainty	Notes
Inductance Gauges LCR meter: Inductance	100 µH	100 Hz 200 Hz 400 Hz 1 kHz 10 kHz	$1{,}5 \cdot 10^{-3} \cdot L$ $1 \cdot 10^{-3} \cdot L$ $1 \cdot 10^{-3} \cdot L$ $1 \cdot 10^{-3} \cdot L$ $2 \cdot 10^{-3} \cdot L$	L = measured Value
	1 mH	100 Hz 200 Hz 400 Hz 1 kHz 10 kHz	$8 \cdot 10^{-4} \cdot L$ $8 \cdot 10^{-4} \cdot L$ $8 \cdot 10^{-4} \cdot L$ $8 \cdot 10^{-4} \cdot L$ $8 \cdot 10^{-4} \cdot L$	
	10 mH	100 Hz 200 Hz 400 Hz 1 kHz 10 kHz	$8 \cdot 10^{-4} \cdot L$ $8 \cdot 10^{-4} \cdot L$ $8 \cdot 10^{-4} \cdot L$ $8 \cdot 10^{-4} \cdot L$ $8 \cdot 10^{-4} \cdot L$	
	100 mH	100 Hz 200 Hz 400 Hz 1 kHz 10 kHz	$8 \cdot 10^{-4} \cdot L$ $8 \cdot 10^{-4} \cdot L$ $8 \cdot 10^{-4} \cdot L$ $8 \cdot 10^{-4} \cdot L$ $8 \cdot 10^{-4} \cdot L$	
	1 H	100 Hz 200 Hz 400 Hz 1 kHz	$8 \cdot 10^{-4} \cdot L$ $8 \cdot 10^{-4} \cdot L$ $8 \cdot 10^{-4} \cdot L$ $4 \cdot 10^{-3} \cdot L$	
Capacitance Gauges LCR meter: Capacitance	1 nF 10 nF 100 nF 1 µF 1,1 µF ≤C< 3,3 µF 3,3 µF ≤C< 11 µF 11 µF ≤C< 33 µF 33 µF ≤C< 110 µF 110 µF ≤C< 330 µF 330 µF ≤C< 1,1 mF	f = 1 kHz f = 100 Hz	$6 \cdot 10^{-3} \cdot C$ $1 \cdot 10^{-3} \cdot C$ $7 \cdot 10^{-4} \cdot C$ $7 \cdot 10^{-4} \cdot C$ $5 \cdot 10^{-3} \cdot C$ $6 \cdot 10^{-3} \cdot C$ $6 \cdot 10^{-3} \cdot C$ $7 \cdot 10^{-3} \cdot C$ $8 \cdot 10^{-3} \cdot C$ $9 \cdot 10^{-3} \cdot C$	C = measured Capacitance f = Frequency

TIME AND FREQUENCY CALIBRATION

Frequency Source Frequency Generator	1 Hz ≤ f ≤ 26,5 GHz	$1{,}0 \cdot 10^{-6}$ Hz ≤ r ≤ 1 Hz	1,55·r	f: Measured frequency (Hz) r = Resolution (Hz) Relative frequency Calibration

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Measurand / Device	Measuring range	Conditions	Measurement Capability / Uncertainty	Notes
Frequency Source Frequency Generator	1 Hz ≤ f < 30 kHz 30 kHz ≤ f < 300 MHz 300 MHz ≤ f < 14GHz 14 GHz ≤ f ≤ 26,5 GHz	1 M Ω, U=30 V 50 Ω, U=12 V 50 Ω, P=27 dBm 50 Ω, P=7 dBm	$2{,}0\cdot10^{-6}$ Hz $3{,}0\cdot10^{-10}\cdot f$ $3{,}0\cdot10^{-11}\cdot f$ 1 Hz	f: Measured Frequency (Hz) U: The amplitude of the measured signal frequency (V) P: The strength of the measured signal frequency (dBm) Absolute Frequency Calibration
Frequency Meters Frequency Counter	10 kHz ≤ f ≤ 20 GHz	$1{,}0\cdot10^{-6}$ Hz ≤ r ≤ 1 Hz	$1{,}55\cdot r$	f: Measured frequency (Hz) r = Resolution (Hz) Common Reference Relative frequency oscillator calibration
Frequency Meters Frequency Counter	10 kHz ≤ f ≤ 20 GHz	-	$4{,}0\cdot10^{-11}\cdot f + r$	f: Measured frequency (Hz) r = Resolution (Hz) common Reference via Ribidium standard
Stopwatch	-30,00 s/day ≤ t ≤ +30,00 s/day 1 s < t ≤ 28800 s	Direct Reading with reference calibrator Frequency reference Comparison method by meter	0,04 s/day 0,100 s	t: Measured Daily Deviation [h / day] or Time Interval [s] in the laboratory and on-site calibration of the deviation of the measured stopwatch.
Optical Tachometer Frequency Meters	60 rpm ≤ ω < 99999 rpm	0,001 rpm ≤ r ≤ 10 rpm	$3{,}0\cdot10^{-6}\cdot\omega + r$ rpm	ω: The measured speed [rpm] r: Optical tachometer display resolution [rpm]
Signal and Pulse characteristics Vertical Deflection (Gain) Oscilloscopes	5 mV ≤ UPP ≤ 5 V 5 mV ≤ UPP ≤ 100 V	Input Impedance 50 Ω Input Impedance 1 MΩ	$3{,}0\ .\ 10^{-3}\ .$ UPP + 100 µV $2{,}5\ .\ 10^{-3}\ .$ UPP + 100 µV	UPP : Applied voltage (peak-peak)

