



Made in Germany



**Passungslehren
Kegellehren
Verzahnungslehren
Messsäulen**

**Cylindrical and Flat Gauges
Taper Gauges
Spline Gauges
Reference Cylinders**

**Calibres cylindriques et plats
Calibres de conicité
Calibres à dentures
Cylindres contrôle**



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Rachenlehren Snap Gauges Calibres à mâchoire	3-5
Grenzlehrdorne Limit Plug Gauges Jauges tampon	5
Prüfstifte Measuring pins Piges de mesure	6
Flache Grenzlochlehren Flat internal limit gauges Jauges plates à tolerance pour alésages	7
Prüfmessscheiben / Prüfmessstäbe Reference discs / Reference bars Disques / Barres de vérification de mesure	7+8
Einstellringe / Gutlehringe / Ausschusslehringe Setting ring gauges / Go ring gauges / NotGo ring gauges Bagues d'ajustage / Bagues entre / Bagues n'entre pas	8
Kegellehren Taper gauges Calibres-verificateurs	9
Verzahnungslehren Spline gauges Calibres à dentures	9
Präzisions-Messsäulen Reference Cylinders Cylindres contrôle	10
Präzisions-Messkugeln Precision balls Billes de précision	10
Grenzflachlehren Feeler gauges Jauges plates	11

9230000911

Grensrachenlehren bis 100 mm

doppelseitig, im Gesenk geschmiedet, Messflächen gehärtet, entspannt, geschliffen und geläppt. Herstellungstoleranz DIN 7162

Limit Snap Gauges, up to 100 mm

double-ended, drop-forged, measuring faces, relieved, ground and lapped, manufacturing tolerances to DIN 7162

Calibres lisses à mâchoires à 100 mm

côtés entre et n'entre pas à double mâchoire, estampés, surfaces de mesurage trempées, recuit, meulées et rodées



9230000912

Gut- und Ausschusseite hartverchromt

Go and NotGo end hard chromed

Côtés entre et n'entre pas en chromage dur

9232000911

Gutseite Hartmetall, Ausschusseite Stahl

Go end in carbide, NotGo end in steel

Côté entre en carbure, n'entre pas en acier

9232500911

Gut- und Ausschusseite Hartmetall

Go and NotGo end in carbide

Côté entre et n'entre pas en carbure



9230000913

Grensrachenlehren bis 100 mm, DIN 2231

Gut- und Ausschusseite in einem Rachen, im Gesenk geschmiedet, Messflächen gehärtet, entspannt, geschliffen und geläppt

Limit Snap Gauges, up to 100 mm, to DIN 2231

Single-ended, drop-forged, measuring faces, relieved, ground and lapped

Calibres lisses à mâchoires, à 100 mm, DIN 2231

Côtés entre et n'entre pas en une seule mâchoire, estampés, surfaces de mesurage trempées, recuit, meulées et rodées



9232500913

Gut- und Ausschusseite Hartmetall

Go and NotGo end in carbide

Côté entre et n'entre pas en carbure

9230000914

Gut- und Ausschusseite hartverchromt

Go and NotGo end hard chromed

Côtés entre et n'entre pas en chromage dur

9230000913

Grensrachenlehren, über 100–205 mm

Gut- und Ausschusseite in einem Rachen, Messflächen gehärtet, entspannt, geschliffen und geläppt, aus einem Stück, im Gesenk geschmiedet

Limit Snap Gauges, 100–205 mm

Single-ended, drop-forged, measuring faces, relieved, ground and lapped

Calibres lisses à mâchoires, au dessus de 100 à 205 mm

Côtés entre et n'entre pas en une seule mâchoire, surfaces de mesurage trempées, recuit, meulées et rodées



9230000914

Gut- und Ausschusseite hartverchromt

Go and NotGo end hard chromed

Côtés entre et n'entre pas en chromage dur

9230000915

Grensrachenlehren, über 100–500 mm

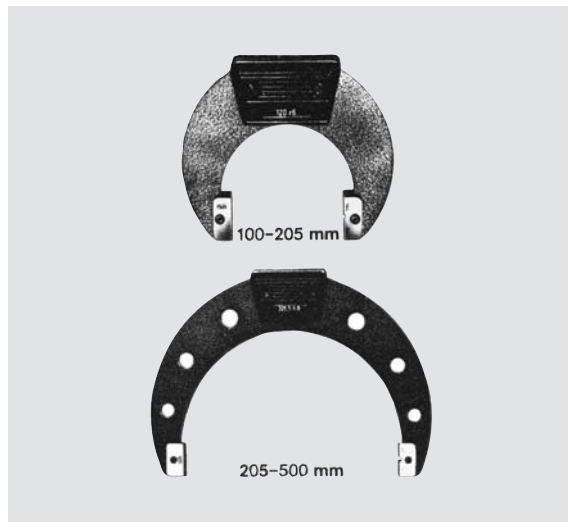
Gut- und Ausschusseite in einem Rachen, jedoch Lehrenbügel aus Stahlblech, Messbacken aufgesetzt, gehärtet, entspannt, geschliffen und geläppt

Limit Snap Gauges, 100–500 mm

Single-ended, frame of sheet steel, measuring jaws mounted, hardened, relieved, ground and lapped

Calibres lisses à mâchoires, de 100 à 500 mm

Côtés entre et n'entre pas en une seule mâchoire étrier en tôle d'acier avec joues de mesure rapportées, trempées, recuit, meulées et rodées



9230000916

Gut- und Ausschusseite hartverchromt

Go and NotGo end hard chromed

Côtés entre et n'entre pas en chromage dur

9230000919

Grensrachenlehren aus Stahlblech, bis 250 mm, DIN 2235

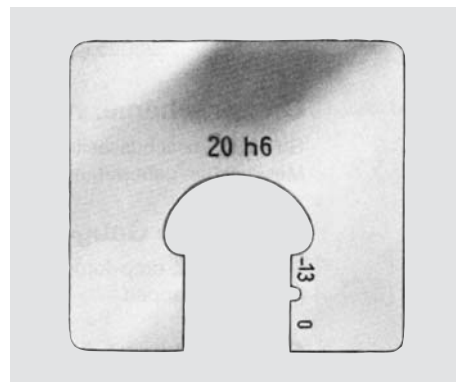
Gut- und Ausschusseite in einem Rachen, aus Lehrenstahl gefertigt, Messflächen gehärtet, entspannt, geschliffen und geläppt

Limit Snap Gauges of sheet steel, up to 250 mm, to DIN 2235

Single-ended, measuring faces hardened, relieved, ground and lapped

Calibres lisses à mâchoires, en tôle d'acier, DIN 2235

Côtés entre et n'entre pas à mâchoire unique, surfaces de mesure trempées, recuit, meulées et rodées



9230000920

Messflächen hartverchromt

Measuring faces hard chromed

Surfaces de mesure en chromage dur



9230000924

Grensrachenlehren, 0,5–5 mm, DIN 2238

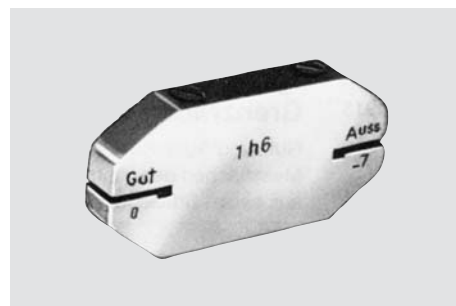
Gut- und Ausschusseite in einem Rachen, aus 2 Teilen zusammengesetzt, gehärtet, entspannt, geschliffen und feinstgeläppt

Limit Snap Gauges, 0,5 to 5 mm, DIN 2238

Single-ended, composed, measuring faces, hardened, relieved, ground and lapped

Calibres lisses à mâchoires, de 0,5 à 5 mm, DIN 2238

Côtés entre et n'entre pas dans une seule mâchoire, composés de 2 parties, surfaces de mesure, trempées, recuit, meulées et rodées finement



9230000925

Messflächen hartverchromt

Measuring faces hard chromed

Surfaces de mesure en chromage dur

9230000928

Verstellbare Grensrachenlehren

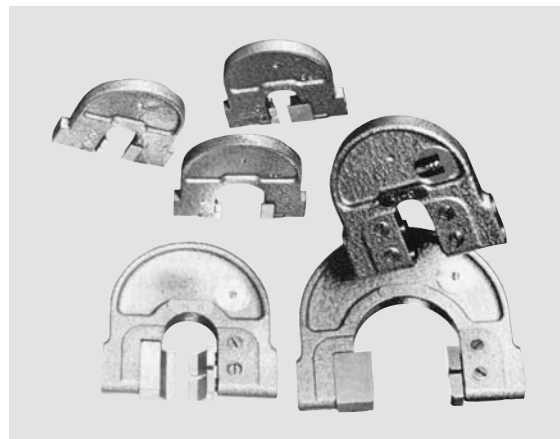
Eine Seite mit zwei Vierkantmessflächen, andere Seite mit fester Messbacke. Gut- und Ausschussseite aus gehärtetem Lehenstahl

Adjustable Limit Snap Gauges

One end with two square measuring faces, one end with a measuring jaw. Go and NotGo end of steel, hardened

Calibres-mâchoires, réglables

Une touche fixe plane et deux touches réglables
Côtés entre et n'entre pas en acier trempé



9230000929

Gut- und Ausschussseite Hartmetall
Go and NotGo end out of carbide
Côtés entre et n'entre pas en carbure

9230000930

Gut- und Ausschussseite Keramik
Go and NotGo end out of ceramic
Côtés entre et n'entre pas en ceramique

9231000928

- Zum Prüfen von Einstichen
Gut- und Ausschussseite aus gehärtetem Lehenstahl
- For checking recesses
Go and NotGo end of steel, hardened
- Pour contrôle de rainures d'arbres
Côtés entre et n'entre pas en acier trempé



Grenzlehrdorne von 1 – 100 mm, DIN 2245 (Form Z vollzylindrisch)

Limit plug gauges 1 – 100 mm, DIN 2245 (form Z solid gaging cylinder)

Jauges tampon de 1 – 100 mm, DIN 2245 (forme Z entièrement cylindriques)

Die Messkörper sind gehärtet, entspannt, geschliffen und geläppt
Gaging members hardened, relieved, ground and lapped
Corps, de l'instrument de mesure trempées, recuit, meulées et rodées



Standardausführung über 1 mm
Standard design with diameter more than 1 mm
Modèle standard au-dessus de 1 mm

9211000901

Gut- und Ausschussseite aus gehärtetem Lehenstahl
Go and NotGo end of steel, hardened
Côtés entre et n'entre pas en acier à calibres trempé

9216000902

Gutseite hartverchromt, Ausschussseite Lehenstahl
Go end hard chromed, NotGo end of steel
Côté entre en chromage dur, Côté n'entre pas en acier

9213000903

Gut- und Ausschussseite hartverchromt
Go and NotGo end hard chromed
Côtés entre et n'entre pas en chromage dur

9212000904

Gut- und Ausschussseite Hartmetall
Go and NotGo end of carbide
Côtés entre et n'entre pas en carbure

9212000905

Gutseite Hartmetall, Ausschussseite Lehenstahl
Go end carbide, NotGo end of steel
Côté entre en carbure, Côté n'entre pas en acier



9211005911
Sonderausführung 0,10 – 10 mm
mit umwendbaren Messzapfen, Lehenstahl
Special design 0,10 – 10 mm with reversible measuring pins, steel
Modèle special de 0,10 – 10 mm, avec tampon réversible, acier

9214005911
Sonderausführung 1 – 10 mm mit umwendbaren Messzapfen, Keramik
Special design 1 – 10 mm with reversible measuring pins, ceramic
Modèle special de 1 – 10 mm, avec tampon réversible, ceramique

Nr./No.

9310000938

Prüfstifte aus Stahl

Genauigkeitsgrad 0 ($\pm 0,0005$ mm)

Measuring pins in steel

Accuracy grade 0 ($\pm 0,0005$ mm)

Piges de mesure en acier

Degré de précision 0 ($\pm 0,0005$ mm)

9310000939

Prüfstifte aus Stahl

Genauigkeitsgrad 1 ($= \pm 0,001$ mm)

Measuring pins in steel

Accuracy grade 1 ($= \pm 0,001$ mm)

Piges de mesure en acier

Degré de précision 1 ($= \pm 0,001$ mm)

**Steigung 0,01 mm – in steps of 0,01 mm –
progression 0,01 mm**

9310000940

Prüfstifte aus Stahl

Genauigkeitsgrad 2 ($= \pm 0,002$ mm)

Measuring pins in steel

Accuracy grade 2 ($= \pm 0,002$ mm)

Piges de mesure en acier

Degré de précision 2 ($= \pm 0,002$ mm)

**Steigung 0,01 mm – in steps of 0,01 mm –
progression 0,01 mm**

9312400938

Prüfstifte aus Hartmetall

Genauigkeitsgrad 0 ($\pm 0,0005$ mm)

Measuring pins in carbide

Accuracy grade 0 ($\pm 0,0005$ mm)

Piges de mesure en carbure

Degré de précision 0 ($\pm 0,0005$ mm)

9312500939

Prüfstifte aus Hartmetall

Genauigkeitsgrad 1 ($\pm 0,001$ mm)

Measuring pins in carbide

Accuracy grade 1 ($\pm 0,001$ mm)

Piges de mesure en carbure

Degré de précision 1 ($\pm 0,001$ mm)

9314010939

Prüfstifte aus Keramik

Genauigkeitsgrad 1 ($= \pm 0,001$ mm)

Measuring pins in ceramic

Accuracy grade 1 ($\pm 0,001$ mm)

Piges de mesure en ceramique

Degré de précision 1 ($\pm 0,001$ mm)



	Ø mm	Standardlängen Lengths / Longueur		
		Gen. 0	Gen. 1	Gen. 2
Stahl Steel / Acier	0,1–0,99	50	40	40
Stahl Steel / Acier	1,0–20,0	50	70	70
Hartmetall Carbide / Carbure	0,8–9,999	40/50	40/50	–
Hartmetall Carbide / Carbure	10,0–20,0	50	50	–



Prüfstiftsätze, Stahl, komplett im Holzkasten Pin sets, steel, complete in wooden box Jeux de piges, en acier, complets en boîte bois			Art.-Nr. Order N° Code	Art.-Nr. Order N° Code
Messbereich mm Measuring range mm Plage de mesure mm	Inhalt (Stück) Contents (pieces) Contents (pièces)	Stufung Steps Progression	Gen.Gr. 1 ($\pm 0,001$ mm) Grade 1 Précision 1	Gen.Gr. 2 ($\pm 0,002$ mm) Grade 2 Précision 2
1,00 – 2,00	100	0,01	9311410100	9311420100
2,01 – 3,00	100	0,01	9311410201	9311420201
3,01 – 4,00	100	0,01	9311410301	9311420301
4,01 – 5,00	100	0,01	9311410401	9311420401
5,01 – 6,00	100	0,01	9311410501	9311420501
6,01 – 7,00	100	0,01	9311410601	9311420601
7,01 – 8,00	100	0,01	9311410701	9311420701
8,01 – 9,00	100	0,01	9311410801	9311420801
9,01 – 10,00	100	0,01	9311410901	9311420901

Tastprüfdorne , zum Überprüfen von Rachenlehren zusammen mit Parallelendmaßen Feeler pin set , for checking snap gauges together with gauge blocks Jeu de piges , pour contrôle de calibres à machoire avec cales étalons	75teilig / pieces / pièces Gen. / Accuracy / Précision $\pm 0,3 \mu\text{m}$	Art.-Nr. 9331400000 Order N° 9331400000 Code 9331400000
Zusammenstellung: Nennmaß 5 mm / Composition: nominal size 5 mm / Composition: côté nominale 5 mm Plus: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 20, 22, 24, 26, 28, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100 μm . Minus: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 20, 22, 24, 26, 28, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100 μm .		

