

of **IAC Meettechnische Services B.V.**
Geometrical Laboratory
Emmen, the Netherlands

Valid from: **09-10-2009** to **01-08-2012**

Replaces annex dated: **24-09-2008**

HCS code	Measured quantity, Instrument, Measure	Range	Best measurement capabilities ($k=2$)	Remarks
DM 0 0	DIMENSIONAL QUANTITIES			
DM 1 0	Length gauges			l = nominal value
	Steel/steel, ceramics/steel	$0,5 \text{ mm} \leq l \leq 100 \text{ mm}$	$0,08 \mu\text{m} + 3,5 \cdot 10^{-6} \cdot l$	Gauge block comparator
	Hard metal/hard metal	$0,5 \text{ mm} \leq l \leq 100 \text{ mm}$	$0,08 \mu\text{m} + 2,5 \cdot 10^{-6} \cdot l$	Gauge block comparator
	Hard metal /steel	$0,5 \text{ mm} \leq l \leq 100 \text{ mm}$	$0,08 \mu\text{m} + 4,5 \cdot 10^{-6} \cdot l$	Gauge block comparator
	General, special dimensions	$0,5 \text{ mm} \leq l \leq 100 \text{ mm}$	$0,08 \mu\text{m} + 4,0 \cdot 10^{-6} \cdot l$	Gauge block comparator in combination with laser-interferometer
	Gauge blocks	$l \leq 1200 \text{ mm}$	$1,0 \mu\text{m} + 1,0 \cdot 10^{-6} \cdot l$	Laser interferometer with Coordinate measuring machine
	Step gauge blocks			
	External dimensions	$l \leq 1200 \text{ mm}$	$1,0 \mu\text{m} + 1,0 \cdot 10^{-6} \cdot l$	
	Internal dimensions	$0,6 \text{ mm} \leq l \leq 1200 \text{ mm}$	$1,0 \mu\text{m} + 1,0 \cdot 10^{-6} \cdot l$	

This annex has been approved by:

Ir. J.C. van der Poel
Chief Executive

of **IAC Meettechnische Services B.V.**
Geometrical Laboratory
Emmen, the Netherlands

Valid from: **09-10-2009** to **01-08-2012**

Replaces annex dated: **24-09-2008**

HCS code	Measured quantity, Instrument, Measure	Range	Best measurement capabilities ($k=2$)	Remarks
DM 2 0	Line scales, displacements			l = nominal length
				l = translation length
	Translations	$l \leq 30$ m	$0,015 \mu\text{m} + 0,9 \cdot 10^{-6} \cdot l$	
	Lineair displacement	$l \leq 30$ m	$0,5 \mu\text{m} + 1,5 \cdot 10^{-6} \cdot l$	(1)
	Straightness deviation of translation axis	tot 1,5 mm	$1,0 \mu\text{m} + 0,5 \cdot 10^{-6} \cdot l$	(1), $l \leq 3$ m
	Pitch and yaw deviation of translation axis	tot 0,4°	$(1,0 + 0,5 \cdot \{l / 1 \text{ m}\})''$	(1), $l \leq 30$ m
	Combined translations			l_1 = smallest translation length l_2 = largest translation length
	Squareness of 2 translation axis	+/- 1500 mm	$1,5 + 2,0 \cdot 10^{-6} \cdot l_2$	(1), $l_1 \leq l_2 \leq 3$ m Laser with pentagon prism
DM 3 0	Length measuring instruments			l = nominal indication/dimension
	Setting rods, Length gauges with flat or spherical ends	$10 \text{ mm} \leq l \leq 600 \text{ mm}$	$1,0 \mu\text{m} + 3 \cdot 10^{-6} \cdot l$	Laser interferometer and one axis length measuring machine
	External screw micrometers	$l \leq 600 \text{ mm}$	$4,0 \mu\text{m} + 5 \cdot 10^{-6} \cdot l$	
	2-point Internal screw micrometers	$l \leq 150 \text{ mm}$	$4,0 \mu\text{m} + 5 \cdot 10^{-6} \cdot l$	
	3-point Internal screw micrometers	$3 \text{ mm} \leq l \leq 150 \text{ mm}$	$4,0 \mu\text{m} + 5 \cdot 10^{-6} \cdot l$	
	Callipers	$l \leq 1200 \text{ mm}$	$9 \mu\text{m} + 0,5 \cdot B + 5 \cdot 10^{-6} \cdot l$	B: Scale division

of **IAC Meettechnische Services B.V.**
Geometrical Laboratory
Emmen, the Netherlands