Measurand / Device	Measuring range	Conditions	Measurement Capability / Uncertainty	Notes
Signal and Pulse characteristics Horizontal Deflection (Gain) Oscilloscopes	2 ns ≤ t ≤ 50 ms 0,1 s ≤ t ≤ 0,5 s 1 s ≤ t ≤ 5 s	Giriş Empedansı 50 Ω UPP > 0,2 V	$6 . 10^{-4} . t$ $1 . 10^{-3} . t$ $5 . 10^{-3} . t$	UPP : Applied voltage (peak-peak)
Signal and Pulse characteristics Rising and Falling Time Oscilloscope	t ≥ 600 ps	-	%3 · t	t: The measured rising time [s]
Signal and Pulse characteristics Band width Oscilloscope	10 MHz ≤ Δf ≤ 18 GHz	-	%3 · Δf	Δf: Measured band width [Hz]

TEMPERATURE CALIBRATION

Liquid Glass thermometers	-80 °C ≤ T ≤ 5 °C 5 °C < T ≤ 80 °C 80 °C < T ≤ 150 °C 150 °C < T ≤ 250 °C 250 °C < T ≤ 420 °C	comparison method (in liquid baths)	0,014 °C 0,016 °C 0,032 °C 0,035 °C 0,040 °C	Including Ice Point uncertainty (Resolution is 0.01 ° C, or over)
Resistance thermometer	-38,8344 °C ≤ T ≤ 29,7646 °C	The triple point of mercury The triple point of water Gallium melting point	0,003 °C 0,003 °C 0,003 °C	ITS-90 Fixed points Calibration (SPRT or PRT) * Together the range between -38.8344 °C with 29.7646 °C
Resistance thermometer	0,01 °C ≤ T ≤ 29,7646 °C	The triple point of water Gallium melting point	0,002 °C 0,002 °C	ITS-90 Fixed points Calibration (SPRT or PRT) * Together the range between -38.8344 °C with 29.7646 °C
Resistance thermometer	0,01 °C ≤ T ≤ 419,527 °C	Mercury triple point The triple point of water Gallium melting point Tin freezing point The freezing of zinc point	0,003 °C 0,003 °C 0,003 °C 0,004 °C 0,006 °C	ITS-90 Fixed points Calibration (SPRT or PRT) * Together the range between -38.8344 °C with 29.7646 °C
Resistance thermometer	0,01 °C ≤ T ≤ 660,323 °C	Mercury triple point The triple point of water Gallium melting point Tin freezing point Zinc freezing point Aluminum freezing point	0,004 °C 0,004 °C 0,004 °C 0,005 °C 0,007 °C 0,010 °C	ITS-90 Fixed points Calibration (SPRT or PRT) * Together the range between -38.8344 °C with 29.7646 °C
Resistance thermometer	0,01 °C	The triple point of water	0,001 °C	Water triple point Comparison or thermometer control