Flache Grenzlochlehren über 100–500 mm DIN 2246 und DIN 2247

Die Messflächen sind gehärtet, entspannt, geschliffen und geläppt
über
100–200 mm: Geschmiedete Rohlinge
200–500 mm: Messkörper aus gehärtetem Lehenstahl

Flat internal limit gauges, 100–500 mm DIN 2246 and DIN 2247

Measuring faces hardened, relieved, ground and lapped
over 100–200 mm: Forged blanks
over 200–500 mm: Gauging members in hardened steel

Jauges plates à tolérances, pour alésages de plus de 100–500 mm DIN 2246 et DIN 2247

Les surfaces de mesurage sont trempées, recuit, meulées et rodées
au dessus de 100–200 mm: Calibres forgés
au dessus de 200–500 mm: Corps des calibres trempés



9210010906 Gut- und Ausschussseite Lehenstahl
bzw. / resp. Go and NotGo end of steel
9210020906 Côtés entre et n'entre pas en acier à calibres

9210010909 Gutseite hartverchromt, Ausschussseite Lehenstahl
bzw. / resp. Go-end hard chromed, NotGo-end of steel
9210020909 Côté entre en chromage dur, côté n'entre pas en acier à calibres

9210010910 Gut- und Ausschussseite hartverchromt
bzw. / resp. Go and NotGo end hard chromed
9210020910 Côtés entre et n'entre pas en chromage dur



9251040931 Prüfmessscheiben nach DIN 2253 im Griff 1–40 mm

Reference discs with handle 1–40 mm to DIN 2253
Disques de vérification de mesures suivant DIN 2253
1–40 mm, en poignée



9251030931 Prüfmessscheiben über 40–100 mm

Reference discs over 40–100 mm
Disques de vérification de mesures, au dessus de 40–100 mm

zum Prüfen von Rachenlehren
for checking snap gauges
pour vérification de calibres à mâchoires

Messflächen gehärtet, entspannt, geschliffen und geläppt
Measuring faces hardened, relieved, ground and lapped
Surfaces de mesurage trempées, recuit, meulées et rodées



9251050931

Prüfmessstäbe über 100–315 mm

Reference bars over 100–315 mm

Barres de vérification de mesures, au dessus de 100–315 mm

Prüfmessstäbe auch als Prüfmessscheiben lieferbar. – Preis auf Anfrage

Reference bars also available as reference discs Price upon inquiry

Barres de vérification de mesures peut être fourni aussi en disques de vérification de mesures Prix sur demande



9221000932

Einstellringe für Messgeräte DIN 2250 C, Stahl

Ring gauges for setting measuring instruments DIN 2250 C, steel

Bagues de mise au point pour appareils de mesure DIN 2250 C, acier

Diese Lehringe werden zum Einstellen von Innenmessgeräten verwendet

These ring gauges are used for setting internal measuring instruments

Ces bagues-jauges sont utilisées pour le réglage de mesurages intérieurs



9221010933

Gutlehringe DIN 2250 G, Stahl

Go ring gauges DIN 2250 G, steel

Bagues de jauge côté entre DIN 2250 G, acier

9221020934

Ausschusslehringe DIN 2254 A, Stahl

NotGo ring gauges DIN 2254 A, steel

Bagues de jauge côté n'entre pas DIN 2254 A, acier

Einstellringe für pneumatische Messgeräte DIN 2250 B (Ausgabe 1977) auf Anfrage

Ring gauges for pneumatic measuring instruments to DIN 2250 B (edit. 1977) upon inquiry

Bagues de jauge pour appareils de mesure pneumatiques DIN 2250 B (edition 1977) sur demande



9222000932

Einstellringe für Messgeräte DIN 2250 C, Hartmetall

Ring gauges for setting measuring instruments DIN 2250 C, carbide

Bagues de mise au point pour appareils de mesure DIN 2250 C, carbure

9222010933

Gutlehringe DIN 2250 C, Hartmetall

Go ring gauges DIN 2250 C, carbide

Bagues entre DIN 2250 C, carbure

9222020934

Ausschusslehringe DIN 2254 C, Hartmetall

NotGo ring gauges DIN 2254 A, carbide

Bagues de jauge côté n'entre pas DIN 2254 A, carbure

9224000932

Einstellringe für Messgeräte DIN 2250 C, Keramik

Ring gauges for setting measuring instruments DIN 2250 C, ceramic

Bagues de mise au point pour appareils de mesure DIN 2250 C, céramique

9224010933

Gutlehringe DIN 2250 C, Keramik

Go ring gauges DIN 2250 C, ceramic

Bagues entre DIN 2250 C, céramique

9224020934

Ausschusslehringe DIN 2254 A, Keramik

NotGo ring gauges DIN 2254 A, ceramic

Bagues de jauge côté n'entre pas DIN 2254 A, céramique



Morsekegellehren, ohne Lappen DIN 229

gehärtet, entspannt, geschliffen und geläppt

Morse taper gauges, without tang DIN 229

hardened, relieved, ground and lapped

Calibres-vérificateurs pour cônes Morse, sans tenon, DIN 229

trempees, recuit, meulées et rodées

9411100941

Kegellehrdorn, DIN 229

Taper plug gauge, DIN 229

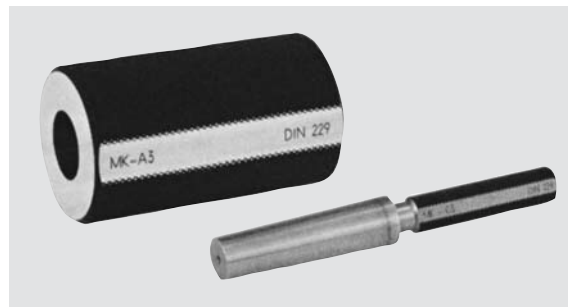
Mandrin-calibre conique, DIN 229

9411100942

Kegellehrhülse, DIN 229

Taper ring gauge, DIN 229

Douille de mandrin-calibre conique, DIN 229



Steilkegellehren, DIN 2079 und DIN 2080

gehärtet, entspannt, geschliffen und geläppt

Steep taper gauges, DIN 2079 and DIN 2080

hardened, relieved, ground and lapped

Calibres-vérificateurs pour cônes à l'angle obtus, DIN 2079 et DIN 2080

trempees, recuit, meulées et rodées

9411200953

Kegellehrdorn, DIN 2079

Taper plug gauge, DIN 2079

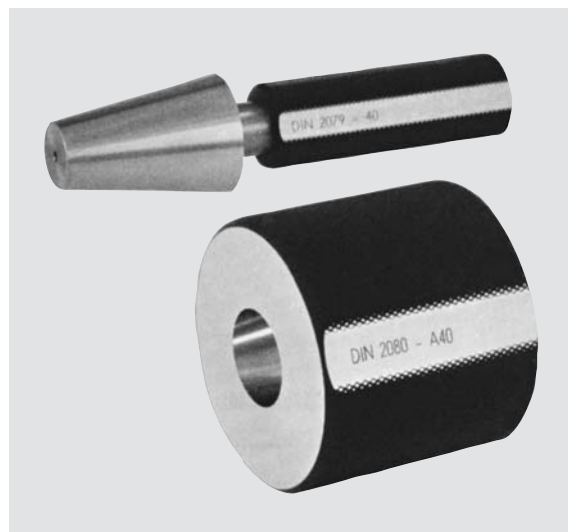
Mandrin-calibre conique, DIN 2079

9411210954

Kegellehrhülse, DIN 2080

Taper ring gauge, DIN 2080

Douille de mandrin-calibre conique, DIN 2080



Verzahnungslehren

Spline Gauges

Calibres à dentures

9710030030

Grenzlehrdorne

9720010010

Gutlehrhinge, vollverzahnt

9720020020

Ausschusslehrhinge, sektorverzahnt

Einstellehren, Meisterlehren

Stirn- und Schrägrad-Lehrzahnräder

Kegelige Verzahnungen

Standardwerkstoff:

Lehrenstahl 60-62 HRC,

Sonderwerkstoff: HSS

Limit plug gauges

Go ring gauges, full form

NotGo ring gauges, sector type

Setting gauges, master gauges

Spur gears, helix gears

Conical splines

Standard material:

tool steel 60-62 HRC

special material: HSS

Tampon à limite

Bague entre à développante

Bague n'entre pas à secteur de développante

Calibres de réglage, calibres étalons

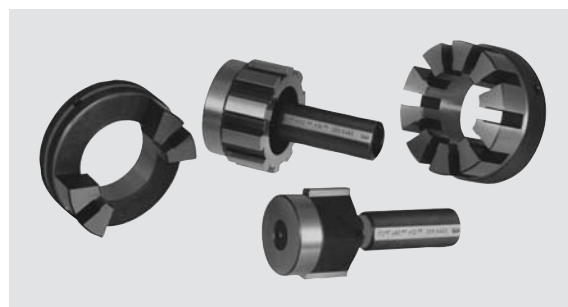
Engrenages droits, hélicoïdaux

Engrenages coniques

Matériau standard:

Acier 60-62 HRC

Matériau spécial: HSS



Präzisions-Messsäulen

aus verschleißfestem Lehenstahl, gehärtet, entspannt,
geschliffen und geläppt

Anwendungsbereiche:

- Für die Kontrolle rechter Winkel nach dem Lichtspaltverfahren oder Zwischenfühlen mittels Parallelendmaße oder mit Tastprüfdornen
- Zur Prüfung und Abnahme von Werkzeugmaschinen in Verbindung mit Messuhr oder Messtaster



Precision Reference Cylinders

of wear-resistant tool-steel, hardened, relieved,
ground and lapped

Applications:

- For checking of right angles by datum gauge, by gauge blocks or measuring pins
- For checking and acceptance test of machine tools together with dial indicator or dial caliper

Available in steel and steel – hard-chromed

Cylindres de contrôle

en acier spécial trempé, détendu, rectifié,
rodé et très résistant

Domaines d'applications:

- Pour le contrôle de la perpendicularité en utilisant une seurec de lumière, des cales étalons ou des piges de contrôle
- Pour la vérification et la réception de machines-outils à l'aide de comparateurs ou palpeurs

Livable en acier spécial et en acier spécial chromé dur

Art.-Nr. 951... = Lehenstahl / 953... = Lehenstahl – hartverchromt



Art.-Nr.	951/953...	...0160060	...0250080	...0360100	...0500120	...0600140	...0800180	...1000180
Höhe/Durchmesser	ca. mm							
Height/Diameter	mm	160/60	250/80	360/100	500/120	600/140	800/180	1000/180
Hauteur/Diamètre	en mm							
Zylinderformgenauigkeit	mm							
Cylindricity	mm	0,001	0,002	0,002	0,003	0,005	0,008	0,010
Cylindricité	mm							
Max. Abweichung der Rechtwinkligkeit zur Messebene	mm							
Max. deviation of squareness with respect to the measuring plane	mm	0,001	0,002	0,003	0,003	0,005	0,008	0,010
Ecart maxi de perpendicularité par rapport à la surface de mesure	mm							

Präzisions-Messkugeln, ohne Bohrung, Genauigkeit $\pm 0,001$ mm

Precision balls, without bore, accuracy $\pm 0,001$ mm

Billes de précision, sans trou, précision $\pm 0,001$ mm

- 9911200000** Chromstahl / Chrome steel / Acier chromé
- 9912200000** Hartmetall / Carbide / Carburé
- 9914310000** Keramik, Genauigkeitsgrad 10 ($\pm 0,00025$ mm), mit Bohrung $\varnothing 6 \times 12$ mm
Ceramic, Grade 10 ($\pm 0,00025$ mm), with bore $\varnothing 6 \times 12$ mm
Céramique, Précision 10 ($\pm 0,00025$ mm), avec trou $\varnothing 6 \times 12$ mm
- 9914410000** Keramik, Genauigkeitsgrad 20 ($\pm 0,001$ mm), mit Bohrung $\varnothing 6 \times 12$ mm
Ceramic, Grade 20 ($\pm 0,001$ mm), with bore $\varnothing 6 \times 12$ mm
Céramique, Précision 20 ($\pm 0,001$ mm), avec trou $\varnothing 6 \times 12$ mm
- 9914300000** Keramik, Genauigkeitsgrad 10 ($\pm 0,00025$ mm), ohne Bohrung
Ceramic, Grade 10 ($\pm 0,00025$ mm), without bore
Céramique, Précision 10 ($\pm 0,00025$ mm), sans trou
- 9914400000** Keramik, Genauigkeitsgrad 20 ($\pm 0,001$ mm), ohne Bohrung
Ceramic, Grade 20 ($\pm 0,001$ mm), without bore
Céramique, Précision 20 ($\pm 0,001$ mm), sans trou



