

Organismo accreditato
Accredited body

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Riferimento
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Tabella allegata al Certificato di
Accreditamento
Annex to the Accreditation Certificate

142T Rev. 12

UNI CEI EN ISO/IEC 17025:2018
General requirements for the competence of testing and calibration laboratories

Attività oggetto di accreditamento
Accredited activities

<p>Dimensional</p> <ul style="list-style-type: none">- Thread rings and plugs (SLN-01)- Gauge blocks (SLN-02)- Long gauge blocks (SLN-03)- Roughness standards (SLN-10)- Diameter standards (polished cylinders) (SLN-11)- Hand instruments: gauges and micrometers (SLN-16)- Hand instruments: comparators and transducers (SLN-17)- One-dimension measuring machines (SLN-19) <p>Torque</p> <ul style="list-style-type: none">- Torque wrenches / Hand torque tools dynamometers (SMT-01)	<p>Via Palasciano, 29 59100 PRATO (PO) Italy</p>	<p>A</p>
<p>Dimensional</p> <ul style="list-style-type: none">- Hand instruments: gauges and micrometers (SLN-16)- One-dimension measuring machines (SLN-19)	<p>On site, at Customer premises</p>	<p>EXT</p>

The measurement uncertainty stated in the hereafter tables has to be intended as expanded uncertainty obtained by multiplying the standard uncertainty by the coverage factor k corresponding to a confidence level of about 95%. Any deviations are promptly indicated.

This document is a translation. The definitive version is the original Italian annex to the accreditation certificate.

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Settore / Calibration field (SLN-01) Thread rings and plugs						
Strumento Instrument	Misurando ⁽¹⁾ Measurand	Condizioni Additional parameters	Campo di misura Measurement range	Incertezza Uncertainty	Metodo/Procedura Method / Procedure	Sede Location
Threaded cylindrical diametrical standards	Mean diameter (internal)	Thread pitch from 0,25 mm to 3,5 mm	from 3 mm to 65 mm	2,0 µm	EURAMET cg-10 ver.2.1 (12/2012)	A
		Thread pitch from 0,6 mm to 6,0 mm	from 65 mm to 120 mm	2,0 µm		
	Mean diameter (external)	Thread pitch from 0,25 mm to 0,3 mm	from 1 mm to 120 mm	2,3 µm		
		Thread pitch from 0,3 mm to 6,0 mm	from 1 mm to 120 mm	2,0 µm		

¹ Mean diameter is computed from the measured diameter and assuming the nominal values of pitch and angle of the thread (simple pitch diameter rif. EURAMET cg-10 ver. 2.1).

(Continued) Metrological area "Dimensional"

Settore / Calibration field (SLN-02) Gauge blocks							
Strumento Instrument	Misurando Measurand	Condizioni Additional parameters	Campo di misura Measurement range	Incertezza ⁽²⁾ Uncertainty		Metodo/Procedura Method / Procedure	Sede Location
				U_1	U_2		
Gauge blocks Steel, Ceramics	Central deviation at 20°C	Using reference standards Return error $\leq 0,03 \mu\text{m}$ Temperature: $(20,0 \pm 0,2) \text{ }^\circ\text{C}$	from 0,5 mm to 100 mm	0,09 μm	$0,6 \cdot 10^{-6} \cdot L$	UNI 8928:1987	A
		Using reference standards Return error $\leq 0,1 \mu\text{m}$ Temperature: $(20,0 \pm 0,2) \text{ }^\circ\text{C}$		0,11 μm	$0,6 \cdot 10^{-6} \cdot L$		
		Using reference standards Return error $\leq 0,2 \mu\text{m}$ Temperature: $(20,0 \pm 0,2) \text{ }^\circ\text{C}$		0,15 μm	$0,4 \cdot 10^{-6} \cdot L$		
		Using reference standards Return error $\leq 0,2 \mu\text{m}$ Temperature: $(20,0 \pm 0,4) \text{ }^\circ\text{C}$		0,28 μm			
		Using working standards Temperature: $(20,0 \pm 0,2) \text{ }^\circ\text{C}$		0,12 μm	$0,6 \cdot 10^{-6} \cdot L$		
	Length deviation	n.a.	from 0,5 mm to 100 mm	0,06 μm			
Flatness	n.a.	0,14 μm					
Gauge blocks for micrometers Steel, Ceramics	Central deviation at 20°C	n.a.	from 0,5 mm to 100 mm	0,12 μm	$0,8 \cdot 10^{-6} \cdot L$		

(continued)

² The expanded measurement uncertainty is obtained by combining the two components (U_1 , U_2) stated in the table as U_1+U_2 and the resulting value is expressed with 2 significant digits. L is the nominal length, expressed in micrometers.

(Continued) Metrological area "Dimensional" – Calibration field "Gauge blocks" (SLN-02)

Strumento Instrument	Misurando Measurand	Condizioni Additional parameters	Campo di misura Measurement range	Incertezza ⁽³⁾ Uncertainty		Metodo/Procedura Method / Procedure	Sede Location
				U_1	U_2		
Gauge blocks Tungsten carbide	Central deviation at 20°C	Using reference standards Return error $\leq 0,03 \mu\text{m}$ Temperature: $(20,0 \pm 0,2) \text{ }^\circ\text{C}$	from 0,5 mm to 100 mm	0,09 μm	$1,4 \cdot 10^{-6} \cdot L$	UNI 8928:1987	A
		Using reference standards Return error $\leq 0,1 \mu\text{m}$ Temperature: $(20,0 \pm 0,2) \text{ }^\circ\text{C}$		0,11 μm	$1,4 \cdot 10^{-6} \cdot L$		
		Using reference standards Return error $\leq 0,2 \mu\text{m}$ Temperature: $(20,0 \pm 0,2) \text{ }^\circ\text{C}$		0,15 μm	$1,2 \cdot 10^{-6} \cdot L$		
		Using reference standards Return error $\leq 0,2 \mu\text{m}$ Temperature: $(20,0 \pm 0,4) \text{ }^\circ\text{C}$		0,45 μm			
		Using working standards Temperature: $(20,0 \pm 0,2) \text{ }^\circ\text{C}$		0,12 μm	$1,4 \cdot 10^{-6} \cdot L$		
	Length deviation	n.a.	from 0,5 mm to 100 mm	0,06 μm			
	Flatness	n.a.		0,14 μm			
Dimensional standards materializing a distance Gauge blocks Check rods Thickness standards Flat pads	Length	n.a.	from 0,5 mm to 100 mm	0,46 μm		Internal method. Calibration by mechanical comparison	
Thickness standards	Thickness	n.a.	from 0,01 mm to 2 mm	0,5 μm			

³ The expanded measurement uncertainty is obtained by combining the two components (U_1 , U_2) stated in the table as U_1+U_2 and the resulting value is expressed with 2 significant digits. L is the nominal length, expressed in micrometers.