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Measurand / Device	Measuring range	Conditions	Measurement Capability / Uncertainty	Notes
Resistance thermometer	0,00 °C	Ice Point	0,014 °C	Including Ice Point uncertainty
Resistance thermometer	-80 °C ≤ T ≤ 5 °C 5 °C < T ≤ 80 °C 80 °C < T ≤ 150 °C 150 °C < T ≤ 250 °C 250 °C < T ≤ 420 °C	comparison method (in liquid baths)	0,014 °C 0,016 °C 0,032 °C 0,035 °C 0,040 °C	On-site or calibration in laboratory
Resistance thermometer	-40 °C ≤ T ≤ 155 °C 155 °C < T ≤ 700 °C	comparison method (in block calibrator)	0,1 °C 0,2 °C	On-site or calibration in laboratory
Thermocouple	-40 °C ≤ T ≤ 420 °C 100 °C ≤ T ≤ 900 °C 900 °C < T ≤ 1350 °C -40 °C ≤ T ≤ 700 °C	comparison method (in liquid baths) comparison method (in horizontal dry ovens) comparison method (in block calibrator)	0,2 °C 0,8 °C 1,5 °C 0,7 °C	for all types for all types On-site calibration or in laboratory (max 140 mm immersion depth)
Digital / Analogue Thermometers (for Pt100 Resistance sensor types)	-80 °C ≤ T ≤ 5°C 5 °C < T ≤ 80 °C 80 °C < T ≤ 150 °C 150 °C < T ≤ 250 °C 250 °C < T ≤ 420 °C 50 °C < T ≤ 300 °C 300 °C < T ≤ 500 °C 100 °C ≤ T ≤ 900 °C 900 °C < T ≤1350 °C -40 °C ≤ T ≤ 155 °C 155 °C < T ≤ 700 °C	comparison method (in liquid baths) Comparative calibration of surface thermometer probes comparison method (in horizontal dry ovens) comparison method (in block calibrator)	0,014 °C 0,016 °C 0,032 °C 0,035 °C 0,040 °C 1,9 °C 2,8 °C 0,8 °C 1,5 °C 0,1 °C 0,2 °C	Including Ice Point uncertainty surface Using Surface Temperature Calibrator Onsite calibration or in the laboratory
Digital / Analogue Thermometers (for thermocouple sensor types)	-80 °C ≤ T ≤ 5°C 5 °C < T ≤ 80 °C 80 °C < T ≤ 150 °C 150 °C < T ≤ 250 °C 250 °C < T ≤ 420 °C 50 °C < T ≤ 300 °C 300 °C < T ≤ 500 °C 100 °C ≤ T ≤ 900 °C 900 °C < T ≤1350 °C -40 °C ≤ T ≤ 155 °C 155 °C < T ≤ 700 °C	comparison method (in liquid baths) Comparative calibration of surface thermometer probes comparison method (in horizontal dry ovens) comparison method (in block calibrator)	0,014 °C 0,016 °C 0,032 °C 0,035 °C 0,040 °C 1,9 °C 2,8 °C 0,8 °C 1,5 °C 0,1 °C 0,2 °C	Including Ice Point uncertainty surface Using Surface Temperature Calibrator Onsite calibration or in the laboratory
Block Calibrator	-40 °C ≤ T ≤ 420 °C	Using reference resistance thermometer Using reference	0,1 °C	For several types

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Measurand / Device	Measuring range	Conditions	Measurement Capability / Uncertainty	Notes
Radiation Thermometer	-40 °C ≤ T ≤ 50 °C 50 °C < T ≤ 550 °C 550 °C < T ≤ 1000 °C	comparative calibration (Using Reference blackbody)	1,3 °C 1,3 °C 2,3 °C	ε = 0.95 and ε = 0.98 (Emissivity)
Detection of temperature distribution of the temperature controlled volume (sterilizer, incubator, oven, air conditioning cabinet, freezers, cold rooms, water baths etc.)	-40 °C ≤ T ≤ 100 °C 100 °C < T ≤ 250 °C 30 % rh ≤ RH ≤ 90 % rh	comparative calibration (Using Reference blackbody)	0,7 °C 1,0 °C 3 % rh	Onsite calibration according to EN 60068-3-11, TS 5151, TS6053, TS 8107, DKD R5-7
Temperature indicator or electrical temperature simulator (Measuring Location)	0 °C ≤ T ≤ 1820 °C -50 °C ≤ T ≤ 1760 °C -50 °C ≤ T ≤1760 °C -270 °C ≤ T ≤1370 °C -210 °C ≤ T ≤1200 °C -270 °C ≤ T ≤1300 °C -270 °C ≤ T ≤1000 °C -270 °C ≤ T ≤ 400 °C -200 °C ≤ T ≤ 650 °C	B type S type R type K type J type N type E type T type Pt 100	0,7 °C 0,5 °C 0,5 °C 0,2 °C 0,1 °C 0,2 °C 0,1 °C 0,1 °C 0,05 °C	For thermocouple sensor types For Pt100 resistance thermometer sensor types
Ash Furnace	100 °C ≤ T ≤ 900 °C 900 °C < T ≤ 1200 °C	Axial temperature distribution in the volume	3,0 °C 4,0 °C	On-site calibration
Electrical temperature simulator (Source Location)	0 °C ≤ T ≤ 1820 °C -50 °C ≤ T ≤ 1760 °C -50 °C ≤ T ≤ 1760 °C -270 °C ≤ T ≤1370 °C -210 °C ≤ T ≤1200 °C -270 °C ≤ T ≤1300 °C -270 °C ≤ T ≤1000 °C -270 °C ≤ T ≤ 400 °C -200 °C ≤ T ≤ 650 °C	B type S type R type K type J type N type E type T type Pt 100	0,7 °C 0,5 °C 0,5 °C 0,2 °C 0,1 °C 0,2 °C 0,1 °C 0,1 °C 0,02 °C	For thermocouple sensor types For resistance thermometer sensor types