Flachlehren (Grenzflachlehren – Wellennutenlehren – Stichmaße) zur Kontrolle von Flachpassungen

Feeler Gauges for checking grooves

Jauges plates pour gorges

bis 16 mm / up to 16 mm / jusqu'au 16 mm

4110000000 Messkörper gehärteter Lehenstahl, Griff Aluminium
Gauge members steel, hardened, handle of aluminium
Parties calibrantes acier trempé, poignée en aluminium

4120000000 Messkörper Vollhartmetall, Griff Aluminium
Gauge members solid carbide, handle of aluminium
Parties calibrantes carbure, poignée en aluminium

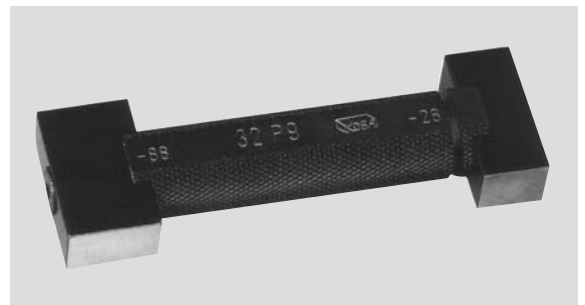
4130000000 Messkörper Keramik, Griff Aluminium
Gauge members ceramic, handle of aluminium
Parties calibrantes ceramique, poignée en aluminium

über 16 – 100 mm /
over 16 – 100 mm / au dessus de 16 – 100 mm

4140000000 Messkörper gehärteter Lehenstahl, Griff Aluminium
Gauge members steel, hardened, handle of aluminium
Parties calibrantes acier trempé, poignée en aluminium

Vorteile / advantages / avantages

- umwendbare Messeinsätze und damit doppelte Lebensdauer
- getrennter Austausch von Gut- bzw. Ausschusseite und damit preisgünstige Leheninstandhaltung
- Gewichterleichterung und dadurch feinfühliges Prüfen
- Reversible gauge members thus double life span
- Separate exchange of Go resp. NotGo ends thus inexpensive maintenance
- Reduced weight hence sensitive gauging
- Côtés réversible afin de doubler la durée de vie
- Possibilité d'échanger séparément le côté entre ou n'entre pas donc maintenance à moindre coût
- Poids réduit afin d'avoir une meilleure sensibilité de mesurage



Grenzflachlehren zur Kontrolle von Nuten in Bohrungen

Feeler Gauges for checking grooves in bores

Jauges plates pour contrôle de rainure intérieure

4700000000 Nennmaß 0,5 – 12,0 mm, Messkörper, Stahl gehärtet, maßstabilisiert, geläpft, einseitig abgeflacht zur sicheren Lagerung
Nominal size from 0,5 – 12,0 mm, gauge members, stabilized in size, lapped, one end flat for safe storage
Côtés nominales de 0,5 – 12,0 mm, acier trempé, stabilisé, rodé, un côté aplati pour stockage sûr

Mehrkant-Grenzlehrdorne, Gut- und Ausschusseite aus gehärtetem Lehenstahl Gutseite volle Form, Ausschusseite vermindert (mit zwei Messflächen)

Multiple-edge limit plug gauge, Go and NotGo end in steel, hardened
Go end full form, NotGo end reduced type (two measuring faces only)

Calibres à forme multiple, Côté entre et n'entre pas en acier trempé
Côté entre en forme entière, Côté n'entre pas reduite (seulement deux face de mesurage)

3141000914 Vierkant-Grenzlehrdorn
Square form limit plug gauge
Tampon carré

3161000916 Sechskant-Grenzlehrdorn
Hexagon form limit plug gauge
Tampon hexagon





Kolb & Baumann GmbH & Co. KG

Hersteller von Präzisions-Messzeugen
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Telefon (0 60 21) 34 63-0
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messzeuge@koba.de

Organisation der Rückführung auf nationale Normale



Physikalisch-Technische
Bundesanstalt - PTB



Deutscher Kalibrierdienst
DKD für die geometrische
Größe Länge bis 1000 mm

KOBA-Kalibrier-Service KKS
für mechanische Messgrößen

Messwesen, Qualitäts-
sicherung, Fertigung,
Entwicklung, Prüflabor

Auszug aus unserem Lieferprogramm:

Parallelendmaße
Endmaßzubehör
Stufenendmaß KOBA-step
Kugelplatte KOBA-check
Kugelstab
Kugelquader KOBA-Q3
Optischer Maßstab KOBA-optima
Optisch-taktile Kalibriernormale
Winkelendmaße
Flachlehren
Einstellstücke
Gewindelehren
Grenzlehrdorne
Ringe
Kegellehren
Rachenlehren
Sonderlehren
Präzisions-Messsäulen
Präzisionsteile nach Zeichnung
Verzahnungslehren



KOBA-Prüflabor



Gewindelehren Thread Gauge Calibres de filetage



Made in Germany

KOLB & BAUMANN GMBH & CO. KG
HERSTELLER VON PRÄZISIONS-MESSZEUGEN
DE-63741 ASCHAFFENBURG · DAIMLERSTR. 24
TELEFON (060 21) 34 63-0 · TELEFAX 34 63-40
Internet <http://www.koba.de> · e-mail: messzeuge@koba.de

Katalog-Nr. 9100/D/E/F/01/2008

Sehr geehrter Kunde,

heute haben Sie die Unterlagen von Kolb & Baumann in Ihren Händen.

Wir freuen uns, dass Sie sich für unsere Produkte interessieren.

KOBA wurde vor über 60 Jahren gegründet und von Anfang an stand die Herstellung von Parallelendmaßen im Vordergrund. Vorerst waren diese Endmaße aus Stahl, später kam dann noch Hartmetall und Keramik hinzu. Des weiteren produzieren wir Endmaßzubehör zum umfangreichen Einsatz unserer Endmaße. Zur weiteren Ergänzung der Produktionspalette wurde die Produktion von Lehren aufgenommen.

Bereits 1979 wurde Kolb & Baumann als 8. DKD-Kalibrierlabor in Deutschland von der PTB akkreditiert. Diese Akkreditierung umfasst die Messgröße Länge bis 1000 mm. Heute gibt es in Deutschland drei Laboratorien welche bis zur Länge von 1000 mm akkreditiert sind, eines davon ist KOBA. Außerdem ist KOBA akkreditiertes DKD-Labor für Lehren und diverse Betriebsmessmittel.

KOBA liefert weltweit in über 40 Länder und ist auch Lieferant für Endmaße und Kalibriernormale bei internationalen Staatsinstituten.

Unsere Kunden vertrauen weltweit den KOBA-Endmaßen und Lehren als hochwertiges deutsches Qualitätsprodukt.

Wir, als rein deutsches Familienunternehmen werden auch weiterhin alles tun um das Vertrauen unserer Kunden in unsere Produkte zu erhalten. Dies ist unsere Tradition und Verpflichtung für die Zukunft

Ihre KOBA-Geschäftsführung



Dipl.-Ing.
Adolf Baumann

Dear Customer,

Today you have the documents of Kolb & Baumann in your hands.

We are glad that you are interested in our products.

The foundations of KOBA were laid more than 60 years ago and at the beginning the manufacture of gauge blocks was the major line. At that time gauge blocks were made out of steel. Later carbide and ceramic were added. Furthermore we manufacture accessories in order to extend the application of our gauge blocks. In order to complete the product range we started the manufacture of gauges.

It was in 1979 when Kolb & Baumann got accredited by the PTB as the 8th DKD-calibration laboratory in Germany. This accreditation comprises the measured value "length" up to 1000 mm. Today out of the three laboratories in Germany who are accredited up to a length of 1000 mm KOBA is one of them. Besides, KOBA is an accredited DKD-laboratory for gauges and other measuring instruments.

KOBA supplies world-wide into more than 40 countries and is also supplier for gauge blocks and calibration masters to various National Physical Laboratories.

Our word-wide customers trust in KOBA-gauge blocks and gauges as a high-grade German quality product.

Being a German family-based company we will do all efforts to keep the confidence in our products. This is our tradition and obligation for the future.

Your KOBA-management

Madame, Monsieur,

Nous avons le plaisir de vous remettre cette documentation sur KOLB & BAUMANN, et nous vous remercions de votre intérêt pour nos produits.

Fabricant d'instruments de mesure de précision, KOBA travaille depuis plus de 60 ans au service de la métrologie dimensionnelle. La fabrication de cales étalons a toujours occupé une place primordiale tout au long de son existence. Dans un premier temps, nous étions spécialisés dans les cales en acier. Par ailleurs, nous fabriquons des accessoires pour cales étalons qui élargissent considérablement le champ d'application de nos cales. Enfin, nous avons complété notre gamme de produits par la fabrication de jauges et calibres.

Notre laboratoire d'étalonnage DKD a été l'un des premiers en Allemagne à être accrédité par le PTB, l'Institut fédéral physico-technique. Cette accréditation concerne la métrologie dimensionnelle de la longueur jusqu'à 1000 mm, tout en sachant que seulement trois laboratoires en Allemagne ont obtenu ce label jusqu'à cette longueur. Par ailleurs, nous disposons d'un laboratoire d'étalonnage accrédité par le DKD (Service Allemand d'étalonnage) pour les jauges et calibres ainsi que pour divers instruments de mesure de précision. KOBA exporte ses produits dans plus de 40 pays du monde ; elle est également fournisseur de cales étalons et d'autres étalons auprès d'instituts et laboratoires nationaux dans le monde entier.

Notre clientèle internationale fait confiance en nos cales étalons, nos jauges et calibres qui sont tous des produits de haute qualité fabriquée en Allemagne.

Notre entreprise familiale KOBA tient à assurer la pérennité de cette qualité « Made in Germany » afin de répondre aux exigences de nos clients qui nous font confiance depuis longtemps. C'est à la fois notre tradition et notre engagement pour l'avenir.

La Direction KOBA



Dipl.-Bw.
Alexander Baumann

Gewindelehren für zylindrische Gewinde

Gewindegrenzlehrdorn mit
Gut- und Ausschußseite

Gewindegrenzlehrdorne werden zur Prüfung des Muttergewindes verwendet. Sie bestehen aus der Gutseite und der Ausschußseite. Der Gewindegutlehrdorn, der das Kleinstmaß darstellt, muss sich ohne größeren Widerstand in das Muttergewinde einschrauben lassen. Der Gewindeausschußlehrdorn, der das Größtmaß des betreffenden Gewindes darstellt, darf sich in ein einwandfreies Muttergewinde nicht einschrauben lassen. Lässt er sich einschrauben, ist das Gewinde zu weit, d. h. Ausschuss.

Mit der Gutseite, die ein volles Gewindeprofil besitzt, soll das Muttergewinde in seiner gesamten Länge geprüft werden. Der Mutterkerndurchmesser wird mit einem normalen Grenzlehrdorn kontrolliert.

Gewindegutlehrdorn

Gewindeausschußlehrdorn

Thread gauges for cylindrical threads

Limit thread plug gauge
with "Go" and "Not Go" ends

Limit thread plug gauges are used for gauging the female thread. They consist of the "Go" and the "Not Go" ends. The "Go" plug thread gauges, which represents the minimum limit, must be able to be screwed-in without greater resistance into the female thread. The "Not Go" plug thread gauge, which represents the maximum limit of the thread in question, must not be able to be screwed-in into an irreproachable female thread. If it can be screwed-in, the thread is too wide, i. e. scrap.

The female thread shall be gauged over its total length with the "Go" end, which possesses a full thread profile. The core diameter of female thread is tested with a standard cylindrical limit plug gauge.

Thread plug gauge "Go"

Thread plug gauge "Not Go"

Calibres de filetages pour filetages cylindriques

Tampon de filetages à tolérance
avec côté »Bon« et »Rebut«

Les jauges-tampons de filetage sont utilisées pour la vérification des filets femelles. Elles se composent d'un côté »Entre« (bon) et d'un côté »N'entre pas« (rebut). La jauges-tampon à tolérance »Entre« représente la mesure minima; elle doit pouvoir être vissée sans grande résistance dans le filetage femelle. La jauges-tampon à tolérance »N'entre pas« représentant le mesure maximum du filetage en cause ne doit pas pouvoir être vissée dans un filetage femelle impeccable. Si on peut la visser, le filetage est trop large, c'est-à-dire c'est du rebut.

Avec le côté »Entre« qui est muni du profil complet de filet, le filetage femelle doit être vérifié sur toute la longueur. Le diamètre du fond de filet femelle est contrôlé avec une jauges-tampon à tolérance normale.

Tampon de filetage »Entre«

Tampon de filetage »N'entre pas«

Gewindegrenzrollenrachenlehre mit Gut- und Ausschussseite

Bügel aus Temperguss

ohne Abb.: Ausführung mit Alu-Bügel

Roller thread gauge with "Go" and "Not Go" ends

Frame of malleable cast iron

Aluminium frame design not illustrated

Calibre-mâchoires, à rouleaux, de filetages à tolérance, avec côté »Entre« et côté »N'entre pas«

Etrier en fonte malleable

sans illustration: modèles au etrier en aluminium

Zur Prüfung des Bolzengewindes wird immer mehr die Gewindegrenzrollenrachenlehre verwendet. Der Vorteil gegenüber dem Leerring besteht darin, dass erstens die Messung erheblich schneller durchgeführt werden kann und zweitens mit ein und derselben Lehre Rechts- und Linksgewinde geprüft werden können. Darüber hinaus sind alle Gütegrade eines Nennmaßes einstellbar. Eingestellt wird die Gewindegrenzrollenrachenlehre mit der unten abgebildeten Einstelllehre. Die entsprechenden Inbusschlüssel werden mitgeliefert. Der Kontrollvorgang geschieht wie bei einer einseitigen Grenzrachenlehre. Das hintere Rollenpaar darf sich nicht über das Bolzengewinde schieben lassen; lässt es sich darüber schieben, so ist das Bolzengewinde zu klein, d. h. Ausschuss.