Valid from: **09-10-2009** to **01-08-2012**

Replaces annex dated: **24-09-2008**

HCS code	Measured quantity, Instrument, Measure	Range	Best measurement capabilities ($k=2$)	Remarks
	Dial indicators	$l \leq 100$ mm	$1,0 \mu\text{m} + 5 \cdot 10^{-6} \cdot l$	Laser interferometer
		$l \leq 50$ mm	$3,0 \mu\text{m} + 6,5 \cdot 10^{-5} \cdot l$	Dial gauge tester
	Test indicators	$l \leq 2$ mm	$2,0 \mu\text{m} + 5 \cdot 10^{-6} \cdot l$	Dial gauge tester
	Vertical Height	$l \leq 1000$ mm	$1,5 \mu\text{m} + 1,5 \cdot 10^{-6} \cdot l$	Laser interferometer
DM 4 0	Diameter			Parallel and tapered to 1:1 d = nominal diameter
	Plain plug gauges	$3 \text{ mm} \leq d \leq 10 \text{ mm}$	$2,5 \mu\text{m} + 5 \cdot 10^{-6} \cdot d$	MasterScanner
		$10 \text{ mm} \leq d \leq 90 \text{ mm}$	$1,5 \mu\text{m} + 5 \cdot 10^{-6} \cdot d$	MasterScanner
		$0,1 \text{ mm} \leq d \leq 200 \text{ mm}$	$1,1 \mu\text{m} + 5 \cdot 10^{-6} \cdot d$	only parallel on universal length measuring machine
	Plain ring gauges	$2,4 \text{ mm} \leq d \leq 10 \text{ mm}$	$2,5 \mu\text{m} + 5 \cdot 10^{-6} \cdot d$	MasterScanner
		$10 \text{ mm} \leq d \leq 100 \text{ mm}$	$1,5 \mu\text{m} + 5 \cdot 10^{-6} \cdot d$	MasterScanner
		$1,5 \text{ mm} \leq d \leq 300 \text{ mm}$	$1,0 \mu\text{m} + 5 \cdot 10^{-6} \cdot d$	only parallel on universal length measuring machine
DM 5 0	Form deviations			
	Straightness deviation	1,5 mm	$1,0 \mu\text{m} + 0,5 \cdot 10^{-6} \cdot l$	l = axis length ≤ 3 m
	Roundness deviation			d = nominal diameter
	External	tot 0,3 mm	0,3 μm	$1 \text{ mm} \leq d \leq 300 \text{ mm}$
	Internal	tot 0,3 mm	0,3 μm	$1,5 \text{ mm} \leq d \leq 300 \text{ mm}$

of **IAC Meettechnische Services B.V.**
Geometrical Laboratory
Emmen, the Netherlands

Valid from: **09-10-2009** to **01-08-2012**

Replaces annex dated: **24-09-2008**

HCS code	Measured quantity, Instrument, Measure	Range	Best measurement capabilities ($k=2$)	Remarks
	Profile deviation			Parallel and tapered objects to 1:1 d = nominal diameter, in- and external
	Axial length (l_A)	$l_A \leq 60$ mm	$1,0 \mu\text{m} + 5 \cdot 10^{-6} \cdot l_A$	idem 4.1.8.3
	Radial length (l_R)	$l_R \leq 15$ mm	$1,5 \mu\text{m} + 5 \cdot 10^{-6} \cdot d$	idem 4.1.8.3
	Flatness	1 mm	$0,5 \mu\text{m} + 3 \cdot 10^{-6} \cdot l_{\text{max}}$	(1), $l_{\text{max}} = \text{longest side} \leq 10$ m
DM 7 0	Thread quantities			d = nominal diameter, α = flank angle
	Screw plug gauges			Parallel and tapered with MasterScanner Parallel with Length measuring machine ULM
	Major diameter, Minor diameter	$2 \text{ mm} \leq d \leq 90 \text{ mm}$	$2,5 \mu\text{m} + 5 \cdot 10^{-6} \cdot d$	MasterScanner
	Pitch diameter, Simple pitch diameter	$2 \text{ mm} \leq d \leq 90 \text{ mm}$	$2,5 \mu\text{m} + 5 \cdot 10^{-6} \cdot d$	$\alpha \geq 27^\circ$, MasterScanner
			$4,0 \mu\text{m} + 5 \cdot 10^{-6} \cdot d$	$\alpha < 27^\circ$, Master Scanner
		$0,8 \text{ mm} \leq d \leq 200 \text{ mm}$	$3,0 \mu\text{m} + 5 \cdot 10^{-6} \cdot d$	$\alpha = 27^\circ$ of 30° , ULM
			$4,0 \mu\text{m} + 5 \cdot 10^{-6} \cdot d$	$\alpha = 15^\circ$, ULM
	Screw ring gauges			Parallel and tapered with MasterScanner Parallel with ULM
	Major diameter, Minor diameter	$2,4 \text{ mm} \leq d \leq 10 \text{ mm}$	$3,0 \mu\text{m}$	MasterScanner

of **IAC Meettechnische Services B.V.**
Geometrical Laboratory
Emmen, the Netherlands