HUMIDITY CALIBRATION

Relative humidity measuring devices (Analog and digital thermohygrometer, humidity generator, two pressure humidity generator, thermohigrograph etc.).	9,0 % rh ≤ RH ≤ 10,0 % rh 10,0 % rh < RH ≤ 15,0 % rh 15,0 % rh < RH ≤ 40,0 % rh 40,0 % rh < RH ≤ 50,0 % rh 50,0 % rh < RH ≤ 75,0 % rh 75,0 % rh < RH ≤ 95,0 % rh	Comparison method	0,21 % rh 0,35 % rh 0,45 % rh 0,77 % rh 1,08 % rh 1,39 % rh	In two-pressure humidity generator

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Measurand / Device	Measuring range	Conditions	Measurement Capability / Uncertainty	Notes
Relative humidity measuring devices Temperature (Analog and digital thermohygrometer, humidity generator, two pressure humidity generator, thermohigrograph etc.).	0 °C ≤ T ≤ 70 °C -40 °C ≤ T ≤ 250 °C	Comparison method	0,14 °C 0,60 °C	In two-pressure humidity generator / Reference temperature chamber
Dew point meter	-10,00 °C FP ≤ T < 0,00 °C DP 0,00 °C DP ≤ T ≤ 60,00 °C DP	Comparison method	0,88 °C DP/FP 0,50 °C DP	DP: Dew point FP: Frost point
Digital thermo-hygrometer	11,3 % rh ≤ RH ≤ 75,3 % rh	Comparison method	3 % rh	In salt solutions
Wood moisture meter	3,0 % mc ≤ MC ≤ 35,5 % mc	Wet-dry mass difference method	1,75 % mc	With scales (according to (TS EN 322 standard)

HARDNESS TEST MACHINE CALIBRATION

Force trace measuring systems Hardness indenter Radius Diameter Axis shift Linearity	0,981 N ≤F≤30 kN 0,001 mm ≤L≤6 mm 120° 136° 148,11° 0,2 mm (1 - 10) mm 0° - 0,5° 0,4 mm along	Direct calibration	% 0,12 $1{,}5\cdot10^{-3}\cdot L$ (min. 0,0005 mm) 0,2° 0,002 mm (0.7 + 2·L) µm 0,2° 0,0007 mm	TS EN ISO 6508-2 TS EN ISO 6506-2 TS EN ISO 6507-2 ISO 18898 F: Force L: Length
Rockwell method	HRA HRB HRC HRE HR15N HR30N HR45N HR15T HR30T HR45T	Indirect calibration	0,5 HRA 1,0 HRB 0,5 HRC 1,0 HRE 0,5 HR15N 0,5 HR30N 0,5 HR45N 1,0 HR15T 1,0 HR30T 1,0 HR45T	TS EN ISO 6508-2 ASTM E18
Brinell method	HBW 2,5/31,25 HBW 2,5/62,5 HBW 2,5/187,5 HBW 5/250 HBW 5/750 HBW 10/3000	Indirect calibration	1,00%	TS EN ISO 6506-2 ASTM E10

Measurand / Device	Measuring range	Conditions	Measurement Capability / Uncertainty	Notes
Vickers method	HV 0,1 HV 0,2 HV 0,3 HV 0,5 HV 1 HV 2 HV 3 HV 5 HV 10 HV 20 HV 30 HV 50 HV 100	Indirect calibration	% 1,0 % 1,0 % 1,0 % 1,0 % 1,0 % 1,0 % 1,0 % 1,0 % 1,0 % 1,0 % 1,0 % 1,0 % 1,0	TS EN ISO 6507-2 ASTM E92
Calibration of Brinell, Vickers and Rockwell Hardness Test Machine	60 HB ≤ HB ≤ 450 HB 200 HV ≤ HV ≤ 840 HV 20 HRA ≤ HRA ≤ 65 HRA 66 HRA ≤ HRA ≤ 88 HRA 20 HRB ≤ HRB ≤ 100 HRB 20 HRC ≤ HRC ≤ 70 HRC 12 HRT ≤ HRT ≤ 93 HRT 20 HRN ≤ HRN ≤ 90 HRN	TS EN ISO 6506-2 ASTM E18 TS EN ISO 6507-2 ASTM E10 TS EN ISO 6508-2 ASTM E92	%2 HB %2 HV 1,0 HRA 0,6 HRA 1,0 HRB 0,6 HRC 2,0 HRT 1,0 HRN	These values are the uncertainty values in indirect calibration with hardness comparison plates. The uncertainty values in direct calibration are given separately.
Trace Depth Inspection / Calibration on Hardness Testing Machines	0 mm < L ≤ 10 mm	TS EN ISO 6506-2 TS EN ISO 6507-2	$1,5 \cdot 10^{-3} \cdot L$	with object micrometer L: Length
Shoremeter	Shore A Shore D	Direct calibration	1 Shore A 1 Shore D	ISO 18898 ASTM D2240