The roller thread gauge is used more and more for testing the male thread. With respect to the ring gauge it has the advantage that firstly gauging can be carried out considerably quicker, and secondly right-hand and left-hand threads can be tested with one and the same gauge. Beyond that, all grades of one nominal size are adjustable. The roller thread gauge is adjusted with the setting gauge illustrated below. The corresponding socket-screw wrenches are delivered with the gauge. The checking process is performed in the same way as with a single end limit snap gauge. The front pair of rollers must be able to be slid easily movable over the male thread. The rear pair of rollers must not be able to be slid over the male threads; it is able to be slid over it, the male thread is too small, i. e. scrap.

On utilise de plus en plus le calibre-mâchoires, à rouleaux, de filetages à tolérance, pour la vérification des filetages de boulons. L'avantage par rapport à la bague cylindrique de jauge réside tout d'abord dans le fait que la mesure s'effectue dans un délai considérablement plus réduit, et ensuite qu'elle peut être effectuée avec un seul et unique calibre pour les filetages à droite et à gauche. De plus, tous les degrés de qualité d'une cote nominale sont réglables. Le calibre-mâchoires, à rouleaux, est ajusté avec la jauge à tolérance dont reproduction ci-après. Les clés à tube, à 6 pans, correspondantes font partie de la fourniture. Le procédé de contrôle s'effectue comme pour un calibre lisse à mâchoires à un seul côté. La paire de rouleaux antérieurs doit pouvoir être poussée avec un léger contact par dessus le filetage de boulon. La paire postérieure de rouleaux ne doit pas pouvoir être poussée par dessus le filetage de boulon; au cas où on peut néanmoins la pousser par dessus le filetage de boulon, c'est parce que ce dernier est trop petit, c'est donc de rebut.

Gewindegrenzeinstelllehre mit Gut- und Ausschussseite für Gewindegrenzrollenrachenlehre

Thread setting gauge with "Go" and "Not Go" ends for thread roller gauge

Jauge filetée d'ajustage pour calibre-mâchoires, à rouleaux, de filetages

Ausführung in Stabform

Setting gauge in bar shape

Jauges d'ajustage sous formes de barres.

Gewindegutlehrring	Thread ring gauge "Go"	Bague filetée »Entre«
Gewindeausschusslehrring	Thread ring gauge "Not Go"	Bague filetée »N'entre pas«
Zur Kontrolle des Bolzengewindes werden Gewindegut- und Ausschusslehrringe verwendet. Über ein „gutes“ Bolzengewinde muß sich der Gutlehrring leicht gängig schrauben lassen; der Gewindeausschusslehrring darf sich nicht einschrauben lassen. Er hat nur einige Gewindegänge und liegt auf dem Kleinstmaß des Flankendurchmessers. Zur Kontrolle der Lehring werden die unten abgebildeten Gegenlehr- und Abnutzungsprüfdorne verwendet.	Thread ring gauge "Go" and "Not Go" are used for testing the male thread. A "Go" male thread must allow the "Go" ring gauge to be easily screwed over; the "Not Go" thread ring gauge must not suffer to be screwed-in. It only has a few turns of thread and is situated on the minimum limit of the flanke diameter. The below illustrated mating gauge plugs and wear testing plug gauges are used for testing the ring gauge. Mating gauge plug for "Go" thread ring gauge.	On utilise les bagues filetées »Entre« et »N'entre pas« pour le contrôle des filetages de boulons (filets mâles). La bague filetée „Entre“ doit pouvoir être vissée aisément sur un filetage de boulon (filet mâle) »bon«; la bague cylindrique de jauge »N'entre pas« ne doit pas pouvoir être vissée. Elle n'a que quelques spires de filets et se situe à la dimension minimum du diamètre du filet. Pour le contrôle des bagues filetées, on utilise les mandrins-calibres contraires et de vérification d'usure, reproduits ci-après.
Gegenlehrdorn für den Gewindegutlehrring	Mating plug gauge for thread ring gauge "Go"	Contre-mandrin-calibre pour la bague filetée »Entre«
Gegenlehrdorn für den Gewindeausschusslehrring	Mating plug gauge for thread ring gauge "Not Go"	Contre-mandrin-calibre pour bague filetée »N'entre pas«
Abnutzungsprüfdorn für den Gewindegutlehrring	Wear testing plug gauge for thread ring gauge "Go"	Mandrin-calibre de vérification d'usure pour bague filetée »Entre«

Grenzlehrdorn mit Gut- und Ausschusseite für den Kerndurchmesser des Muttergewindes

Cylindrical limit plug gauge with "Go" and "Not Go" ends for the core diameter of the female thread

Mandrin-calibre avec côtés »Entre« et »N'entre pas« pour le diamètre de fond de filet du filet femelle

Grensrachenlehre mit Gut- und Ausschusseite für den Außendurchmesser des Bolzen- gewindes

Limit snap gauge with "Go" and "Not Go" ends for the outside diameter of the male thread

Calibre lisse à mâchoires, avec côtés »Entre« et »N'entre pas« pour le diamètre extérieur du file- tage mâle

für kegelige Gewinde

Bei kegeligen Gewindelehren wird die Toleranz durch ange- schliffene Absätze markiert

for taper thread

On taper thread gauges the toler- ance is marked by partially gro- und spots

pour filetages mâles

Sur les calibres de filetages côn- ques, la tolérance est mar-quée par des indications gravées

Gewindegrenzlehrdorn, konisch mit Toleranzmarke

Limit thread plug gauge, taper with tolerance mark

Jauges-tampon à tolérances, cônique, avec marque de tolérance

Gewindegrenzlehring, konisch mit Toleranzmarke

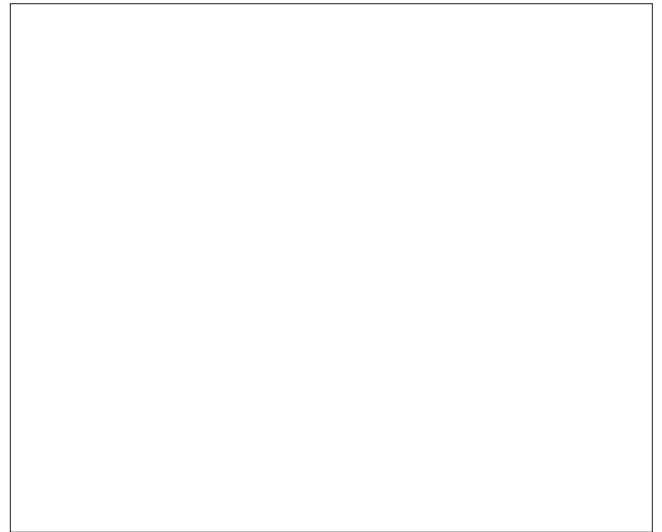
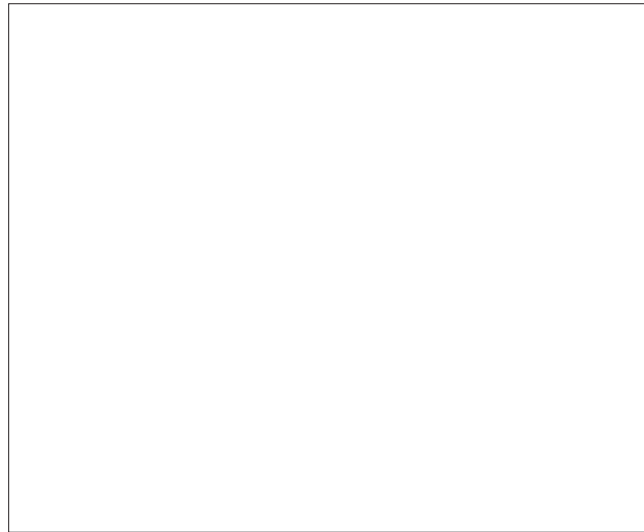
Limit thread ring gauge, taper with tolerance mark

Bague filetée, cônique, avec marque de tolérance

Gewindemessdrähte

Thread measuring wires

Piges pour la mesure de filetages



Anwendung

Messdrähte finden bei der Bestimmung des Flankendurchmessers von Gewinden und der Lückenweite profilartiger Teile nach dem Dreidraht-Messverfahren Verwendung. Bei diesem Messverfahren wird zwischen parallelen Messflächen das Prüfmaß gemessen und danach der Flankendurchmesser oder die Lückenweite rechnerisch bzw. tabellarisch ermittelt. Die Messdrähte sind gehärtet, geläppt und werden aus chromlegierten Lehrenstahl hergestellt.

Ausführung

Messdrähte werden in drei Ausführungen gefertigt:

- Als Kurzmessdrähte mit Aufsteckhaltern zur Befestigung an Messschrauben und anzeigenden Messgeräten.
- Als Einzelmessdrähte in der Form zylindrischer Messstifte.
- Als Messdrähte mit Ösengriff.

Aufsteckhalter werden in Ganzmetallausführung gefertigt. Ab Gewindesteigung 5,0 mm wird zur Verbreiterung der Messspindel ein Zwischenendmaß in den Halter eingebaut.

Technische Daten

Zulässige Abweichungen
vom Nenndurchmesser $\pm 0,5 \mu\text{m}$
vom Kreis $\pm 0,35 \mu\text{m}$

Aufnahmebohrung der Aufsteckhalter $\varnothing 6,0/6,5/8,0 \text{ mm}$, andere auf Anfrage. Die Lieferung von Kurzmessdrähten mit Aufsteckhaltern erfolgt in Einzelsätzen. Für metrisches, Trapezgewinde, Whitworth und Zeiss-Reihe können komplette Satzzusammenstellungen geliefert werden.

Application

Measuring wires are used for the determination of the effective diameter of threads and for the circular space width of splined components according to the best-wire method. The procedure is to take measurement of the dimension between parallel measuring faces. The effective diameter or the circular space width is then calculated or taken from a table.

In order to avoid errors of the pitch angle with regard to the measured dimension wires are manufactured to the best diameter.

The measuring wires are from chrome-alloyed steel, hardened and lapped.

Design

Measuring wires are manufactured as follows:

1. Short measuring wires with frame to mount on micrometer calipers and indicating measuring instruments.
2. Individual measuring wires same as cylindrical pins.
3. Measuring wires with eyelet handle.

The entire frame is made of metal. From pitch 5 mm onward the frame is equipped with a special gauge block.

Technical data

permissible variation
from the nominal size $\pm 0.5 \mu\text{m}$
from the circular variation $\pm 0.35 \mu\text{m}$

Bore for the frame is $\varnothing 6.0/6.5/8.0 \text{ mm}$, other bore $\varnothing$ on application.

Short measuring wires with frames are supplied in individual sets. There are complete compositions of sets for metric trapezoidal, Whitworth threads and the Zeiss-range.

Utilisation

Pour la mesure de filetages par la méthode des trois piges. Le diamètre sur flancs est déterminé par calcul ou obtenu à l'aide de tables de conversion, en partant de la cote mesurée sur piges.

Les diamètres des piges sont judicieusement déterminés en vue de limiter les erreurs de mesures dues au défaut d'angles de flancs.

Les piges sont en acier chromé, trempées et rodées.

Modeles

Les piges sont fabriquées en trois versions:

- version courte avec dispositif pour fixation sur micromètres et instruments de mesure à affichage.
- piges à l'unité de forme cylindrique.
- piges avec manche taraudé.

Caracteristiques techniques

Tolérances:

valeur nominale	$\pm 0,5 \mu\text{m}$
cylindricité	$\pm 0,35 \mu\text{m}$

Alésage du dispositif de fixation $\varnothing 6,0/6,5/8,0 \text{ mm}$, autres sur demande.

Les piges courtes avec dispositif de fixation sont livrées à l'unité. Pour les filetages métriques, trapézoïdaux, Whitworth ou la gamme Zeiss, des jeux complet peuvent être livrés.

Zuordnung der günstigsten Messdraht-Ø des metr. Gewindes für die Steigungen anderer Gewindearten

Classification of the best wire diameter of metric threads for pitches of other types of threads

Correspondances des Ø de pîge pour filetages métriques et autres filetages

günstiger Messdraht- Ø des metr. Gewindes d ₀	Metrisches Gewinde DIN 13 (Regel- und Feingewinde) Steigung h	Whitworth- Gewinde DIN 11 Fein- gewinde DIN 239, 240 Rohrgewinde DIN 259 BSW BSF BSP Gg / 1"	U S St- and Unified Gewinde UNC (NC) UNF (NF) UNEF (NEF) Gg / 1"	Trapez- Gewinde DIN 103 DIN 378 DIN 379 h	British- Association Gewinde BA h
mm	mm	mm	mm	mm	mm
0,115 0,144 0,173	0,2 0,25 0,3	— (100) 80	— (100) 80	— — —	— 0,28 0,31
0,202 0,231 0,260	0,35 0,4 0,45	— — 60	72 64 56	— — —	0,35 0,39 0,43 0,48
0,289 0,346 0,404	0,5 0,6 0,7	48 40 —	48 44 40 36	— — —	0,53 0,59 0,66 0,73
0,433 0,462 0,520	0,75 0,8 0,9	— 32 30 28	— 32 28	— — —	— 0,81 (0,9) 0,9
0,577 0,722 0,866	1,0 1,25 1,5	26 24 22 20 19 18 16	24 20 18 16	— — —	1,0 — —
1,010 1,155 1,443	1,75 2,0 2,5	14 12 11 10	14 13 12 11 10	— 2 —	— — —
1,732 2,021 2,309	3 3,5 4	9 8 7 6	9 8 7 —	3 4 —	— — —
2,598 2,887 3,175 3,464	4,5 5 5,5 6	— 5 4½ 4	6 5 4½ 4	— 5 6 —	— — — —

Zuordnung der Messdraht-Ø nach Zeiss für die Steigungen anderer Gewindearten

Classification of the wire diameter according to Zeiss for pitches of other types of threads

Correspondances des Ø de pîges selon Zeiss pour les différents types de filetages