(Continued) Metrological area "Dimensional"

Settore / Calibration field (SLN-03) Long gauge blocks							
Strumento <i>Instrument</i>	Misurando <i>Measurand</i>	Condizioni <i>Additional parameters</i>	Campo di misura <i>Measurement range</i>	Incertezza ⁽⁴⁾ <i>Uncertainty</i>		Metodo/Procedura <i>Method / Procedure</i>	Sede <i>Location</i>
				U_1	U_2		
Dimensional standards materializing a distance Gauge blocks Check rods Thickness standards Flat pads	Length	n.a.	from 100 mm to 650 mm	0,42 μm	$1,4 \cdot 10^{-6} \cdot L$	Internal method. Calibration by mechanical comparison	A

Settore / Calibration field (SLN-10) Roughness standards							
Strumento <i>Instrument</i>	Misurando <i>Measurand</i>	Condizioni <i>Additional parameters</i>	Campo di misura <i>Measurement range</i>	Incertezza ⁽⁵⁾ <i>Uncertainty</i>		Metodo/Procedura <i>Method / Procedure</i>	Sede <i>Location</i>
				U_1	U_2		
Groove depth standards Step standards Roughness standards Compliant with UNI EN ISO 5436-1:2001	d	n.a.	from 0,2 μm to 500 μm	$0,03 \cdot d$	10 nm	Internal method. Calibration performed by stylus profilometer	A
	R_a		from 0,02 μm to 500 μm	$0,05 \cdot R_a$	10 nm		
	R_z		from 0,05 μm to 1000 μm	$0,08 \cdot R_z$	20 nm		
	R_{Sm}		from 10 μm to 1000 μm	$0,02 \cdot R_{Sm}$	0,5 μm		

⁴ The expanded measurement uncertainty is obtained by combining the two components (U_1 , U_2) stated in the table as U_1+U_2 and the resulting value is expressed with 2 significant digits. L is the nominal length, expressed in micrometers.

⁵ The absolute values stated in the right column have to be intended as the minimum value of the resulting expanded measurement uncertainty.

(Continued) Metrological area "Dimensional"

Settore / Calibration field (SLN-11) Diameter standards (polished cylinders)						
Strumento Instrument	Misurando Measurand	Condizioni Additional parameters	Campo di misura Measurement range	Incertezza Uncertainty	Metodo/Procedura Method / Procedure	Sede Location
Internal cylinders	Internal diameter	Temperature: (20,0 ± 0,5) °C	from 1,5 mm to 100 mm	0,7 µm	EURAMET cg-06 ver. 2.0 (03/2011)	
			from 100 mm to 140 mm	0,8 µm		
			from 140 mm to 180 mm	0,9 µm		
			from 180 mm to 220 mm	1,0 µm		
			from 220 mm to 250 mm	1,1 µm		
Forks	Internal diameter	Temperature: (20,0 ± 0,5) °C	from 5 mm to 100 mm	0,7 µm	Internal method. Calibration by mechanical comparison	A
			from 100 mm to 140 mm	0,8 µm		
			from 140 mm to 180 mm	0,9 µm		
			from 180 mm to 220 mm	1,0 µm		
			from 220 mm to 250 mm	1,1 µm		
External cylinders	External diameter	Temperature: (20,0 ± 0,5) °C	up to 100 mm	0,52 µm	EURAMET cg-06 ver. 2.0 (03/2011)	
			up to 1 mm	0,73 µm		
			from 1 mm to 10 mm	0,50 µm		
			from 10 mm to 100 mm	0,57 µm		
			up to 1 mm	0,86 µm		
			from 1 mm to 10 mm	0,50 µm		
			from 10 mm to 100 mm	0,57 µm		

(continued)

(Continued) Metrological area "Dimensional" – Calibration field "Diameter standards (polished cylinders)" (SLN-11)

Strumento Instrument	Misurando Measurand	Condizioni Additional parameters	Campo di misura Measurement range	Incertezza Uncertainty	Metodo/Procedura Method / Procedure	Sede Location	
<i>(continua)</i>							
External spheres	Steel	External diameter	Temperature: (20,0 ± 0,5) °C	up to 100 mm	0,52 μm	Internal method. Calibration by mechanical comparison	A
	Ceramics			up to 1 mm	0,73 μm		
				from 1 mm to 10 mm	0,50 μm		
	Tungsten carbide			from 10 mm to 100 mm	0,57 μm		
				up to 1 mm	0,86 μm		
				from 1 mm to 10 mm	0,50 μm		
				from 10 mm to 100 mm	0,57 μm		

(Continued) Metrological area "Dimensional"

The expanded measurement uncertainties stated in the hereafter tables are obtained assuming a coverage factor k equal to 2 and they refer to the calibration of an ideal instrument, without considering its repeatability contributions: these contributions will be computed when estimating the uncertainty value to be associated to the calibration results. Deviations are marked as (\diamond), for which the expanded measurement uncertainty values are related to a coverage factor k equal to 1,65: the actual coverage factor will be computed, from time to time, considering the experimental results on the repeatability of the instrument being calibrated.