MATERIAL TESTING MACHINE CALIBRATION

Concrete Testing Machine Force: F	200 kN ≤ F ≤ 3000 kN	TS EN 12390-4	0,32%	Compression (with Class 1 loadcell)
Tensile / Compression Testing Machine Force: F Force Gauges	1 N ≤ F ≤ 1500 kN 1 mN ≤ F ≤ 50 N 1 N ≤ F ≤ 500 N	TS EN ISO 7500-1 ASTM E4	% 0,16 % 0,10 % 0,10	Tensile (with Class 0,5 loadcell) Tensile (with E2 Class weights) Tensile (with F1 Class weights)

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Charpy Impact Testing Machine Calibration Mechanical Energy: Kp	Nominal Energy 0,5J ≤ Kp ≤ 750J	TS EN ISO 148-2 ASTM E23 DIN 51222	Force: % 0,16 Pendelum length: 1 mm Angle: 0,03° Time: 0,04 s	Measurement uncertainty is calculated for the following parameters. 1 - Resonance status. 2 - Potential Energy. 3 - Indicator deviation.
Extensometer	0 mm ≤ L ≤ 60 mm	TS EN ISO 9513 ASTM E83	$1{,}5 \cdot 10^{-3} \cdot L$	min. 0,5 µm
DIMENSIONAL CALIBRATION				
Outside Micrometer	0 ≤ L ≤ 300 mm 301 mm < L ≤ 500 mm	r: 0,001 mm r: 0,001 mm	(1,5+10 · L) µm (3,5+10 · L) µm	L: Length (m) r: Resolution VDI / VDE / DGQ 2618 Part 10.1
Caliper	0 ≤ L ≤ 1000 mm	r: 0,01 mm	(10+20 · L) µm	L: Length (m) r: Resolution VDI / VDE / DGQ 2618 Part 9.1
Depth Caliper	0 ≤ L ≤ 1000 mm	r: 0.01 mm	(10+20 · L) µm	L: Length (m) r: Resolution VDI / VDE / DGQ 2618 Part 9.2
Height Caliper	0 ≤ L ≤ 1000 mm	r: 0,01 mm	(10+20 · L) µm	L: Length (m) r: Resolution VDI / VDE / DGQ 2618 Part 9.3
Thickness Gauge Lever gauges for external measurements	0 ≤ L ≤ 50 mm	r: 0,01 mm	(3+10 · L) µm	L: Length (m) r: Resolution VDI / VDE / DGQ 2618 Part 12.1
Feeler Gauge	0,01 mm ≤ L ≤ 2 mm	-	2.2 µm	DIN 2275
Cylindrical Measuring Pins	0,1 mm ≤ D ≤ 20 mm	Steel Hard metal	(0,7+2 · D) µm (0,8+2 · D) µm	D: Diameter (m) VDI / VDE / DGQ 2618 Part 4.2

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Measurand / Device	Measuring range	Conditions	Measurement Capability / Uncertainty	Notes
Dial Gauge	0 ≤ L ≤ 50 mm	r: 0,001 mm	(0,9+10 · L) µm	L: Length (m) r: Resolution VDI / VDE / DGQ 2618 Part 11.1
Dial Indicator	L ≤ 3 mm	r: 0,001 mm	0,6 µm	r: Resolution L: Length VDI / VDE / DGQ 2618 Part 11.2
Lever Gauge	L ≤ 2 mm	r: 0,001 mm	0,7 µm	r: Resolution L: Length VDI / VDE / DGQ 2618 Part 11.3
Inside Cylinder (Ring Gauge)	1,5 mm ≤ D ≤ 300 mm	-	(0,8+2 · D) µm	D: Diameter (m) VDI / VDE / DGQ 2618 Part 4.1
Outside Cylinder (Plug Gauge)	D ≤ 300 mm	-	(0,7+2 · D) µm	D: Diameter (m) VDI / VDE / DGQ 2618 Part 4.1
Screw Ring Gauge	4 mm ≤ D ≤ 100 mm	Pitch 0.5 mm ≤ L ≤ 7 mm	(2,5+2 · D) µm	D: Diameter (m) VDI / VDE / DGQ 2618 Part 4.9
Screw Plug Gauge	3 mm ≤ D ≤ 300 mm	Pitch 0.5 mm ≤ L ≤ 7 mm	(2,3+2 · D) µm	D: Diameter (m) VDI / VDE / DGQ 2618 Part 4.8
Surface Roughness Standard	0,1 µm ≤ Rz ≤ 25 µm	-	0,06 · Ra 0,06 · Rz	Rz: Average peak height (µm) (ISO 5436-1 Type A ve Type D)
Micrometer Setting Standard	0 ≤ L ≤ 450 mm	-	(0,8+2 · L) µm	L: Length(m) DKD R 4-3 Part 4.4
Internal Micrometer (2-point contact Micrometer)	25 mm ≤ L ≤ 100 mm 100 mm < L ≤ 300 mm	r: 0.001 mm r: 0.01 mm	(1,2+10 · L) µm (2,5+10 · L) µm	L: Length (m) r: Resolution VDI / VDE / DGQ 2618 Part 10.7
Coating thickness standard (Thickness Gauge Foils)	0,005 mm ≤ L ≤ 5 mm	-	(0,6+2 · L) µm	L: Length (m) DIN EN ISO 2360 DIN EN ISO 2178