Messdraht- Ø nach Zeiss d _{Dm}	Metrisches Gewinde DIN 13 (Regel- und Feingewinde) Steigung h	Whitworth- Gewinde DIN 11 Fein- gewinde DIN 239, 240 Rohrgewinde DIN 259 BSW BSF BSP Gg / 1"	U S St- and Unified Gewinde UNC (NC) UNF (NF) UNEF (NEF) Gg / 1"	Trapez- Gewinde DIN 103 DIN 378 DIN 379 h	British- Association Gewinde BA h
mm	mm	mm	mm	mm	mm
0,170 0,195	0,25 0,3 —	— —	— 80	— —	0,28 0,31 0,35
0,220 0,250	0,35 0,4	— 60	72 64	— —	0,35 0,39 0,43
0,290 0,335	0,45 0,5 0,6	— 48 40	56 48	— —	0,48 0,53 0,53 0,59
0,390 0,455	— 0,7 0,75 0,8	— —	44 40 36	— —	0,66 0,73 0,81
0,530 0,620	0,9 1,0	32 28 26 24	32 28 —	— —	0,90 1,00
0,725 0,895	1,25 1,5	22 20 19 18 16	24 20 18	— —	— —
1,100 1,350	1,75 2,0	14 12 11	16 14 13 12 11	2 —	— —
1,650 2,050	2,5 3,0 3,5	10 9 8 7	10 9 8 7	3 4	— —
2,550 3,200	4,0 4,5 5,0 5,5	6 5 4½	6 5 4½	5 6	— —
4,000 5,050 6,350	6,0 (8,0) —	4 3½ 3¼ 3 2⅞ 2¾ 2⅝ 2½	4 3½ — —	7 8 9 10 12	— — —

Normen der wichtigsten Gewinde

Standards of the most important threads

Normes des filetages les plus importants

Metrisches ISO-Gewinde DIN 13
Metric ISO thread DIN 13
Filetage métrique ISO DIN 13

Toleranzfelder Einschraubgruppe „N“ (normal)
Tolerance ranges, group of engagement "N" (standard)
Marges de tolérance des vis du groupe »N« (normal)

Toleranzklasse Tolerance class Classe de tolérance	Toleranzfeld Tolerance range Marge de tolérance Bolzensgewinde Male thread Filet mâle	Toleranzfeld Tolerance range Marge de tolérance Muttergewinde Female thread Filet femelle	Oberflächenzustand Surface condition Etat de la surface
fein (f) fine (f)	4 h	4 H, 5 H	blank oder dünn phosphatiert finished or thinly bonderized polie ou légèrement phosphatée
mittel (m) medium (m) moyenne (m)	6 g	6 H	blank, phosphatiert oder für dünne galvanische Schutzschicht finished, bonderized or for thin galvanic protective coating polie, phosphatée ou avec une légère couche galvanique de protection
grob (g) coarse (g) grosse (g)	8 g	7 H	blank, phosphatiert oder für dünne galvanische Schutzschicht finished, bonderized or for thin galvanic protective coating polie, phosphatée ou avec une légère couche galvanique de protection

Whitworth-Gewinde
Whitworth thread
Filetage Whitworth

Toleranzfelder Einschraubgruppe „N“ (normal)
Tolerance ranges, group of engagement "N" (standard)
Marges de tolérance des vis du groupe »N« (normal)

Toleranzklasse für Bolzen- und Muttergewinde Tolerance class for male and female threads Classe de tolérance pour filetages mâle et femelles	fein (f) fine (f)	mittel (m) medium (m) moyenne (m)	grob (g) coarse (g) grosse (g)
Gewindemaße British-Standard 84 Thread dimensions British-Standard 84 Dimensions des filetages British-Standard 84	Sollmaße und Herstellungstoleranzen der Gewindelehren British-Standard 919 Nominal dimensions and manufacturing tolerances of the thread gauges British-Standard 919 Dimensions obligatoires et tolérances de fabrication des calibres de filetage British-Standard 919		

Whitworth-Rohrgewinde DIN/ISO 228, zylindrisch
Whitworth pipe thread, DIN/ISO 228, cylindrical
Filetage de tube Whitworth, DIN/ISO 228, cylindrique

Toleranzklasse für Bolzen- und Muttergewinde Tolerance class for male and female threads Classe de tolérance pour filetages mâles et femelles	mittel medium moyenne A	grob coarse grosse B
---	---	-----------------------------------

Trapezgewinde DIN 13
Trapezoidal threads DIN 13
Filetage trapezoïdal DIN 13

Toleranzfelder Einschraubgruppe „N“ (normal)
Tolerance ranges, group of engagement "N" (standard)
Marges de tolérance des vis du groupe »N« (normal)

Toleranzklasse Tolerance class Classe de tolérance	Toleranzfeld Tolerance range Marge de tolérance Bolzenschraube Male thread Filet mâle	Toleranzfeld Tolerance range Marge de tolérance Muttergewinde Female thread Filet femelle
mittel (m) medium (m) moyenne (m)	7 e	7 H
grob (g) coarse (g) grosse (g)	8 c	8 H

Unified-Gewinde (UST-Gewinde)

Unified threads (UST threads)

Filetage Unified (filetage UST)

UNC – UNF – UNEF – 4 UN – 6 UN – 12 UN – 16 UN – 20 UN – 28 UN – 32 UN – UNS (Spezialgewinde / special threads / filetage spécial)

Toleranzklasse Tolerance class Classe de tolérance			
Bolzenschraube Male thread Filet mâle	1 A	2 A	3 A
Muttergewinde Female thread Filet femelle	1 B	2 B	3 B

Lehrenmaße Gewindelehrdorne nach

Manufacturing tolerances of thread plug gauges to

Tolérances de fabrication pour calibres de filetage selon

ANSI B1.2

Lehrenmaße Gewindelehrringe nach

Manufacturing tolerances of thread ring gauges to

Tolérances de fabrication pour baques de filetage selon

BS 919

Gewindeausschußlehrdorne bzw. -ausschußseiten von Gewindegrenzlehrdornen nach ANSI B1.2 für Unified Zoll-Gewinde werden mit „Minus“-Toleranz geliefert. Wird eine „Plus“-Toleranz gewünscht, bitten wir um einen Hinweis in Ihrer Bestellung.

Thread limit plug gauges NotGo or NotGo members to thread plug gauges to ANSI B1.2 of Unified thread will be supplied with a “minus“-tolerance. If a “plus“-tolerance is required please state in your order.

Falls die Bestellung keine Toleranzklasse angibt, kommt die in dieser Tabelle blau unterlegte Toleranzklasse zur Lieferung.

If the order does not mention a tolerance class, the tolerance class printed on blue-black ground will be delivered.

Au cas où il n'est pas indiqué de classe de tolérance dans la commande, il sera fourni la classe de tolérance indiquée sur fond bleu dans ce tableau.

Die in den Normen angegebenen Flankendurchmessermaße für Gewindelehrringe sind nur gültig, wenn die Gewindelehrringe direkt gemessen werden. Dies muss von dem Besteller angegeben werden. Werden die Gewindelehrringe nach Prüfdorn gefertigt, sind diese Maße nicht verbindlich. Für die angegebenen Normen gilt die jeweils neueste Ausgabe.

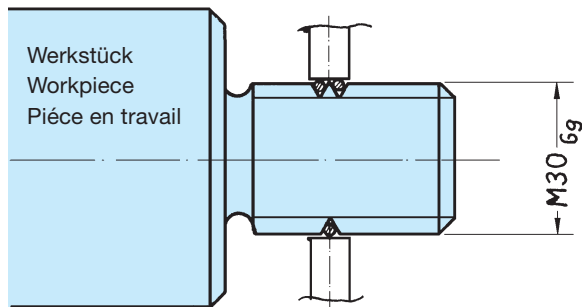
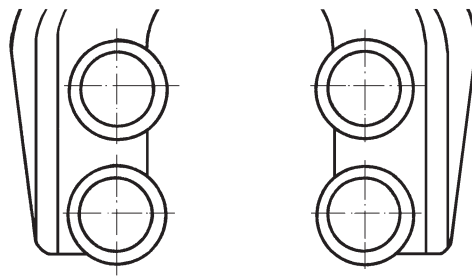
The effective diameter dimensions for thread ring gauges mentioned in the standards are only valid if the thread ring gauges are directly gauged. This must be stated by the orderer. If the thread ring gauges are made according to testing plug gauge these dimensions are not binding. Standards indicated are subject to the latest edition.

Les dimensions des filets indiquées dans les normes pour les bagues filetées ne sont valables que si les bagues filetées sont mesurées directement. Mention doit en être faite dans la commande par le client. Au cas où les bagues filetées sont fabriquées d'après le calibre-mandrin de vérification, ces dimensions sont sans engagement. Pour les normes indiquées les plus nouvelles éditions sont valables.

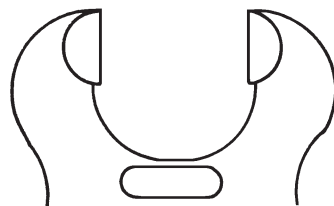
Prüfung des Bolzengewindes und ihrer Komponenten **Inspection of the male thread and its components** **Contrôle du filet mâle et leurs composantes**



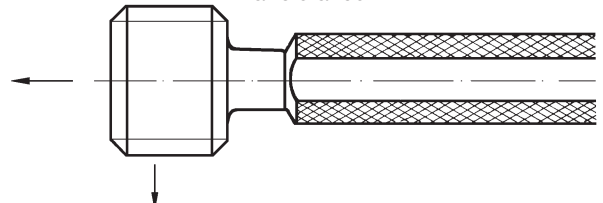
Gewindegrenz-
rollenrachenlehre
Thread limit snap
gauge with rollers
Calibre-mâchoire
de filetage à roule-
aux à tolérance



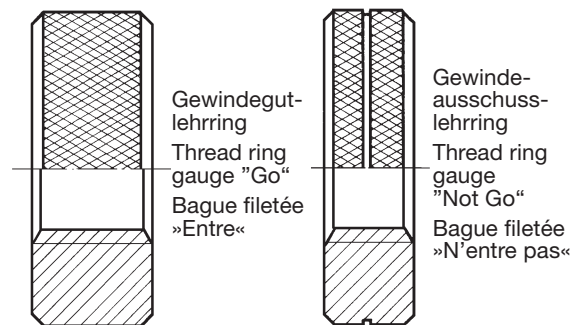
Grensrachenlehre für
Außendurchmesser
Limit snap gauge for
outside diameter
Calibre lisse à mâchoire
pour diamètre extérieur



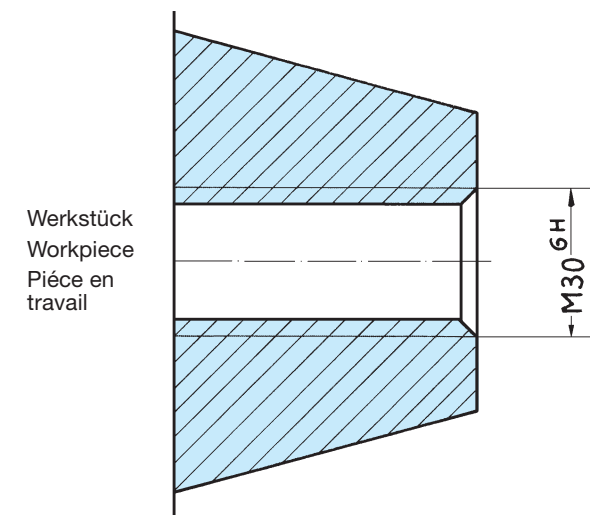
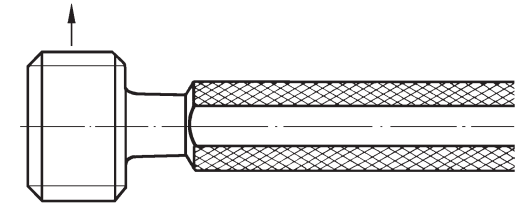
Einstelllehre für Gewindegrenzrollenrachenlehre
Setting gauge for thread limit snap gauge with rollers
Jauge d'ajustage pour Calibre-mâchoire à rouleaux à tolérance



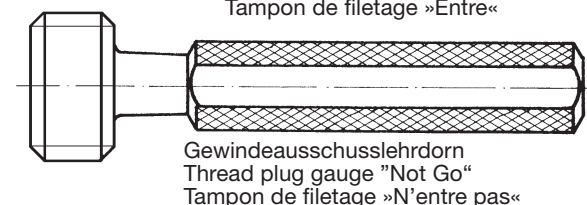
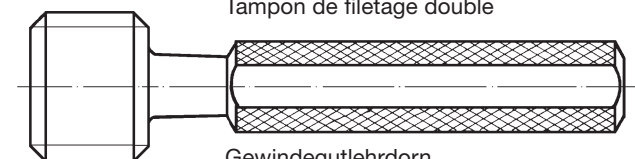
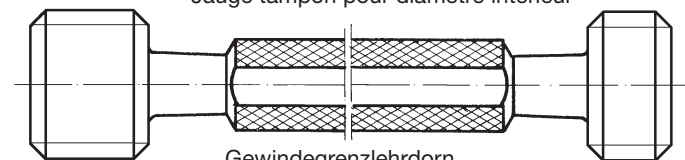
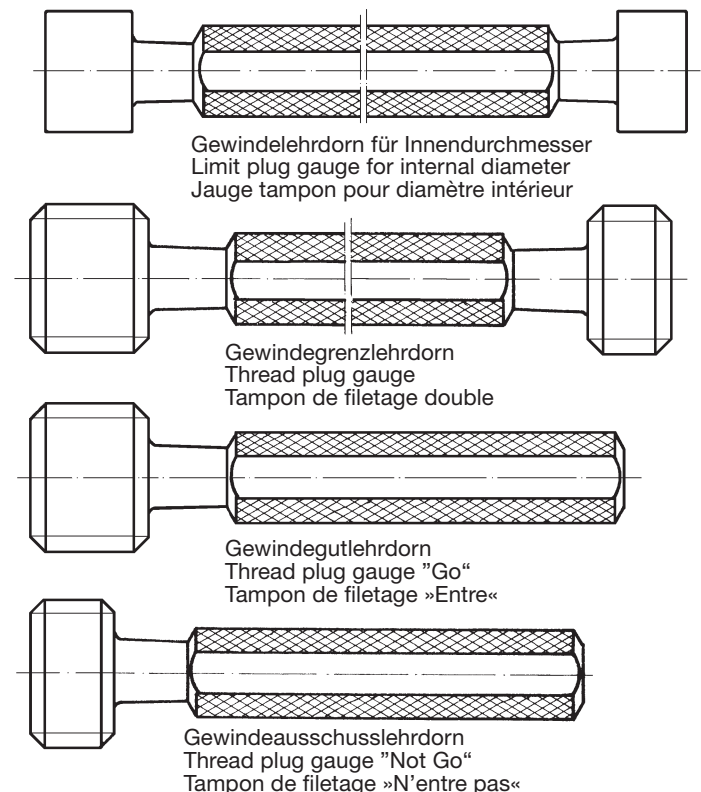
Gegenlehrdorn für Gewindegutlehrhrring
Mating gauge for thread ring gauge "Go"
Contre mandrin-calibre pour bague filetée »Entre«