Settore / Calibration field		(SLN-16) Hand instruments: gauges and micrometers							
Strumento/Tipo/Unità di formato Instrument/Type/Scale interval		Misurando Measurand	Condizioni Additional parameters	Campo di misura Measurement range	Incertezza ⁽⁶⁾ Uncertainty		Metodo/Procedura Method / Procedure	Sede Location	
					U_1	U_2			
Calipers for depth measurent	Analog	1 μm	Lenght	Temperature: (20,0 \pm 0,5) $^{\circ}\text{C}$ Without temperature compensation	up to 1000 mm	0,6 μm	$3,4 \cdot 10^{-6} \cdot L$	UNI EN ISO 13385-2:2020	A, EXT
		5 μm				1,5 μm	$2,8 \cdot 10^{-6} \cdot L$		
		10 μm				3 μm	$1,8 \cdot 10^{-6} \cdot L$		
		20 μm				7 μm			
		50 μm				13 μm			
		100 μm				25 μm			
	Digital	1 μm			up to 1000 mm	0,7 μm	$3,2 \cdot 10^{-6} \cdot L$		
		5 μm				3 μm	$1,8 \cdot 10^{-6} \cdot L$		
		10 μm				7 μm			
		20 μm				10 μm			
		50 μm				25 μm			
		100 μm				50 μm			

(continued)

⁶ The expanded measurement uncertainty is obtained by combining the two components (U_1 , U_2) stated in the table as U_1+U_2 and the resulting value is expressed with 2 significant digits. L is the nominal length, expressed in micrometers.

(Continued) Metrological area "Dimensional" – Calibration field "Hand instruments: gauges and micrometers" (SLN-16)

Strumento/Tipo/Unità di formato <i>Instrument/Type/Scale interval</i>		Misurando <i>Measurand</i>	Condizioni <i>Additional parameters</i>	Campo di misura <i>Measurement range</i>	Incertezza ⁽⁷⁾ <i>Uncertainty</i>		Metodo/Procedura <i>Method / Procedure</i>	Sede <i>Location</i>		
					U_1	U_2				
Analogue indicating calipers with circular scale	Analog	10 μm	(For external calibration only) Room temperature: (20 \pm 0,5) $^{\circ}\text{C}$	up to 1000 mm	5 μm		UNI EN ISO 13385-1:2019	A, EXT		
		20 μm			7 μm					
		50 μm			13 μm					
		100 μm			25 μm					
		10 μm	Room temperature: (20 \pm 5) $^{\circ}\text{C}$	up to 1000 mm	3 μm	$27 \cdot 10^{-6} \cdot L$		UNI EN ISO 13385-1:2019	EXT	
		20 μm			6 μm	$25 \cdot 10^{-6} \cdot L$				
		50 μm			15 μm	$18 \cdot 10^{-6} \cdot L$				
		100 μm			30 μm	$12 \cdot 10^{-6} \cdot L$				
Vernier calipers	Analog	20 μm	Room temperature: (20,0 \pm 0,5) $^{\circ}\text{C}$	up to 1000 mm	10 μm		UNI EN ISO 13385-1:2019		A	
		50 μm			25 μm					
		100 μm			50 μm					
		20 μm	Room temperature: (20,0 \pm 0,5) $^{\circ}\text{C}$	up to 625 mm	10 μm				UNI EN ISO 13385-1:2019	EXT
		50 μm			25 μm					
		100 μm			50 μm					
		20 μm	Room temperature: (20 \pm 5) $^{\circ}\text{C}$	up to 625 mm	12 μm	$20 \cdot 10^{-6} \cdot L$		UNI EN ISO 13385-1:2019		EXT
		50 μm			30 μm	$12 \cdot 10^{-6} \cdot L$				
100 μm	65 μm									

(continued)

⁷ The expanded measurement uncertainty is obtained by combining the two components (U_1 , U_2) stated in the table as U_1+U_2 and the resulting value is expressed with 2 significant digits. L is the nominal length, expressed in micrometers.

(Continued) Metrological area "Dimensional" – Calibration field "Hand instruments: gauges and micrometers" (SLN-16)

Strumento/Tipo/Unità di formato <i>Instrument/Type/Scale interval</i>	Misurando <i>Measurand</i>	Condizioni <i>Additional parameters</i>	Campo di misura <i>Measurement range</i>	Incertezza ⁽⁸⁾ <i>Uncertainty</i>		Metodo/Procedura <i>Method / Procedure</i>	Sede <i>Location</i>		
				<i>U₁</i>	<i>U₂</i>				
Vernier calipers	Digital	Length	Room temperature: (20,0 ± 0,5) °C	up to 1000 mm	5 µm		UNI EN ISO 13385-1:2019	A	
					7 µm				
					10 µm				
					25 µm				
					50 µm				
			5 µm	Room temperature: (20,0 ± 0,5) °C	up to 625 mm	5 µm			EXT
			7 µm						
			10 µm						
			25 µm						
			50 µm						
			5 µm	Room temperature: (20 ± 5) °C	up to 625 mm	3 µm		27·10 ⁻⁶ ·L	
			6 µm			25·10 ⁻⁶ ·L			
			13 µm			20·10 ⁻⁶ ·L			
			30 µm			12·10 ⁻⁶ ·L			
			65 µm						

⁸ The expanded measurement uncertainty is obtained by combining the two components (U_1 , U_2) stated in the table as U_1+U_2 and the resulting value is expressed with 2 significant digits. L is the nominal length, expressed in micrometers.

(Continued) Metrological area "Dimensional" – Calibration field "Hand instruments: gauges and micrometers" (SLN-16)

Strumento/Tipo/Unità di formato <i>Instrument/Type/Scale interval</i>		Misurando <i>Measurand</i>	Condizioni <i>Additional parameters</i>	Campo di misura <i>Measurement range</i>	Incertezza ⁽⁹⁾ <i>Uncertainty</i>		Metodo/Procedura <i>Method / Procedure</i>	Sede <i>Location</i>
					U_1	U_2		
Bore gauges	Analog	0,1 µm	Room temperature: (20 ± 5) °C Scale span: from 2 mm	up to 100 mm	0,4 µm		Internal method. Calibration by mechanical comparison	A
		0,5 µm			0,4 µm			
		1 µm			0,42 µm			
		2 µm			0,48 µm			
		5 µm			0,7 µm			
		10 µm			1 µm			
		100 µm			10 µm			
	Digital	0,1 µm	Room temperature: (20 ± 5) °C Scale span: from 2 mm	up to 100 mm	0,4 µm		Internal method. Calibration by mechanical comparison	
		0,5 µm			0,5 µm			
		1 µm			0,7 µm			
		2 µm			1,2 µm			
		5 µm			2,5 µm			
		10 µm			5 µm			
Micrometers with extensions for internal measurement	1 µm	Room temperature: (20 ± 5) °C	from 50 mm to 100 mm	0,85 µm		Internal method. Calibration by mechanical comparison		
			from 100 mm to 150 mm	0,95 µm				

⁹ The expanded measurement uncertainty is obtained by combining the two components (U_1 , U_2) stated in the table as U_1+U_2 and the resulting value is expressed with 2 significant digits. L is the nominal length, expressed in micrometers.