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Measurand / Device	Measuring range	Conditions	Measurement Capability / Uncertainty	Notes
Long Gauge Block	100 mm < L ≤ 500 mm	-	(0,5+3 · L) µm	L: Length (m) VDI / VDE / DGQ 2618 Part 3.1
Test Sieve	20 µm ≤ L ≤ 5 mm 5 mm < L ≤ 125 mm	-	3,0 µm 35,0 µm	L: Length ISO 3310-1 ISO 3310-2 ISO 3310-3
Radius Gauge	1 mm ≤ r ≤ 25 mm	-	2,5 µm	Optical measuring method r: Radius
VOLUME CALIBRATION				
Burette	1 ml ≤ V ≤ 5 ml 10 ml 25 ml 50 ml 100 ml	Evacuation	2 µL 4 µL 7 µL 15 µL 15 µL	TS EN ISO 385 ISO 4787 EURAMET cg 19 ISO / TR 20461 V: Measured Volume
Volumetric Flask	1 mL ≤ V ≤ 5 mL 10 mL 20 mL 25 mL 50 mL 100 mL 200 mL 250 mL 500 mL 1000 mL 2000 mL	Filling	2 µL 7 µL 10 µL 10 µL 30 µL 30 µL 50 µL 50 µL 61 µL 95 µL 0,1 mL	TS 1491 EN ISO 1042 TS ISO 4787 Euramet cg 19 ISO/TR 20461 V: Measured Volume
Graduated cylinder (metered cylinders)	5 ml 10 ml 25 ml 50 ml 100 ml 250 ml 500 ml 1000 ml 2000 ml	Filling	2 µL 6 µL 6 µL 30 µL 30 µL 50 µL 61 µL 90 µL 0,1 mL	TS EN ISO 4788 TS ISO 4787 Euramet cg 19 ISO/TR 20461
Pyknometer	1 mL ≤ V ≤ 5 mL 10 mL ≤ V ≤ 25 mL 50 mL 100 mL 10 mL ≤ V ≤ 25 mL 50 mL 100 mL 25 mL 50 mL	Filling Gay-Lussac Reischauer Hubbard	1,5 µL 3 µL 3 µL 3 µL 3 µL 3 µL 3 µL 3 µL 3 µL	TS ISO 3507 TS ISO 4787 Euramet cg 19 ISO/TR 20461 TS EN ISO 2811 V: Measured Volume

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Measurand / Device	Measuring range	Conditions	Measurement Capability / Uncertainty	Notes
One mark Volumetric Pipette	0,5 ml ≤ V ≤ 5 mL 10 mL ≤ V ≤ 100 mL	Evacuation	2 µL 3 µL	TS 1489 ISO 648 TS EN ISO 835 TS ISO 4787 Euramet cg 19 ISO/TR 20461 V: Measured Volume
Graduated Volumetric Pipette	0,1 ml ≤ V ≤ 5 mL 10 mL ≤ V ≤ 100 mL	Evacuation	2 µL 3 µL	TS ISO 4787 TS EN ISO 835 Euramet cg 19 ISO/TR 20461 V: Measured Volume
Piston Pipette	100 µL 200 µL 500 µL 1 mL 2 mL 5 mL 10 mL	Single or multi- channel piston Hand movement or motor driven	0,2 µL 0,2 µL 0,4 µL 1,1 µL 1,1 µL 2,8 µL 5,6 µL	TS EN ISO 8655-2 TS EN ISO 8655-6 ISO/TR 20461
Piston Burette	1 mL ≤ V ≤ 5 mL 10 mL ≤ V ≤ 50 mL 100 mL	Single or multi- channel piston Hand movement or motor driven	0,5 µl 5 µl 10 µl	TS EN ISO 8655-3 TS EN ISO 8655-6 ISO/TR 20461 V: Measured Volume
ACOUSTIC CALIBRATION				
Sound pressure response level / Sound level meters	94 dB 104 dB 114 dB	31,5 Hz ≤ f ≤ 16000 Hz	0,22 dB 0,22 dB 0,22 dB	Calibration with the multifunction acoustic calibrator f = The sound frequency
Sound Pressure Level / Sound Calibrators	70 dB ≤ p ≤ 130 dB	250 Hz 1000 Hz	0.12 dB 0.12 dB	p = Measured Value
Frequency / Sound Calibrators	250 Hz 1000 Hz	-	0.02 Hz 0.02 Hz	-
Noise dosimeter	% 0 - % 600	31,5 Hz ≤ f ≤ 16000 Hz	% 1,0	%: Noise dose value f = frequency
PRESSURE CALIBRATION				
Gauge Pressure Analog and Digital Pressure Gauges, Pressure Calibrator, Pressure transducer, Differential Pressure Gauge etc.	100 Pa ≤ p ≤ 2,5 kPa 2,5 kPa < p < 5 kPa	Pneumatic	0,8 Pa 2 Pa	p: applied pressure value, Pa According to the Euramet / cg.17 calibration guide