Abnutzungsprüfdorn für Gewindegutlehrhrring
Wear testing plug gauge for thread ring gauge "Go"
Mandrin-calibre de vérification d'usure pour bague filetée »Entre«



Prüfung des Innengewindes **Inspection of the female thread** **Contrôle du filet femelle**



Nachfolgende Gewindelehren auf Anfrage:

Following thread gauges upon enquiry:

Autres jauges de filetages sur demande:

Gewindelehren für metrische Feingewinde, DIN 13, Steigung 0,25 - 0,50 mm	Thread gauges for metric fine thread, DIN 13 pitch 0.25 - 0.50 mm	Jauges de filetages à tolérances pour filetages métrique à pas fin, DIN 13 pas de 0,25 - 0,50 mm
Gewindelehren für Whitworth-Regelgewinde	Thread gauges for Whitworth standard thread	Jauges de filetages à tolérances pour filetages normaux Whitworth
Gewindelehren für Rundgewinde	Thread gauges for round thread	Jauges de filetages à tolérances pour filetages ronds
Gewindelehren für Amerikanisches zylindrisches Rohrgewinde, NPSM/NPSL	Thread gauges for American cylindrical pipe thread, NPSM/NPSL	Jauges de filetages cylindriques américains de tubes, NPSM/NPSL
Gewindelehren für British Association Gewinde, BA	Thread gauges for British Association thread, BA	Jauges de filetages à tolérances pour filetages de l'Association Britannique, BA
Gewindelehren für Fahrradgewinde, DIN 79 012	Thread gauges for cycle thread, DIN 79 012	Jauges de filetages à tolérances pour filetages de bicyclette, DIN 79012
Gewindelehren für Ventilgewinde, DIN 7756	Thread gauges for valve thread, DIN 7756	Jauges de filetages à tolérances pour filetages de soupapes, DIN 7756
Gewindelehren für Elektrogewinde, DIN 40 400	Thread gauges for electric thread, DIN 40 400	Jauges de filetages à tolérances pour filetages de électriques, DIN 40400
Gewindelehren für kegeliges Gewinde, DIN 158	Thread gauges for taper thread, DIN 158	Jauges de filetages à tolérances pour filetages de côniques, DIN 158
Gegenlehrdorne Abnutzungsprüfdorne Gewindegrenzrollen- rachenlehren Gewindegrenzeinstelllehre	Mating plug gauges Wear testing plug gauges Roller thread gauges thread setting gauges	Contre-mandrin-calibres Mandrin-calibre de vérification Calibre-mâchoire à rouleaux de filetage Jauges d'ajustage



Made in Germany



Gauge Blocks and Accessories

**Wear resistant Special Steel
Ceramic
Carbide**



**Calibration Center of the
German Calibration Service**
for length up to 1000 mm

DKD

accredited by

Physikalisch - Technische Bundesanstalt - PTB



Calibration-Service
Calibration of used gauge blocks
and gauges

In accordance with DIN/ISO 9000 – 9004, traceable
to National Standards via our own **DKD**-laboratory



KOLB & BAUMANN GMBH & CO. KG
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DE-63741 ASCHAFFENBURG · DAIMLERSTR. 24
GERMANY

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Internet <http://www.koba.de> · e-mail: messzeuge@koba.de

Catalogue No. 1000/E/01/2007

Dear Customer,

Today you have the documents of Kolb & Baumann in your hands.

We are glad that you are interested in our products.

The foundations of KOBA were laid more than 60 years ago and at the beginning the manufacture of gauge blocks was the major line. At that time gauge blocks were made out of steel. Later carbide and ceramic were added. Furthermore we manufacture accessories in order to extend the application of our gauge blocks. In order to complete the product range we started the manufacture of gauges.

It was in 1979 when Kolb & Baumann got accredited by the PTB as the 8th DKD-calibration laboratory in Germany. This accreditation comprises the measured value "length" up to 1000 mm. Today out of the three laboratories in Germany who are accredited up to a length of 1000 mm KOBA is one of them. Besides, KOBA is an accredited DKD-laboratory for gauges and other measuring instruments.

KOBA supplies world-wide into more than 40 countries and is also supplier for gauge blocks and calibration masters to various National Physical Laboratories.

Our word-wide customers trust in KOBA-gauge blocks and gauges as a high-grade German quality product.

Being a German family-based company we will do all efforts to keep the confidence in our products. This is our tradition and obligation for the future.

Your KOBA-management



Dipl.-Ing. Adolf Baumann



Dipl.-Bw. Alexander Baumann

Contents

Gauge Block	Page
Introduction	4
Ceramic Gauge Blocks	5
Accuracy	6
Material	7
Single Gauge Blocks	7
Sets of Gauge Blocks	8 + 9
Supplementary Sets	10, 11 + 12
Guidelines for calibrating Gauge Block Comparators	13
German Calibration Service - DKD	14 + 15
KOBA-Calibration Service	16
Maintenance of Gauge Blocks	17
 Gauge Block Accessories	
Examples	18
Gauge Block Holders	19
Measuring Jaws	19
Other Component Parts	20
Sets of Accessories	21
Sets of Accessories for internal gauge sets	22
Your Contact Persons at KOBA	23
Manufacturing programme	24

Subject to modifications of design, dimensions, combinations and weights.

Reprint of test and illustration, also as excerpts, only with our authorization.

The data of the Standard Sheets are given herein by the courtesy of the German Standardization Committee. The latest edition is available in Standard Sheet Size A 4 from Messrs. Beuth-Vertriebs-GmbH, 10787 Berlin and Cologne.



**HARDNESS
WEAR
RESISTANCE
STABILITY
SERVICE**



Gauge Blocks

are a high quality product, our exacting standards are backed by more than 60 years experience and research, resulting in the careful selection of the purest steel which must fulfill our high standard demanded, especially with regard to

stability, wear resistance, uniform co-efficient of expansion. The ageing to eliminate internal stresses and stabilizing methods, along with special lapping techniques are some of the many critical considerations KOBÄ offers potential users.

All gauge blocks and accessory sets are supplied in wooden storage cases, in ingenious "easy to select" design.

The use of gauge block accessories in conjunction with gauge blocks offers the possibility of many measuring and gauging applications. KOBÄ accessories are manufactured to the same exacting standard as are our gauge blocks.

When KOBÄ is selected we are confident that our customers are obtaining the very best in materials, workmanship and, most important, value for money. Kolb & Baumann runs a DKD Laboratory accredited by the Deutscher Akkreditierungsrat .



Made in Germany

KOBA - Ceramic - Gauge Blocks made of zirkonia



wear resistant – stability in size – corrosion resistant



Advantages:

- wear resistant similar to carbide
- high hardness
- thermal expansion coefficient almost similar to steel
- corrosion resistant
- each ceramic gauge block is provided with identification number and calibration certificate
- best for use in the work shop

Technical data:

- density 6,05 g/cm³
- total porosity 0 %
- hardness 1350 HV
- compressive strength 2100 N/mm²
- bending strength 800 N/mm²
- modulus of elasticity 205.000 N/mm²
- thermal conductivity 2,3 W/mK
- coefficient of expansion $(10 \pm 1) \cdot 10^{-6} \text{ K}^{-1}$



Limit deviations of the length l_e at any point and tolerances of variation in length l_v to EN ISO 3650:1998, former DIN 861

nominal length range mm	calibration grade K		grade 0		grade 1		grade 2	
	limit deviations of length at any point from nominal length	tolerance for the variation in length	limit deviations of length at any point from nominal length	tolerance for the variation in length	limit deviations of length at any point from nominal length	tolerance for the variation in length	limit deviations of length at any point from nominal length	tolerance for the variation in length
	$\pm l_e$ μm	l_v μm	$\pm l_e$ μm	l_v μm	$\pm l_e$ μm	l_v μm	$\pm l_e$ μm	l_v μm
from 0,5 up to 10	0,2	0,05	0,12	0,1	0,2	0,16	0,45	0,3
over 10 up to 25	0,3	0,05	0,14	0,1	0,3	0,16	0,6	0,3
over 25 up to 50	0,4	0,06	0,2	0,1	0,4	0,18	0,8	0,3
over 50 up to 75	0,5	0,06	0,25	0,12	0,5	0,18	1	0,35
over 75 up to 100	0,6	0,07	0,3	0,12	0,6	0,2	1,2	0,35
over 100 up to 150	0,8	0,08	0,4	0,14	0,8	0,2	1,6	0,4
over 150 up to 200	1	0,09	0,5	0,16	1	0,25	2	0,4
über 200 up to 250	1,2	0,1	0,6	0,16	1,2	0,25	2,4	0,45
over 250 up to 300	1,4	0,1	0,7	0,18	1,4	0,25	2,8	0,5
over 300 up to 400	1,8	0,12	0,9	0,2	1,8	0,3	3,6	0,5
over 400 up to 500	2,2	0,14	1,1	0,25	2,2	0,35	4,4	0,6
over 500 up to 600	2,6	0,16	1,3	0,25	2,6	0,4	5,0	0,7
over 600 up to 700	3	0,18	1,5	0,3	3	0,45	6,0	0,7
over 700 up to 800	3,4	0,2	1,7	0,3	3,4	0,5	6,5	0,8
over 800 up to 900	3,8	0,2	1,9	0,35	3,8	0,5	7,5	0,9
over 900 up to 1000	4,2	0,25	2	0,4	4,2	0,6	8	2

Accuracy

KOBA Gauge Blocks are manufactured and verified to the specifications of EN ISO 3650. As tolerances are kept to a minimum by internal standards, it is guaranteed that every KOBA Gauge Block is within the limits stipulated.



△ KOBA-Laboratory (partial view)

Gauge Block Inspection ▽



The high level of accuracy and the reliability of the measuring results are guaranteed by two separate feed-backs attributed to the internationally fixed unit of length by means of a wave length,

- permanent comparison with the master gauges interferometrically verified by the Physikalisch-Technischen Bundesanstalt,
- parallel to this interferometric examination in our fully airconditioned laboratories.

Tolerance ranges of the individual grades within the limits of which the actual size is guaranteed, can be taken from the table above.

The durability of gauge blocks is achieved by a special process developed by us, combining natural and artificial ageing.

The grade of accuracy should be selected according to the intended purpose.

K: Gauge blocks of Grade K are excellently suitable as the most accurate material measure with regard to length, and for checking gauge blocks of lower grades.

Gauge blocks of Grade K will be clearly marked with a serial no. They will be supplied with a DKD-calibration certificate which shows the deviation from the nominal size of each gauge block. Please ask for our special offer.

0: Used as master gauges for all accurate measurements of length, for checking all gauge blocks in use, for final inspection, for setting accurate measuring instruments.

1: For checking of gauges, for setting measuring instruments.

2: Used as standard for setting or workshop gauge for the manufacture of jigs and gauges, as well as for machines and instruments.

Upon request we supply a certificate of true size value of the Physikalisch-Technische Bundesanstalt, which will be charged separately.

In most of the factories the use of only one grade will not do, as the accuracy varies in the individual departments and manufacturing stages. But just this fact implies the efficient use of gauge blocks. Example: If gauge blocks of grade 0 are no longer accurate enough for inspection as a result of frequent use they are passed on to a department or workshop place where the demands on the accuracy are accordingly lower.

We recommend, however, to have them inspected at our laboratory before passing on.

Material

Special Steel stable in size, wear resistant

KOBA Steel Gauge Blocks

This carefully hardened and stress relieved steel type which is specially smelted resulting in the highest possible degree of purity has a homogeneous molecular distribution which gives excellent properties against abrasion and wear. The wear is well minimized due to the homogenous dispersal of steel elements and thus uniform fine structure of carbide components. A clever method of ageing will remove residual austenite and therefore guarantee smallest possible changes in size even below the EN ISO-standard.

Ceramic

KOBA Ceramic Gauge Blocks

The wear behavior of KOBA Ceramic Gauge Blocks is similar to that of carbide. The co-efficient of thermal expansion is closer to steel and is $(10 \pm 1) \cdot 10^{-6} \text{ K}^{-1}$. Ceramic gauge blocks are not subject to corrosion and are therefore excellently suitable for the work shop. The bending strength of 800 N/mm^2 is so high that there is no danger of breakage during ordinary use. KOBA Ceramic Gauge Blocks are available in grades 0, 1 and 2.

Carbide

KOBA Carbide Gauge Blocks

The wear ratio as compared to that of steel is approx. 1:50 to 1:100. Carbide gauge blocks are mainly used as wear protectors as gauge block combination specially wears at the outside measuring faces.

All KOBA gauge block sets are provided with two empty slots for storing carbide wear protectors, in 1 mm or 2 mm.

Every gauge block from 0,5 – 100 mm is available of solid tungsten carbide. The material used in these gauge blocks has a co-efficient of thermal expansion $4,5 \cdot 10^{-6} \text{ K}^{-1}$. Carbide gauge blocks are used in workshops and tool rooms under severe wear and abrasion conditions.

We wish to stress that steel gauge blocks be used where when work pieces of steel have to be checked and a standard reference temperature of exactly 20°C cannot be maintained. Considering the difference of the co-efficient of thermal expansion between steel and carbide, this would lead to a larger uncertainty of measurement.

Single Gauge Blocks

from – up to	Graduation	Material
0,1 – 0,49	0,01	H
0,5 – 0,99	0,01	SH
0,5 – 0,95	0,05	K
1		SHK
1,0005		SHK
1,001 – 1,009	0,001	SHK
1,01 – 1,49	0,01	SHK
1,5 – 1,9	0,1	SHK
2 – 25	0,5	SHK
30		SHK
40		SHK
50		SHK
60		SHK
70		SHK
75		SHK
80		SHK
90		SHK
100		SHK

S = available in steel

H = available in carbide

K = available in ceramic

nominal size	Material
125	SKb
150	SKb
175	SKb
200	SKb
250	SKb
300	SKb
400	SKb
500	SKb
600	S
700	S
800	S
900	S
1000	S

S = available in steel

Kb = available with
ceramic tips

Intermediate sizes on request

Cross section

Rectangular cross section:

below 0,5 mm	20 × 9
0,5 – 10 mm	30 × 9
over 10 mm	35 × 9

Gauge Blocks over 100 mm are manufactured with clamping holes at both ends for use with gauge block clamps, which may be used in conjunction with holders of other manufacturers.