(Continued) Metrological area "Dimensional" – Calibration field "Hand instruments: gauges and micrometers" (SLN-16)

Strumento/Tipo/Unità di formato <i>Instrument/Type/Scale interval</i>			Misurando <i>Measurand</i>	Condizioni <i>Additional parameters</i>	Campo di misura <i>Measurement range</i>	Incertezza ⁽¹⁰⁾ <i>Uncertainty</i>		Metodo/Procedura <i>Method / Procedure</i>	Sede <i>Location</i>
						U_1	U_2		
Micrometers for depth measurement	Analog	1 μm	Length	Room temperature: (20 \pm 5) $^{\circ}\text{C}$	up to 1000 mm	0,5 μm	$3,5 \cdot 10^{-6} \cdot L$	Internal method. Calibration by mechanical comparison	A
		5 μm				0,8 μm	$3,2 \cdot 10^{-6} \cdot L$		
		10 μm				1,3 μm	$2,9 \cdot 10^{-6} \cdot L$		
		20 μm				2,4 μm	$2,2 \cdot 10^{-6} \cdot L$		
		50 μm				7 μm			
		100 μm				13 μm			
	Digital	1 μm	Length	Room temperature: (20 \pm 5) $^{\circ}\text{C}$	up to 1000 mm	0,8 μm	$3,2 \cdot 10^{-6} \cdot L$	Internal method. Calibration by mechanical comparison	
		5 μm				3 μm	$2 \cdot 10^{-6} \cdot L$		
		10 μm				7 μm			
		20 μm				10 μm			
		50 μm				25 μm			
		100 μm				50 μm			
2-Point micrometers for internal measurement	Analog	1 μm	Length	Room temperature: (20 \pm 5) $^{\circ}\text{C}$	up to 150 mm	0,3 μm	$2,2 \cdot 10^{-6} \cdot L$	UNI EN ISO 3611:2010	
		2 μm				0,36 μm	$2,0 \cdot 10^{-6} \cdot L$		
		5 μm				0,64 μm	$1,3 \cdot 10^{-6} \cdot L$		
		10 μm				1,3 μm			
	Digital	0,1 μm			up to 150 mm	0,28 μm	$2,3 \cdot 10^{-6} \cdot L$		
		1 μm				0,64 μm	$1,3 \cdot 10^{-6} \cdot L$		
		10 μm				5 μm			

(continued)

¹⁰ The expanded measurement uncertainty is obtained by combining the two components (U_1 , U_2) stated in the table as U_1+U_2 and the resulting value is expressed with 2 significant digits. L is the nominal length, expressed in micrometers.

(Continued) Metrological area "Dimensional" – Calibration field "Hand instruments: gauges and micrometers" (SLN-16)

Strumento/Tipo/Unità di formato <i>Instrument/Type/Scale interval</i>	Misurando <i>Measurand</i>	Condizioni <i>Additional parameters</i>	Campo di misura <i>Measurement range</i>	Incertezza (11) <i>Uncertainty</i>		Metodo/Procedura <i>Method / Procedure</i>	Sede <i>Location</i>		
				U_1	U_2				
<i>(continued)</i>									
2-Point micrometers for internal measurement	Analog	Length	Room temperature: (20 ± 5) °C	up to 150 mm	0,3 µm	$2,2 \cdot 10^{-6} \cdot L$	Internal method. Calibration by mechanical comparison	EXT	
					0,36 µm	$2,0 \cdot 10^{-6} \cdot L$			
					0,64 µm	$1,3 \cdot 10^{-6} \cdot L$			
					1,3 µm				
	Digital			0,1 µm	0,28 µm	$29 \cdot 10^{-6} \cdot L$			
				1 µm	up to 150 mm	0,64 µm			$26 \cdot 10^{-6} \cdot L$
10 µm	5,8 µm	$10 \cdot 10^{-6} \cdot L$							
3-Point micrometers for internal measurement	Analog	Length	Room temperature: (20,0 ± 0,5) °C	up to 150 mm	0,82 µm	$1,3 \cdot 10^{-6} \cdot L$	Internal method. Calibration by mechanical comparison	A	
					0,85 µm	$1,3 \cdot 10^{-6} \cdot L$			
					1,0 µm	$1,0 \cdot 10^{-6} \cdot L$			
					1,5 µm				
	Digital			0,1 µm	up to 150 mm	0,8 µm			$1,3 \cdot 10^{-6} \cdot L$
				1 µm	1,0 µm	$1,0 \cdot 10^{-6} \cdot L$			
				10 µm	5 µm				

11 The expanded measurement uncertainty is obtained by combining the two components (U_1 , U_2) stated in the table as $U_1 + U_2$ and the resulting value is expressed with 2 significant digits. L is the nominal length, expressed in micrometers.

(Continued) Metrological area "Dimensional" – Calibration field "Hand instruments: gauges and micrometers" (SLN-16)

Strumento/Tipo/Unità di formato <i>Instrument/Type/Scale interval</i>			Misurando <i>Measurand</i>	Condizioni <i>Additional parameters</i>	Campo di misura <i>Measurement range</i>	Incertezza ⁽¹²⁾ <i>Uncertainty</i>		Metodo/Procedura <i>Method / Procedure</i>	Sede <i>Location</i>
						U_1	U_2		
Height gauges	Analog	1 μm	Length	Room temperature: (20 \pm 0,5) °C	up to 1000 mm	0,5 μm	$3 \cdot 10^{-6} \cdot L$	UNI EN ISO 13225:2012	A
		5 μm				1,7 μm	$2 \cdot 10^{-6} \cdot L$		
		10 μm				3 μm	$1,4 \cdot 10^{-6} \cdot L$		
		20 μm				7 μm			
		50 μm				13 μm			
		100 μm				25 μm			
	Analog	1 μm		Room temperature: (20 \pm 0,5) °C	up to 1000 mm	0,5 μm	$3,3 \cdot 10^{-6} \cdot L$	UNI EN ISO 13225:2012	EXT
		5 μm				1,5 μm	$2,6 \cdot 10^{-6} \cdot L$		
		10 μm				3 μm	$1,8 \cdot 10^{-6} \cdot L$		
		20 μm				7 μm			
		50 μm				13 μm			
		100 μm				25 μm			
	Analog	1 μm		Room temperature: (20 \pm 5) °C	up to 1000 mm	0,5 μm	$30 \cdot 10^{-6} \cdot L$	UNI EN ISO 13225:2012	EXT
		5 μm				1,5 μm	$30 \cdot 10^{-6} \cdot L$		
		10 μm				3 μm	$28 \cdot 10^{-6} \cdot L$		
		20 μm				6 μm	$25 \cdot 10^{-6} \cdot L$		
		50 μm				15 μm	$19 \cdot 10^{-6} \cdot L$		
		100 μm				29 μm	$13 \cdot 10^{-6} \cdot L$		

(continued)

¹² The expanded measurement uncertainty is obtained by combining the two components (U_1 , U_2) stated in the table as U_1+U_2 and the resulting value is expressed with 2 significant digits. L is the nominal length, expressed in micrometers.