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Measurand / Device	Measuring range	Conditions	Measurement Capability / Uncertainty	Notes
Gauge / Absolute Pressure Analog and Digital Pressure Gauges, Pressure Calibrator, Pressure transducer, Differential Pressure Gauge etc.	5 kPa ≤ p ≤ 350 kPa 0,35 MPa < p ≤ 7 MPa	Pneumatic	$4 \cdot 10^{-5} \cdot p$ $5 \cdot 10^{-5} \cdot p + 1,5$ Pa	p: applied pressure value, Pa According to the Euramet / cg.17 calibration guide
Gauge / Negative Pressure Analog and Digital Pressure Gauges, Pressure Calibrator, Pressure transducer, Differential Pressure Gauge etc.	7 MPa < p ≤ 13,5 MPa -95 kPa ≤ p ≤ -5 kPa	Pneumatic	$4 \cdot 10^{-5} \cdot p + 50$ Pa $4 \cdot 10^{-5} \cdot p$	p: applied pressure value, Pa According to the Euramet / cg.17 calibration guide
Gauge / Absolute Pressure Analog and Digital Pressure Gauges, Pressure Calibrator, Pressure transducer, Differential Pressure Gauge etc.	0,4 MPa ≤ p ≤ 160 MPa	Pneumatic	$4 \cdot 10^{-5} \cdot p + 200$ Pa	p: applied pressure value, Pa According to the Euramet / cg.17 calibration guide
TORQUE CALIBRATION				
Torque Hand Tools	0,2 N·m ≤ M ≤ 1000 N·m	Temperature: between 18 °C and 28 °C During calibration: ± 1 °C Relative humidity < 90 % rh	% 0,2	ISO 6789-1 TS ISO 6789-2
Torque Hand Tools Calibration System	0,2 N·m ≤ M ≤ 1000 N·m	Temperature: between 18 °C and 28 °C During calibration: ± 1 °C Relative humidity < 90 % rh	% 0,2	DKD-R-3-8
Reference Torque Wrench	0,2 N·m ≤ M ≤ 1000 N·m	Temperature : 21 °C ± 1 °C Relative Humidity 45 % rh ± 10 % rh	% 0,02	DKD-R-3-7
Torque Transducer	0,2 N·m ≤ M ≤ 1000 N·m	Temperature : 21 °C ± 1 °C Relative Humidity 45 % rh ± 10 % rh	% 0,01	DIN 51309
WEIGHING SCALE CALIBRATION				

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Measurand / Device	Measuring range	Conditions	Measurement Capability / Uncertainty	Notes
Non-Automatic Weighing Scales	m ≤ 6000 g m ≤ 6000 g m ≤ 400 kg	using E_2 masses using F_1 masses using M_1 masses	$2 \cdot 10^{-6}$ $8 \cdot 10^{-6}$ $9 \cdot 10^{-5}$	Euramet cg-18/v4.0
MASS CALIBRATION				
E2 Class Weights	1 mg ≤ m ≤ 20 mg 50 mg 100 mg 200 mg 500 mg 1g 2 g 5g 10 g 20 g 50 g 100 g 200 g 500 g 1 kg 2 kg 5 kg	Air	0,003 mg 0,004 mg 0,005 mg 0,006 mg 0,008 mg 0,010 mg 0,012 mg 0,016 mg 0,020 mg 0,025 mg 0,03 mg 0,05 mg 0,10 mg 0,25 mg 0,5 mg 1 mg 2,5 mg	OIML R111-1
F1 Class Weights	1 mg ≤ m ≤ 5 mg 10 mg 20 mg 50 mg 100 mg 200 mg 500 mg 1 g 2 g 5 g 10 g 20 g 50 g 100 g 200 g 500 g 1 kg 2 kg 5 kg 10 kg	Air	0,006 mg 0,008 mg 0,010 mg 0,012 mg 0,016 mg 0,020 mg 0,025 mg 0,03 mg 0,04 mg 0,05 mg 0,06 mg 0,08 mg 0,10 mg 0,16 mg 0,3 mg 0,8 mg 1,6 mg 3 mg 8 mg 16 mg	OIML R111-1