Valid from: **09-10-2009** to **01-08-2012**

Replaces annex dated: **24-09-2008**

HCS code	Measured quantity, Instrument, Measure	Range	Best measurement capabilities ($k=2$)	Remarks
	Major diameter, Minor diameter	$10 \text{ mm} \leq d \leq 100 \text{ mm}$	$2,5 \mu\text{m} + 5 \cdot 10^{-6} \cdot d$	MasterScanner
	Pitch diameter, Simple pitch diameter	$2,4 \text{ mm} \leq d \leq 10 \text{ mm}$	$3,0 \mu\text{m}$	$\alpha \geq 27^\circ$, MasterScanner
			$4,5 \mu\text{m}$	$\alpha < 27^\circ$, MasterScanner
		$10 \text{ mm} \leq d \leq 100 \text{ mm}$	$2,5 \mu\text{m} + 5 \cdot 10^{-6} \cdot d$	$\alpha \geq 27^\circ$, MasterScanner
			$3,5 \mu\text{m} + 5 \cdot 10^{-6} \cdot d$	$\alpha < 27^\circ$, MasterScanner
		$1,5 \text{ mm} \leq d \leq 10 \text{ mm}$	$5,0 \mu\text{m}$	$\alpha = 27^\circ$ of 30° , ULM
			$6,0 \mu\text{m}$	$\alpha = 15^\circ$, ULM
		$10 \text{ mm} \leq d \leq 95 \text{ mm}$	$4,0 \mu\text{m} + 5 \cdot 10^{-6} \cdot d$	$\alpha = 27^\circ$ of 30° , ULM
		$10 \text{ mm} \leq d \leq 200 \text{ mm}$	$5,0 \mu\text{m} + 5 \cdot 10^{-6} \cdot d$	$\alpha = 15^\circ$, ULM
	Other screw thread quantities (internal-external thread)			Parallel and tapered to 1:1 external: $0,8 \leq d \leq 90 \text{ mm}$ internal: $2,4 \leq d \leq 100 \text{ mm}$
	Pitch (p)	$0,1 \text{ mm} \leq p \leq 40 \text{ mm}$	$0,75 \mu\text{m}$	MasterScanner
	Profile deviations			
	Axial length (l_A)	$l_A \leq 60 \text{ mm}$	$1,0 \mu\text{m} + 5 \cdot 10^{-6} \cdot l_A$	MasterScanner
	Radial length (l_R)	$l_R \leq 15 \text{ mm}$	$1,5 \mu\text{m} + 5 \cdot 10^{-6} \cdot d$	MasterScanner
	Flank angle (α)	$10^\circ \leq \alpha \leq 45^\circ$	$0,1^\circ$	MasterScanner
	Top angle (β)	$20^\circ \leq \beta \leq 90^\circ$	$0,1^\circ$	MasterScanner

of **IAC Meettechnische Services B.V.**
Geometrical Laboratory
Emmen, the Netherlands

Valid from: **09-10-2009** to **01-08-2012**

Replaces annex dated: **24-09-2008**

HCS code	Measured quantity, Instrument, Measure	Range	Best measurement capabilities ($k=2$)	Remarks
	Taper (γ)	$0^\circ \leq \gamma \leq 45^\circ$ (= 1:1)	0,1°	MasterScanner
DM 8 1	Machine tools, work pieces			l = nominal value
	Distance between two parallel planes of a product			
	External dimension	$l \leq 1200$ mm	$1,0 \mu\text{m} + 1,0 \cdot 10^{-6} \cdot l$	laser interferometer with 3D-CMM
	Internal dimension	$0,6 \text{ mm} \leq l \leq 1200$ mm	$1,0 \mu\text{m} + 1,0 \cdot 10^{-6} \cdot l$	laser interferometer with 3D-CMM
DM 9 0	Angle			
	Round tables, Index tables, Angle measuring equipment, rotary-axis	360°	1"	Combination of incremental angular encoder with laser-interferometer with angular optics

Remarks:

The temperature of the environment for the calibration in the laboratory is nominal 20 °C.

Best measurement capabilities: the highest feasible measurement uncertainty for a stated measurement point or range expressed as the total measurement uncertainty, in positive and negative.

The measurement uncertainty is calculated according to EA-4/02 .Expression of the Uncertainty of Measurement in Calibration..

The laser measurements are related to the calibration in the local laboratory and the laboratory on location.

(1) The laser measurements are related to the calibration of machine tools on location.