(Continued) Metrological area "Dimensional" – Calibration field "Hand instruments: gauges and micrometers" (SLN-16)

Strumento/Tipo/Unità di formato <i>Instrument/Type/Scale interval</i>	Misurando <i>Measurand</i>	Condizioni Additional parameters	Campo di misura Measurement range	Incertezza ⁽¹³⁾ Uncertainty		Metodo/Procedura Method / Procedure	Sede Location		
				U_1	U_2				
Height gauges	Digital	Length	up to 1000 mm	0,1 μm	$2,3 \cdot 10^{-6} \cdot L$	UNI EN ISO 13225:2012	A		
				1 μm	$1,3 \cdot 10^{-6} \cdot L$				
				5 μm	$1,3 \cdot 10^{-6} \cdot L$				
				10 μm					
				20 μm					
				50 μm					
				100 μm					
	Digital		0,1 μm	$3,4 \cdot 10^{-6} \cdot L$	up to 1000 mm	0,4 μm	$3,2 \cdot 10^{-6} \cdot L$	UNI EN ISO 13225:2012	EXT
			1 μm	$3,2 \cdot 10^{-6} \cdot L$					
			5 μm	$1,8 \cdot 10^{-6} \cdot L$					
			10 μm						
			20 μm						
			50 μm						
			100 μm						
	Digital		0,1 μm	$30 \cdot 10^{-6} \cdot L$	up to 1000 mm	0,4 μm	$30 \cdot 10^{-6} \cdot L$		
			1 μm	$30 \cdot 10^{-6} \cdot L$					
			5 μm	$28 \cdot 10^{-6} \cdot L$					
			10 μm	$25 \cdot 10^{-6} \cdot L$					
			20 μm	$20 \cdot 10^{-6} \cdot L$					

(continued)

¹³ The expanded measurement uncertainty is obtained by combining the two components (U_1 , U_2) stated in the table as $U_1 + U_2$ and the resulting value is expressed with 2 significant digits. L is the nominal length, expressed in micrometers.

(Continued) Metrological area "Dimensional" – Calibration field "Hand instruments: gauges and micrometers" (SLN-16)

Strumento/Tipo/Unità di formato <i>Instrument/Type/Scale interval</i>	Misurando <i>Measurand</i>	Condizioni <i>Additional parameters</i>	Campo di misura <i>Measurement range</i>	Incertezza ⁽¹⁴⁾ <i>Uncertainty</i>		Metodo/Procedura <i>Method / Procedure</i>	Sede <i>Location</i>		
				U_1	U_2				
<i>(continued)</i>									
Height gauges	Digital	50 μm 100 μm	Length	Room temperature: (20 \pm 5) °C	up to 1000 mm	29 μm 65 μm	13·10 ⁻⁶ ·L	UNI EN ISO 13225:2012	EXT
Outside micrometers Caliper gauges Dial gauge with fixed zero point Dial indicator thickness gauge	Analog	1 μm	Length	(For external calibration only) Room temperature: (20,0 \pm 0,5) °C	up to 1000 mm	0,3 μm	5·10 ⁻⁶ ·L	Internal method. Calibration by mechanical comparison	A
		2 μm				0,35 μm	5·10 ⁻⁶ ·L		
		5 μm				0,6 μm	4·10 ⁻⁶ ·L		
		10 μm				1,2 μm	3,4·10 ⁻⁶ ·L		
		Digital			up to 625 mm	1 μm	0,3 μm		5·10 ⁻⁶ ·L
						2 μm	0,35 μm		5·10 ⁻⁶ ·L
						5 μm	0,6 μm		4·10 ⁻⁶ ·L
						10 μm	1,2 μm		3,4·10 ⁻⁶ ·L
	Analog	up to 1000 mm	0,1 μm	0,3 μm	5·10 ⁻⁶ ·L				
			1 μm	0,6 μm	4,5·10 ⁻⁶ ·L				
			10 μm	5,8 μm	1·10 ⁻⁶ ·L				
			Digital	up to 625 mm	1 μm	0,3 μm	30·10 ⁻⁶ ·L		
					2 μm	0,35 μm	30·10 ⁻⁶ ·L		
					5 μm	0,6 μm	30·10 ⁻⁶ ·L		
10 μm	1,2 μm	30·10 ⁻⁶ ·L							
Digital	up to 625 mm	0,1 μm	0,3 μm	30·10 ⁻⁶ ·L					
		1 μm	0,6 μm	30·10 ⁻⁶ ·L					
		10 μm	6 μm	22·10 ⁻⁶ ·L					

¹⁴ The expanded measurement uncertainty is obtained by combining the two components (U_1 , U_2) stated in the table as U_1+U_2 and the resulting value is expressed with 2 significant digits. L is the nominal length, expressed in micrometers.