Other cross sections on request.

Storage case

KOBA Gauge Blocks are furnished in fine wooden boxes.

Every case is provided with a serial No.



Verification by means of the interference comparator at the KOBA laboratory.



1087 M



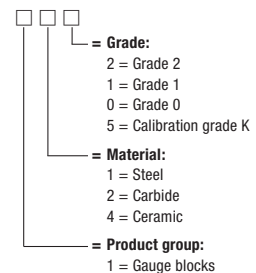
1111 M

Gauge Block Sets, metric

Smallest Step mm	Number of Gauge Blocks	Contents dimensions in mm	pcs.	Standard measuring range	Weight kg	Set No. Order No.
0,0005	122	1,0005 1,001 1,002 1,003 . . . 1,009 1,01 1,02 1,03 . . . 1,49 0,5 1 1,5 1,6 1,7 1,8 1,9 2 2,5 3 . . . 25 30 40 50 60 70 75 80 90 100	1 9 49 7 47 5 4	3-270	4,2	1122 M ...4001122
0,001	116	1,001 1,002 1,003 . . . 1,009 1,01 1,02 1,03 . . . 1,49 0,5 1 1,5 2 . . . 25 30 40 50 60 . . . 100	9 49 50 8	2-270	4,0	1116 M ...4001116
0,001	111	1,001 1,002 1,003 . . . 1,009 1,01 1,02 1,03 . . . 1,49 0,5 1 1,5 2 . . . 24,5 25 50 75 100	9 49 49 4	2-225	3,8	1111 M ...4001111
0,0005	112	Supplement to 1111 M plus size 1,0005 (1111 M + 1,0005 mm)		3-225	3,8	1112 M ...4001112
0,005	103	1,005 1,01 1,02 1,03 . . . 1,49 0,5 1 1,5 2 . . . 24,5 25 50 75 100	1 49 49 4	2-225	3,8	1103 M ...4001103
0,001	91	1,001 1,002 1,003 . . . 1,009 1,01 1,02 1,03 . . . 1,49 1,6 1,7 1,8 1,9 0,5 1 1,5 2 . . . 9,5 10 20 30 . . . 100	9 49 4 19 10	2-270	3,1	1091 M ...4001091
0,001	87	1,001 1,002 1,003 . . . 1,009 1,01 1,02 1,03 . . . 1,49 0,5 1 1,5 2 . . . 9,5 10 20 30 . . . 100	9 49 19 10	2-270	3,0	1087 M ...4001087
0,0005	88	Supplement to 1087 M plus size 1,0005 (1087 M + 1,0005 mm)		3-270	3,0	1088 M ...4001088
0,005	83	1,005 1,01 1,02 1,03 . . . 1,49 1,6 1,7 1,8 1,9 0,5 1 1,5 2 . . . 9,5 10 20 30 . . . 100	1 49 4 19 10	2-270	3,0	1083 M ...4001083
0,005	79	1,005 1,01 1,02 1,03 . . . 1,49 0,5 1 1,5 2 . . . 9,5 10 20 30 . . . 100	1 49 19 10	2-270	3,0	1079 M ...4001079
0,005	76	1,005 1,01 1,02 1,03 . . . 1,49 0,5 1 1,5 2 . . . 9,5 10 20 30 40 50 75 100	1 49 19 5 2	2-225	2,5	1076 M ...4001076
0,005	47	1,005 1,01 1,02 1,03 . . . 1,09 1,1 1,2 1,3 . . . 1,9 1 2 3 . . . 24 25 50 75 100	1 9 9 24 4	3-225	2,6	1047 Ma ...4011047
0,005	47	1,005 1,01 1,02 1,03 . . . 1,19 1,2 1,3 1,4 . . . 1,9 1 2 3 . . . 9 10 20 30 . . . 100	1 19 8 9 10	3-270	2,6	1047 Mb ...4021047



The first three number of the Order No. compose as follows:



Next is the seven digit order code.

Example:

Gauge block set 103 pcs; Set No. 1103 M;

Material: steel; Grade 0 = Order No. 110 4001103



Made in Germany

- Each Gauge Block set (except for the supplementary sets) are provided with additional slots for storage of 2 carbide wear protectors 1 mm or 2 mm.
- The insert of the storage case is screwed and can be removed for cleaning.
- Bottom and cover of the storage cases contain a layer of special paper for rust prevention.
- Figure strips inside the storage cases are in oblique position for easy reading when sitting.



1047 Ma



1008 M



The first three number of the Order No. compose as follows:

- □ □
- = **Grade:**
 - 2 = Grade 2
 - 1 = Grade 1
 - 0 = Grade 0
 - 5 = Calibration grade K
 - = **Material:**
 - 1 = Steel
 - 2 = Carbide
 - 4 = Ceramic
 - = **Product group:**
 - 1 = Gauge blocks

Next is the seven digit order code.

Example:

Gauge block set 32 pcs; Set No. 1032 M;

Material: steel; Grade 2 = Order No. 112 4001032



Made in Germany

Gauge Block sets, metric and supplementary sets

Smallest Step mm	Number of Gauge Blocks	Contents dimensions in mm	pcs.	Standard measuring range	Weight kg	Set No. Order No.
0,001	46	1,001 1,002 1,003 . . . 1,009 1,01 1,02 1,03 . . . 1,09 1,1 1,2 1,3 . . . 1,9 1 2 3 . . . 9 10 20 30 . . . 100	9 9 9 9 10	3-270	2,6	1046 M ...4001046
0,001	41	1,001 1,002 1,003 . . . 1,009 1,01 1,02 1,03 . . . 1,09 1,1 1,2 1,3 . . . 1,9 1 2 3 . . . 9 10 20 40 70 100	9 9 9 9 5	3-210	2,0	1041 M ...4001041
0,005	38	1,005 1,01 1,02 1,03 . . . 1,09 1,1 1,2 1,3 . . . 1,9 1 2 3 . . . 9 10 20 30 . . . 100	1 9 9 9 10	3-270	2,5	1038 M ...4001038
0,005	33	1,005 1,01 1,02 1,03 . . . 1,09 1,1 1,2 1,3 . . . 1,9 1 2 3 . . . 9 10 20 40 70 100	1 9 9 9 5	3-210	1,6	1033 M ...4001033
0,005	32	1,005 1,01 1,02 1,03 . . . 1,09 1,1 1,2 1,3 . . . 1,9 1 2 3 . . . 9 10 20 30 50	1 9 9 9 4	3-100	1,2	1032 M ...4001032
0,005	18	1,005 1,01 1,02 1,03 1,06 1,1 1,2 1,3 1,6 1 2 3 6 10 20 30 60 100	1 4 4 4 5	5-190	1,5	1018 Ma ...4011018
0,001	18	1,001 1,002 . . . 1,009 1,01 1,02 . . . 1,09	9 9	–	0,4	1018 Mb ...4021018
0,001	9	1,001 1,002 . . . 1,009	9	–	0,25	1009 Ma ...4011009

Carbide wear protectors

–	2	2; 2	2	–		1002 MaH
–	2	1; 1	2	–		1002 MbH

length bars

–	8	125 150 175 200 250 300 400 500	4 1 3	–	7	1008 M ...4001008
100	9	200 300 400 500 600 700 800 900 1000	5 4	–	18	1009 Mb ...4021009
100	5	600 700 800 900 1000	5	–	4	1005 M ...4001005
–	6	50 100 200 300 400 500	6	–	5	1006 M ...4001006

- Each Gauge Block set (except for the supplementary sets) are provided with additional slots for storage of 2 carbide wear protectors 1 mm or 2 mm.
- The insert of the storage case is screwed and can be removed for cleaning.
- Bottom and cover of the storage cases contain a layer of special paper for rust prevention.
- Figure strips inside the storage cases are in oblique position for easy reading when sitting.



1010 MP



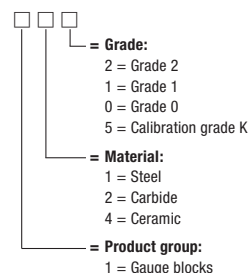
1004 MR

Gauge Block Sets for the inspection of measuring tools (DIN/ISO 9000ff)

Smallest Step mm	Number of Gauge Blocks	Contents dimensions in mm	Standard measuring range	Weight kg	Set No. Order No.
Check sets for micrometer calipers (see page 12 for clamping stand)					
–	10	for 0–25 2,5 5,1 7,7 10,3 12,9 15 17,6 20,2 22,8 25	0–25	1,0	1010 M ...4001010
–	10	2,5 5,1 7,7 10,3 12,9 15 17,6 20,2 22,8 25 plus 1 optical parallel Ø 30 mm	0–25	1,2	1010 MP ...4301010
–	11	for 25–50 25 27,5 30,1 32,7 35,3 37,9 40 42,6 45,2 47,8 50	25–50	1,8	1011 Ma* ...4011011
–	11	for 50–75 50 52,5 55,1 57,7 60,3 62,9 65 67,6 70,2 72,8 75	50–75	2,6	1011 Mb* ...4021011
–	11	for 75–100 75 77,5 80,1 82,7 85,3 87,9 90 92,6 95,2 97,8 100	75–100	3,5	1011 Mc* ...4031011
–	13	for 0–100 Supplement to 1010 M plus sizes 50 75 100	0–100	1,5	1013 M ...4001013
Check sets for vernier calipers					
–	2	for 0–150 41,3 131,4	0–150	1,0	1002 M ...4001002
–	2	for 0–150 41,3 131,4 plus 1 ring gauge Ø 30 mm	0–150	1,1	1002 MR ...4201002
–	3	for 0–200 and 0–250 41,3 131,4 243,5	0–200 0–250	1,5	1003 M ...4001003
–	4	for 0–200, 0–250 and 0–300 41,3 131,4 243,5 281,2	0–200 0–250 0–300	2,3	1004 M ...4001004
–	4	for 0–200, 0–250 and 0–300 41,3 131,4 243,5 281,2 plus 1 ring gauge Ø 30 mm	0–200 0–250 0–300	2,5	1004 MR ...4201004
–	5	41,3 131,4 243,5 281,2 481,1	up to 500	4,0	1005 Mb ...4021005
–	7	41,3 131,4 243,5 281,2 481,1 700 900	up to 1000	9,0	1007 M ...4001007
The gauge blocks mentioned are also available individually or as sets with different compositions. The nominal sizes stated are in accordance with guideline VDI/VDE/DGQ 2618.					
Combination set for micrometer calipers 0–25 and vernier calipers 0–150					
<i>new</i>	12	for 0–25 2,5 5,1 7,7 10,3 12,9 15 17,6 20,2 22,8 25 plus 1 optical parallel Ø 30 and 1 ring gauge Ø 30 mm	for 0–150 41,3 131,4 0–25 and 0–150	2,0	1012 MPR ...4401012
–	12	same as 1012 MPR but without optical parallel and ring gauge		1,8	1012 M ...4001012



The first three number of the Order No. compose as follows:



Next is the seven digit order code.

Example:

Gauge block set 11 pcs; Set No. 1011 Ma;

Material: steel; Grade 1 = Order No. 111 4011011



Made in Germany

* available Grade 1 and 2 only

- The insert of the storage case is screwed and can be removed for cleaning.
- Bottom and cover of the storage cases contain a layer of special paper for rust prevention.
- Figure strips inside the storage cases are in oblique position for easy reading when sitting.

Monitoring and calibration of inspection equipment by use of gauge blocks



Relevant quality management standards such as EN ISO 9001:2000, TS 16949 etc. demand a comprehensive and regular calibration of the measuring instruments used by the company.

The VDI/VDE/DGQ-guidelines 2618 and calibration guidelines DKD-R 4.3 of the German Calibration Service which have been accepted in many sectors form the basis for the execution of calibration of length measurement equipment.

The DKD-R 4.3 describes the required scopes of calibration under metrological aspects, presents possible measuring procedures and mentions suitable standards for the execution of a calibration of inspection equipments. The calibration procedures documented in DKD-R 4.3 are the working basis for each of the DKD-laboratories accredited for the calibration of inspection equipment.

The wide-spread VDI/VDE/DGQ guideline 2618 is “the” manual for the practical execution of the appropriate monitoring and measuring tasks in line with the monitoring of inspection equipment. It serves as a working basis for many companies certified to EN ISO 9000:2000 or TS 16949. For the majority of respectable servicing companies within the sector of inspection equipment calibration the VDI/VDE/DGQ guideline 2618 is also the basis for the applied test sequences.

As can be seen from the following listing the numbering of the two guideline families is identical. This is the consequence of constructional co-operation of both organizations and a distribution of tasks according to the respective strengths. Thus the DKD is responsible for metrologically sensible calibration procedures whereas VDI/VDE/DGQ represents practice-oriented implementation of the calibration procedures.

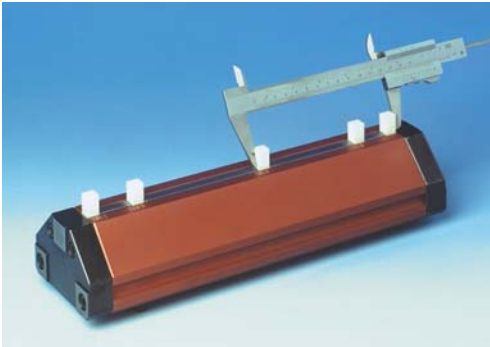
Frequently in guidelines for the execution of incoming or monitoring inspections but also for the calibration of measurement equipment the use of gauge blocks is recommended or even compulsory. On one hand this reflects the large confidence into the metrological characteristics of the gauge block, but also proves how practical and effective gauge blocks can be applied in this segment.