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Measurand / Device	Measuring range	Conditions	Measurement Capability / Uncertainty	Notes
F2 Class Weights	1 mg ≤ m ≤ 5 mg	Air	0,020 mg	OIML R111-1
	10 mg		0,025 mg	
	20 mg		0,03 mg	
	50 mg		0,04 mg	
	100 mg		0,05 mg	
	200 mg		0,06 mg	
	500 mg		0,08 mg	
	1 g		0,10 mg	
	2 g		0,12 mg	
	5 g		0,16 mg	
	10 g		0,20 mg	
	20 g		0,25 mg	
	50 g		0,3 mg	
	100 g		0,5 mg	
	200 g		1,0 mg	
	500 g		2,5 mg	
	1 kg		5,0 mg	
	2 kg		10 mg	
	5 kg		25 mg	
	10 kg		50 mg	
	20 kg		100 mg	
	50 kg		250 mg	
M1 Class Weights	1 mg ≤ m ≤ 5 mg	Air	0,06 mg	OIML R111-1
	10 mg		0,08 mg	
	20 mg		0,10 mg	
	50 mg		0,12 mg	
	100 mg		0,16 mg	
	200 mg		0,20 mg	
	500 mg		0,25 mg	
	1g		0,3 mg	
	2g		0,4 mg	
	5g		0,5 mg	
	10 g		0,6 mg	
	20 g		0,8 mg	
	50 g		1,0 mg	
	100 g		1,6 mg	
	200 g		3,0 mg	
	500 g		8,0 mg	
	1 kg		16 mg	
	2 kg		30 mg	
	5 kg		80 mg	
	10 kg		160 mg	
	20 kg		300 mg	
	50 kg		800 mg	

Measurand / Device	Measuring range	Conditions	Measurement Capability / Uncertainty	Notes
M2 Class Weights	100 mg 200 mg 500 mg 1 g 2 g 5 g 10 g 20 g 50 g 100 g 200 g 500 g 1 kg 2 kg 5 kg 10 kg 20 kg 50 kg	Air	0,5 mg 0,6 mg 0,8 mg 1,0 mg 1,2 mg 1,6 mg 2,0 mg 2,5 mg 3 mg 5 mg 10 mg 25 mg 50 mg 100 mg 250 mg 500 mg 1000 mg 2500 mg	OIML R111-1
M3 Class Weights	1 g 2 g 5 g 10 g 20 g 50 g 100 g 200 g 500 g 1kg 2 kg 5 kg 10 kg 20 kg 50 kg	Air	3 mg 4 mg 5 mg 6 mg 8 mg 10 mg 16 mg 30 mg 80 mg 160 mg 300 mg 800 mg 1600 mg 3000 mg 8000 mg	OIML R111-1
Non-Standard Weights	1 g ≤ m ≤ 30 g 30 g < m ≤ 50 g 50 g < m ≤ 5000 g 5000 g < m ≤ 10000 g	Air	0,2 mg 1,2 mg 13 mg 45 mg	OIML R111-1 OIML D 28 NISTIR 6969 using E1 Class Weights
Non-Standard Weights	10000 g < m ≤ 20000 g	Air	80 mg	OIML R111-1 OIML D 28 NISTIR 6969 using E2 Class Weights
Non-Standard Weights	20000 g < m ≤ 60000 g	Air	250 mg	OIML R111-1 OIML D 28 NISTIR 6969 using F1 Class Weights

FORCE CALIBRATION

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Measurand / Device	Measuring range	Conditions	Measurement Capability / Uncertainty	Notes
Force Transducers, Load Cells, Force Measuring Rings, Dynamometer	10 N ≤ F ≤ 100 kN	-	0,005%	EN ISO 376 ASTM E74 Using dead weight force calibration machine F: Measured force value
HARDNESS BLOCK CALIBRATION				
Rockwell Hardness Reference Blocks	HRA HRB HRC HRN HRT	-	1 HRA 1 HRBW 1 HRC 1 HRN 1 HRTw	ISO 6508-3 ASTM E18 Using reference hardness test machine
Brinell Hardness Reference Blocks	HBW 1/5 HBW 1/10 HBW 1/30 HBW 2,5/62,5 HBW 2,5/185 HBW 5/62,5 HBW 5/250 HBW 10/100 HBW 10/250	-	% 1,0	ISO 6506-3 ASTM E10 Using reference hardness test machine
Vickers Hardness Reference Blocks	HV 5 HV 10 HV 20 HV 30 HV 50 HV 100	-	% 1,0	ISO 6507-3 ASTM E384 Using reference hardness test machine