(Continued) Metrological area "Dimensional" – Calibration field "Hand instruments: gauges and micrometers" (SLN-16)

Strumento/Tipo/Unità di formato Instrument/Type/Scale interval		Misurando Measurand	Condizioni Additional parameters	Campo di misura Measurement range	Incertezza ⁽¹⁵⁾ Uncertainty		Metodo/Procedura Method / Procedure	Sede Location			
					U_1	U_2					
Internal dial caliper gauge	Analog	1 μm	n.a.	up to 150 mm	0,30 μm	$2,2 \cdot 10^{-6} \cdot L$	Internal method. Calibration by mechanical comparison	A			
		2 μm			0,36 μm	$2,0 \cdot 10^{-6} \cdot L$					
		5 μm			0,64 μm	$1,3 \cdot 10^{-6} \cdot L$					
		10 μm			1,3 μm						
		1 μm			Room temperature: (20 \pm 5) $^{\circ}\text{C}$	up to 150 mm			0,3 μm	$29 \cdot 10^{-6} \cdot L$	
		2 μm			0,36 μm				$28 \cdot 10^{-6} \cdot L$		
		5 μm			0,64 μm				$26 \cdot 10^{-6} \cdot L$		
		10 μm			1,2 μm				$24 \cdot 10^{-6} \cdot L$		
	Digital	0,1 μm	n.a.	up to 150 mm	0,28 μm	$2,3 \cdot 10^{-6} \cdot L$		Internal method. Calibration by mechanical comparison	A		
		1 μm			0,64 μm	$1,3 \cdot 10^{-6} \cdot L$					
		10 μm			5 μm						
		0,1 μm			Room temperature: (20 \pm 5) $^{\circ}\text{C}$	up to 150 mm			0,28 μm	$29 \cdot 10^{-6} \cdot L$	EXT
		1 μm			0,64 μm				$26 \cdot 10^{-6} \cdot L$		
		10 μm			5,8 μm				$10 \cdot 10^{-6} \cdot L$		
Presetting master for internal and external measurement with sliding measuring faces (as TAR-AL)	Digital	0,1 μm	Length	Room temperature: (20,0 \pm 0,5) $^{\circ}\text{C}$	up to 1000 mm	Internal method. Calibration by mechanical comparison	A				
		1 μm						0,3 μm	$3,3 \cdot 10^{-6} \cdot L$		
	0,1 μm	Length	Room temperature: (20 \pm 0,5) $^{\circ}\text{C}$	up to 1000 mm	0,7 μm		$2,8 \cdot 10^{-6} \cdot L$	EXT			
	1 μm				0,3 μm		$3,5 \cdot 10^{-6} \cdot L$				
	0,1 μm	Length	Room temperature: (20 \pm 0,5) $^{\circ}\text{C}$	up to 1000 mm	0,7 μm		$3,2 \cdot 10^{-6} \cdot L$				
	1 μm				0,3 μm		$30 \cdot 10^{-6} \cdot L$				
				0,7 μm	$30 \cdot 10^{-6} \cdot L$						

¹⁵ The expanded measurement uncertainty is obtained by combining the two components (U_1 , U_2) stated in the table as U_1+U_2 and the resulting value is expressed with 2 significant digits. L is the nominal length, expressed in micrometers.

(Continued) Metrological area "Dimensional"

The expanded measurement uncertainties stated in the hereafter tables are obtained assuming a coverage factor k equal to 2 and they refer to the calibration of an ideal instrument, without considering its repeatability contributions: these contributions will be computed when estimating the uncertainty value to be associated to the calibration results. Deviations are marked as (\diamond), for which the expanded measurement uncertainty values are related to a coverage factor k equal to 1,65: the actual coverage factor will be computed, from time to time, considering the experimental results on the repeatability of the instrument being calibrated.

Settore / Calibration field		(SLN-17) Hands instruments: comparatore and transducers						
Strumento/Tipo/Unità di formato Instrument/Type/Scale interval		Misurando Measurand	Condizioni Additional parameters	Campo di misura Measurement range	Incertezza ⁽¹⁶⁾ Uncertainty		Metodo/Procedura Method / Procedure	Sede Location
					U_1	U_2		
Dial test indicators Linear transducers	Analog	0,1 μm	n.a.	up to 100 mm	0,32 μm	$7,6 \cdot 10^{-6} \cdot L$	UNI EN ISO 463:2006	A
		0,5 μm			0,32 μm	$7,6 \cdot 10^{-6} \cdot L$		
		1 μm			0,36 μm	$7,2 \cdot 10^{-6} \cdot L$		
		2 μm			0,4 μm	$7,0 \cdot 10^{-6} \cdot L$		
		5 μm			0,66 μm	$5,6 \cdot 10^{-6} \cdot L$		
		10 μm			1,2 μm	$3,8 \cdot 10^{-6} \cdot L$		
		100 μm			10 μm	(\diamond)		
	Digital	0,1 μm	n.a.	up to 100 mm	0,32 μm	$7,6 \cdot 10^{-6} \cdot L$		
		0,5 μm			0,44 μm	$6,6 \cdot 10^{-6} \cdot L$		
		1 μm			0,66 μm	$5,6 \cdot 10^{-6} \cdot L$		
		2 μm			1,2 μm	$3,8 \cdot 10^{-6} \cdot L$		
		5 μm			3 μm	$1 \cdot 10^{-6} \cdot L$		
		10 μm			5 μm	(\diamond)		
		100 μm			50 μm	(\diamond)		

(continued)

¹⁶ The expanded measurement uncertainty is obtained by combining the two components (U_1 , U_2) stated in the table as U_1+U_2 and the resulting value is expressed with 2 significant digits. L is the nominal length, expressed in micrometers.

(Continued) Metrological area "Dimensional" – Calibration field "Hand instruments: comparators and transducers" (SLN-17)

Strumento/Tipo/Unità di formato Instrument/Type/Scale interval	Misurando Measurand	Condizioni Additional parameters	Campo di misura Measurement range	Incertezza ⁽¹⁷⁾ Uncertainty		Metodo/Procedura Method / Procedure	Sede Location		
				U_1	U_2				
<i>(continued)</i>									
Dial test indicators	Analog	Length	n.a.	up to 2 mm	0,38 μm		UNI EN ISO 463:2006 EN ISO 9493:2010	A	
					0,5 μm				
					1 μm				
					2 μm				
					5 μm				
					10 μm	(\diamond)			
					100 μm	(\diamond)			
	Digital		0,1 μm	n.a.	up to 2 mm	0,38 μm			
			0,5 μm			0,48 μm			
			1 μm			0,7 μm			
			2 μm			1,2 μm			
			5 μm			2,5 μm			(\diamond)
			10 μm			5 μm			(\diamond)

(continued)

¹⁷ The expanded measurement uncertainty is obtained by combining the two components (U_1 , U_2) stated in the table as U_1+U_2 and the resulting value is expressed with 2 significant digits. L is the nominal length, expressed in micrometers.

(Continued) Metrological area "Dimensional" – Calibration field "Hand instruments: comparators and transducers" (SLN-17)

Strumento/Tipo/Unità di formato Instrument/Type/Scale interval	Misurando Measurand	Condizioni Additional parameters	Campo di misura Measurement range	Incertezza ⁽¹⁸⁾ Uncertainty		Metodo/Procedura Method / Procedure	Sede Location	
				U_1	U_2			
(continued)								
Micrometric heads	Analog	Length	Room temperature: (20 ± 5) °C	up to 100 mm	0,32 µm	$7,6 \cdot 10^{-6} \cdot L$	Internal method. Calibration by mechanical comparison	A
					0,5 µm	$7,6 \cdot 10^{-6} \cdot L$		
					1 µm	$7,2 \cdot 10^{-6} \cdot L$		
					2 µm	$7,0 \cdot 10^{-6} \cdot L$		
					5 µm	$5,6 \cdot 10^{-6} \cdot L$		
					10 µm	$3,8 \cdot 10^{-6} \cdot L$		
					100 µm	(\diamond)		
	Digital		0,1 µm	$7,6 \cdot 10^{-6} \cdot L$				
			0,5 µm	$6,6 \cdot 10^{-6} \cdot L$				
			1 µm	$5,6 \cdot 10^{-6} \cdot L$				
			2 µm	$3,8 \cdot 10^{-6} \cdot L$				
			5 µm	$1 \cdot 10^{-6} \cdot L$				
			10 µm	(\diamond)				
			100 µm	(\diamond)				
(continued)								

¹⁸ The expanded measurement uncertainty is obtained by combining the two components (U_1 , U_2) stated in the table as $U_1 + U_2$ and the resulting value is expressed with 2 significant digits. L is the nominal length, expressed in micrometers.

(Continued) Metrological area "Dimensional" – Calibration field "Hand instruments: comparators and transducers" (SLN-17)

Strumento/Tipo/Unità di formato <i>Instrument/Type/Scale interval</i>	Misurando <i>Measurand</i>	Condizioni <i>Additional parameters</i>	Campo di misura <i>Measurement range</i>	Incertezza ⁽¹⁹⁾ <i>Uncertainty</i>		Metodo/Procedura <i>Method / Procedure</i>	Sede <i>Location</i>	
				U_1	U_2			
Optical scales and linear transducers for external measurement	Analog	Room temperature: (20 ± 5) °C	up to 600 mm	0,5 µm	4·10 ⁻⁶ ·L	Internal method. Calibration by mechanical comparison	A	
			from 600 mm to 1000 mm	3,4 µm				
			up to 1000 mm	2 µm	2·10 ⁻⁶ ·L			
				3 µm	1,6·10 ⁻⁶ ·L			
				7 µm				
	Digital		Room temperature: (20 ± 5) °C	up to 600 mm	0,4 µm			4·10 ⁻⁶ ·L
				from 600 mm to 1000 mm	3,4 µm			
				up to 600 mm	0,8 µm			3,4·10 ⁻⁶ ·L
				from 600 mm to 1000 mm	3,5 µm			
				up to 1000 mm	2 µm			2·10 ⁻⁶ ·L
		3 µm			1,6·10 ⁻⁶ ·L			
		7 µm						
		13 µm						
		50 µm						

¹⁹ The expanded measurement uncertainty is obtained by combining the two components (U_1 , U_2) stated in the table as U_1+U_2 and the resulting value is expressed with 2 significant digits. L is the nominal length, expressed in micrometers.

(Continued) Metrological area "Dimensional"

Settore / Calibration field		(SLN-19) One-dimension measuring machines					Metodo/Procedura Method / Procedure	Sede Location
Strumento / Unità di formato Instrument / Scale interval	Misurando Measurand	Condizioni Additional parameters	Campo di misura Measurement range	Incertezza ⁽²⁰⁾ Uncertainty				
				U_1	U_2			
Measuring machines for the calibration of comparators (21)	0,01 μm	Measurement error	Temperature up to 100 mm	(20,0 \pm 0,5) $^{\circ}\text{C}$	0,05 μm	$1,4 \cdot 10^{-6} \cdot L$	Internal method. Calibration by comparison with laser interferometer	A, EXT
				(20,0 \pm 1,0) $^{\circ}\text{C}$	0,05 μm	$1,6 \cdot 10^{-6} \cdot L$		
				(20,0 \pm 3,0) $^{\circ}\text{C}$	0,06 μm	$3,3 \cdot 10^{-6} \cdot L$		
				(20,0 \pm 5,0) $^{\circ}\text{C}$	0,07 μm	$5,4 \cdot 10^{-6} \cdot L$		
				(20 \pm 10) $^{\circ}\text{C}$	0,07 μm	$11 \cdot 10^{-6} \cdot L$		
	0,1 μm	Measurement error	Temperature up to 100 mm	(20,0 \pm 0,5) $^{\circ}\text{C}$	0,08 μm	$1,3 \cdot 10^{-6} \cdot L$		
				(20,0 \pm 1,0) $^{\circ}\text{C}$	0,08 μm	$1,5 \cdot 10^{-6} \cdot L$		
				(20,0 \pm 3,0) $^{\circ}\text{C}$	0,08 μm	$3,2 \cdot 10^{-6} \cdot L$		
				(20,0 \pm 5,0) $^{\circ}\text{C}$	0,08 μm	$5,3 \cdot 10^{-6} \cdot L$		
				(20 \pm 10) $^{\circ}\text{C}$	0,08 μm	$11 \cdot 10^{-6} \cdot L$		
	1 μm	Measurement error	Temperature up to 100 mm	(20,0 \pm 0,5) $^{\circ}\text{C}$	0,61 μm			
				(20,0 \pm 1,0) $^{\circ}\text{C}$	0,62 μm			
				(20,0 \pm 3,0) $^{\circ}\text{C}$	0,70 μm			
				(20,0 \pm 5,0) $^{\circ}\text{C}$	0,60 μm	$2,4 \cdot 10^{-6} \cdot L$		
				(20 \pm 10) $^{\circ}\text{C}$	0,60 μm	$7 \cdot 10^{-6} \cdot L$		

(continued)

²⁰ The expanded measurement uncertainty is obtained by combining the two components (U_1 , U_2) stated in the table as U_1+U_2 and the resulting value is expressed with 2 significant digits. L is the nominal length, expressed in micrometers.

²¹ Limited to machines that perform temperature compensation.

(Continued) Metrological area "Dimensional" – Calibration field "One-dimension measuring machines" (SLN-19)

Strumento / Unità di formato <i>Instrument / Scale interval</i>	Misurando <i>Measurand</i>	Condizioni <i>Additional parameters</i>	Campo di misura <i>Measurement range</i>	Incertezza ⁽²²⁾ <i>Uncertainty</i>		Metodo/Procedura <i>Method / Procedure</i>	Sede <i>Location</i>	
				U_1	U_2			
One-dimension measuring machines Single axes of measuring machines (23)	0,01 μm	Measurement error	Temperature up to 2000 mm	(20,0 \pm 0,5) $^{\circ}\text{C}$	0,05 μm	$1,8 \cdot 10^{-6} \cdot L$	Internal method. Calibration by comparison with laser interferometer	A, EXT
				(20,0 \pm 1,0) $^{\circ}\text{C}$	0,05 μm	$2,1 \cdot 10^{-6} \cdot L$		
				(20,0 \pm 3,0) $^{\circ}\text{C}$	0,06 μm	$3,9 \cdot 10^{-6} \cdot L$		
				(20,0 \pm 5,0) $^{\circ}\text{C}$	0,07 μm	$6,0 \cdot 10^{-6} \cdot L$		
				(20 \pm 10) $^{\circ}\text{C}$	0,07 μm	$12 \cdot 10^{-6} \cdot L$		
	0,1 μm	Measurement error	Temperature up to 2000 mm	(20,0 \pm 0,5) $^{\circ}\text{C}$	0,07 μm	$1,8 \cdot 10^{-6} \cdot L$		
				(20,0 \pm 1,0) $^{\circ}\text{C}$	0,07 μm	$2,1 \cdot 10^{-6} \cdot L$		
				(20,0 \pm 3,0) $^{\circ}\text{C}$	0,07 μm	$3,9 \cdot 10^{-6} \cdot L$		
				(20,0 \pm 5,0) $^{\circ}\text{C}$	0,07 μm	$6,0 \cdot 10^{-6} \cdot L$		
				(20 \pm 10) $^{\circ}\text{C}$	0,07 μm	$12 \cdot 10^{-6} \cdot L$		
	1 μm	Measurement error	Temperature up to 2000 mm	(20,0 \pm 0,5) $^{\circ}\text{C}$	0,65 μm	$1,5 \cdot 10^{-6} \cdot L$		
				(20,0 \pm 1,0) $^{\circ}\text{C}$	0,60 μm	$1,8 \cdot 10^{-6} \cdot L$		
				(20,0 \pm 3,0) $^{\circ}\text{C}$	0,60 μm	$3,6 \cdot 10^{-6} \cdot L$		
				(20,0 \pm 5,0) $^{\circ}\text{C}$	0,60 μm	$6,0 \cdot 10^{-6} \cdot L$		
				(20 \pm 10) $^{\circ}\text{C}$	0,60 μm	$12 \cdot 10^{-6} \cdot L$		

(continued)

²² The expanded measurement uncertainty is obtained by combining the two components (U_1 , U_2) stated in the table as U_1+U_2 and the resulting value is expressed with 2 significant digits. L is the nominal length, expressed in micrometers.

²³ Limited to machines that perform temperature compensation.

(Continued) Metrological area "Dimensional" – Calibration field "One-dimension measuring machines" (SLN-19)

Strumento / Unità di formato <i>Instrument / Scale interval</i>	Misurando <i>Measurand</i>	Condizioni <i>Additional parameters</i>	Campo di misura <i>Measurement range</i>	Incertezza ⁽²⁴⁾ <i>Uncertainty</i>		Metodo/Procedura <i>Method / Procedure</i>	Sede <i>Location</i>	
				U_1	U_2			
Measuring projectors (linear motion axes) Presetter machine tools (linear motion axes) (25)	0,01 μm	Measurement error	Temperature	up to 1000 mm	0,05 μm	$1,8 \cdot 10^{-6} \cdot L$	Internal method. Calibration by comparison with laser interferometer	A, EXT
					0,05 μm	$2,1 \cdot 10^{-6} \cdot L$		
					0,06 μm	$3,9 \cdot 10^{-6} \cdot L$		
					0,07 μm	$6,0 \cdot 10^{-6} \cdot L$		
					0,07 μm	$12 \cdot 10^{-6} \cdot L$		
	0,1 μm	Measurement error	Temperature	up to 1000 mm	0,07 μm	$1,8 \cdot 10^{-6} \cdot L$		
					0,07 μm	$2,1 \cdot 10^{-6} \cdot L$		
					0,07 μm	$3,9 \cdot 10^{-6} \cdot L$		
					0,07 μm	$6,0 \cdot 10^{-6} \cdot L$		
					0,07 μm	$12 \cdot 10^{-6} \cdot L$		
	1 μm	Measurement error	Temperature	up to 1000 mm	0,65 μm	$1,5 \cdot 10^{-6} \cdot L$		
					0,60 μm	$1,8 \cdot 10^{-6} \cdot L$		
					0,60 μm	$3,6 \cdot 10^{-6} \cdot L$		
					0,60 μm	$6,0 \cdot 10^{-6} \cdot L$		
					0,60 μm	$12 \cdot 10^{-6} \cdot L$		

²⁴ The expanded measurement uncertainty is obtained by combining the two components (U_1 , U_2) stated in the table as U_1+U_2 and the resulting value is expressed with 2 significant digits. L is the nominal length, expressed in micrometers.

²⁵ Limited to machines that perform temperature compensation.

Area metrologica
Metrological area

Torque

Settore / Calibration field (SMT-01) **Torque wrenches / Hand torque tools dynamometers**

Strumento <i>Instrument</i>	Misurando <i>Measurand</i>	Condizioni <i>Additional parameters</i>	Campo di misura <i>Measurement range</i>	Incertezza <i>Uncertainty</i>	Metodo/Procedura <i>Method / Procedure</i>	Sede <i>Location</i>
Torque wrenches Torque screwdrivers direct reading or click-type	Torque	Room temperature: from 18 °C to 28 °C Right-hand and left-hand tightening	from 0,2 N·m to 1000 N·m	1 %	UNI EN ISO 6789-2:2017 or Internal method. Calibration by direct comparison with reference torque	A

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