Measuring and inspection equipments for which inspection/calibration by gauge blocks is recommended:

Measuring and inspection equipment	DKD-R 4.3	VDI/VDE/DGQ-guideline
Gauge Blocks	Sheet 3.1	Sheet 3.1
Snap gauges	Sheet 4.7	Sheet 4.7
Vernier calipers	Sheet 9.1	Sheet 9.1
depth vernier calipers	n. a.	Sheet 9.2
height calipers	n. a.	Sheet 9.3
Micrometer calipers	Sheet 10.1	Sheet 10.1
Micrometer calipers for thread measurements	Sheet 10.2	n. a.
Dial test indicators	Sheet 10.3	Sheet 10.3
Lever calipers for outside measurements	n. a.	Sheet 12.1
Further guidelines under preparation		

Calibration master for checking vernier calipers and height gauges

Gauge blocks in ceramic



For measuring range up to 300 mm.

Steps according to VDI/VDE/DGQ 2618
41,3/131,4/243,5/281,2 mm.

For horizontal and vertical application.

Set No. 1004 Ma (5,2 kg/with box 9,3 kg)
Order No. 5410011004

For measuring range up to 500 mm.

Steps according to VDI/VDE/DGQ 2618
41,3/131,4/243,5/281,2/481,1 mm.

For horizontal and vertical application.

Set No. 1005 Ma (7,6 kg/with box 10,9 kg)
Order No. 5410011005

For measuring range up to 1000 mm.

Steps according to VDI/VDE/DGQ 2618
41,3/131,4/243,5/281,2/481,1/700/900 mm.

For horizontal and vertical application.

Set No. 1007 Ma (12,8 kg/with box 20,5 kg)
Order No. 5410011007

Other spacings available on request.



Clamping stand No. 2350



Measuring range 0–100 mm,

in combination with check sets 1010 M /
1010 MP / 1011 Ma / 1011 Mb / 1011 Mc.

Simple and efficient handling while
temperature of the hand will be avoided.

Set No. 2350
Order No. 2160002350



Made in Germany

Check set for depth gauges



Composition same as Set No. 1010 M
Set No. 1010 MT / Order No. 5324401010

Composition same as Set No. 1011 Ma
Set No. 1011 MaT / Order No. 5324411011

Composition same as Set No. 1011 Mb
Set No. 1011 MbT / Order No. 5324421011

Composition same as Set No. 1011 Mc
Set No. 1011 McT / Order No. 5324431011

Other steps on request.



11	0,5	0,5	1,0	1,005	1,01	1,0	Set No. 1011 M
piece	4,0	4,0	100	100 mm		kg	Order No. 1154001011
	6	6 (bridge type)					

Uncertainties of measurement:
PTB U = 0,01 µm / KOBA U = 0,03 µm

The required calibration of set 1011 M can either be carried through by the Physikalisch-Technische Bundesanstalt or by our DKD-laboratory.

Guideline for the calibration of gauge block comparators within the framework of the German Calibration Service (DKD) - DKD - R 4-1 - Edition 1994

in accordance with the European cooperation for Accreditation of Laboratories **EA - G21** August 1996

1 Range of application

This guideline is applicable to gauge block measuring instruments used to calibrate gauge blocks up to 100 mm nominal length by the differential measuring method (of. DIN 861, part 1, January 1980, section 6.3). Accredited calibrating DKD laboratories follow this guideline taking the conditions stipulated upon accreditation into account.

The terms used in this guideline are in compliance with DIN 861, part 1, DIN 1319 and DIN 2257.

2 Components of the gauge block measuring instrument

The gauge block measuring instrument comprises the measurement pedestal, the measurement table with gauge block positioning device, two length indicators, an electronic measuring instrument with numerical display and digital interface, if necessary.

3 Carrying-out of the calibration

3.1 External inspection

The following characteristics of state shall be checked:

- perfect condition of the upper surface of the measurement table;
- undamaged condition and sphericity of the measuring faces of the anvils and central position of the vertex of the measuring faces;
- measuring force of the upper and lower length indicators in compliance with the manufacturer's specifications;
- correct sequence for the retraction of the two anvils. The measuring face of the lower anvil must be retracted under the surface of the measurement table.
- in the non-lowered position, the measuring face of the lower anvil shall protrude from the measurement table surface by 20 µm to 100 µm.

3.2 Standards used

The pairs of gauge blocks No. 1 to No. 6 made of the same material are considered to be standards. The pairs to be used together during calibration have been marked by A and B and provided with an identification number. As regards the quality of the measuring faces, the standards shall be of the calibration degree K, with the exception of the special gauge block. Gauge block B of pair No. 6 is a special block designed as a bridge; one of its measuring faces is divided into three sections of almost equal size (9 x 10 mm), the two outer sections being 13 ± 3) µm higher than the center section. The plane measuring face of the gauge block must have wringing quality. The deviation should not exceed 0,05 µm in the central area (7 mm in diameter) and 0,2 µm on the protruding sections.

Pair No.	Nominal dimensions A (mm)	B (mm)
1	0,5	0,5
2	1,0	1,005
3		1,01
4	4,0	4,0
5	100,0	100,0
6	6,0	6,0*

* bridge type

The difference between the central lengths of gauge blocks A and B forming pairs 1 to 5, and the deviations f_0 and f_U from the central length of gauge blocks B of pairs 2 and 3 have been determined with an uncertainty of measurement of 0,015 µm. Gauge block pair No. 6 has not been calibrated.

3.3 Calibration method

3.3.1 Differential measurement of the central lengths

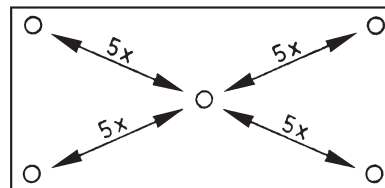
Using the standards, 5 differential measurements with each of the gauge block pairs Nos. 1 to 5 shall be carried out on the gauge block measuring instrument to be calibrated. The 5 measurements shall be repeated after the positions of gauge blocks A and B have been interchanged in the gauge block positioning device.

3.3.2 Differential measurement with the special gauge block

Two measurement series, each comprising 10 measurements, shall be carried out for pair No. 6. In the first measurement series, the special gauge block shall be arranged so that the plane measuring face touches the measuring table; the bridge-like measuring face shall touch the table during the second measurement series. These measurements allow the sensitivity of the lower length indicator to be checked as well.

3.3.3 Deviations f_0 and f_U from the central length

To determine the deviations f_0 and f_U , each of the four points defined in DIN 861, section 6.3.2, and located in the four edges of the measuring face of the single gauge block 1,005 mm or 1,01 mm shall be traced 5 times in succession (of. drawing) starting in the center of the measuring face.



The four measurement series shall be repeated after the gauge block has been rotated through 180° with the position of the contact area remaining unchanged.

4 Evaluation of the measurement results and information to be given in the calibration certificate

4.1 Difference between central lengths

From the single values determined according to 3.3.1, the mean value (arithmetic mean) and the standard deviation (DIN 2257, section 4.1.3) shall be determined for each measurement series of a pair of gauge blocks (10 measurement values).

4.2 Difference between the central lengths of gauge block pair No. 6

From the single values determined according to 3.3.2, the mean values, the difference between the mean values and the standard deviations shall be determined for the two measurement series (10 measurement values each) corresponding to the two positions of the special gauge block.

4.3 Deviations f_0 and f_U from the central length

From the single values determined according to 3.3.3, the mean value and the standard deviation shall be determined for each measurement series.

The deviations f_0 and f_U from the central length result from the eight mean values.

4.4 Assessment criteria

All standard deviations determined according to 4.1, 4.2 und 4.3 must not exceed the value of 0,015 µm. The permissible deviation of the mean values according to 4.1, and the permissible deviation of the values f_0 and f_U according to 4.3 from the values of the standards amount to ± 0,03 µm. The difference between the mean values according to 4.2 may be ± 0,03 µm at most.

4.5 Place of calibration

The gauge block measuring instrument shall be calibrated at its place of use.

4.6 Information to be given in the calibration certificate

The following minimum information must be given in the calibration certificate:

4.6.1 The place of use.

4.6.2 The calibration number and identification number of the standards used.

4.6.3 The manufacturer, type designation and serial number of the components of the gauge block measuring instrument.

4.6.4 The principle of the length indicators.

4.6.5 Measuring range used and digital step of the display during calibration.

4.6.6 Setting of the control elements of the electronic length measuring instrument (compound circuit).

4.6.7 Temperature range in which the calibration was carried out.

4.6.8 Measurement results in tabular form: The "differences between the central lengths" E according to 4.1 and the values N of the standards at 20°C shall be compared and the difference E-N and the standard deviation according to 4.1 indicated. For gauge block pair No. 6, the mean values of the two measurement series according to 4.2, the difference between the mean values, and both standard deviations shall be stated. The "deviations f_0 and f_U from the central length" E determined according to 4.3 with the gauge block measuring instrument shall be compared with the values N of the standard, and the difference and the maximum standard deviation of the 8 measurement series concerned shall be stated.

4.6.9 If the instrument meets the requirements according to 4.4, both the measurement pedestal and the display unit of the gauge block measuring instrument shall be provided with a DKD calibration mark.

Aims and tasks of the German Calibration Service

The DKD was established on 25th August 1977 by the Federal Ministry of Economics, the Physikalisch-Technische Bundesanstalt (PTB) as the highest technical authority for metrology in the Federal Republic of Germany, and the industry.

The DKD guarantees that measuring and testing equipment of industrial metrology is linked to national standards. In industry there is a need for high precision measuring instruments and measuring standards to be calibrated, and awarded a recognized test certificate. This promotes competition on the national and international markets.

The importance of the DKD

In public commissioning, in export and in technological and scientific collaboration, proof of the conformity with national standards is increasingly required for the measuring equipment used for product testing. To guarantee the reliability of measuring results, for example, testing regulations of national and other official bodies often include the requirement that the measuring equipment used must have been calibrated against national standards.

The importance of calibration certificates on the national and international competition is increasing more and more. Therefore it is of interest both for the manufacturer and the user of the measuring equipment.

With this, the gauge block has a particular importance as it represents the standard of length.

The issue of DKD-calibration certificates raises the confidence in the metrological qualification of the calibration center. This is due to the fact of supervision by the PTB as the metrological national institute of the Federal Republic of Germany.



Performance

On commission, Calibration Laboratories of the DKD check measuring instruments and inspection equipment. The results are stated in a calibration certificate and the test pieces are provided with a calibration label. By this means the traceability to the National Standard is proved.

The volume of calibration is based on the DKD-guideline DKD-R4-3, as well as annexures 8 and 9 of the accreditation document.

Objekt of calibration	Uncertainty of measurement $\geq$
Gauge blocks / steel 0,5 thru 1000 mm	center: $0,05 \mu\text{m} + 0,5 \cdot 10^{-6} \cdot L$ f_o / f_u : $0,05 \mu\text{m}$
Gauge blocks / ceramic / tungsten carbide 0,5 thru 100 mm	center: $0,07 \mu\text{m} + 0,6 \cdot 10^{-6} \cdot L$ f_o / f_u : $0,05 \mu\text{m}$
Gauge block pairs according to DKD-R4-1	$0,03 \mu\text{m}$
Gauge block measuring instruments on site according to DKD-R4-1	$0,03 \mu\text{m} + 0,002 \cdot D$
Micrometer calipers for outside 0 – 300 mm > 300 – 1000 mm	$3 \mu\text{m} + 10 \cdot 10^{-6} \cdot L$ $5 \mu\text{m} + 10 \cdot 10^{-6} \cdot L$
Dial indicators, digital or analog up to 100 mm	$3 \mu\text{m} + 10 \cdot 10^{-6} \cdot L$
Dial test indicators up to 1,6 mm	$0,7 \mu\text{m}$
High precision dial indicators up to 3 mm	$0,5 \mu\text{m}$
Plug gauges up to 500 mm	$2 \mu\text{m} + 2 \cdot 10^{-6} \cdot L$
Setting ring gauges up to 250 mm	$2 \mu\text{m} + 2 \cdot 10^{-6} \cdot L$
Optical flats and opt. parallels	$0,1 \mu\text{m}$

(At present extensions are under preparation)

DEUTSCHER KALIBRIERDIENST

DKD



 DKD-K-01301

Kalibrierlaboratorium für die Messgröße Länge
 Calibration laboratory for the measuring length
 Akkreditiert durch die / accredited by the
 Akkreditierungsstelle des DKD bei der

PHYSIKALISCH-TECHNISCHEN BUNDESANSTALT (PTB)





**KOLB & BAUMANN
 ASCHAFFENBURG**

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**DKD-K-
 01301**

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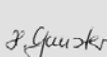
Kalibrierschein Calibration Certificate

Kalibrierzeichen
 Calibration mark

Gegegen Object	122 gauge blocks to DIN EN ISO 3650 of steel, from nominal size 0,5 mm up to 100,0 mm inclusive	Dieser Kalibrierschein dokumentiert die Rückführung auf nationale Normen in Über- einstimmung mit dem Internationalen Einheitensystem (SI).
Hersteller Manufacturer	"KOB" Kolb & Baumann	Der DKD ist Unterzeichner der multi- lateralen Übereinkommen der European co-operation for Accreditation (EA) und der International Laboratory Accreditation Cooperation (ILAC) zur gegenseitigen Anerkennung der Kalibrierscheine.
Typ Type		Für die Einhaltung einer angemessenen Frist zur Wiederholung der Kalibrierung ist der Benutzer verantwortlich.
Fabrikat / Serien-Nr. Serial number	86973	This calibration certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI).
Auftraggeber Customer	SPECIMEN	The DKD is signatory to the multilateral agreements of the European co-operation for Accreditation (EA) and of the International Laboratory Accreditation Cooperation (ILAC) for the mutual recognition of calibration certificates.
Auftragsnummer Order No.	26759	The user is obliged to have the object recalibrated at appropriate intervals.
Anzahl der Seiten des Kalibrierscheines Number of pages of the certificate	7	
Datum der Kalibrierung Date of calibration	10.12.2003	

Dieser Kalibrierschein darf nur vollständig und unverändert weiterverbreitet werden. Auszüge oder Änderungen bedürfen der Genehmigung sowohl der Akkreditierungsstelle des DKD als auch des ausstellenden Kalibrierlaboratoriums. Kalibrierscheine ohne Unterschrift und Stempel haben keine Gültigkeit.

This a calibration certificate may not be reproduced other than in full except with the permission of both the Accreditation Body of the DKD and the issuing laboratory. Calibration certificates without signature and seal are not valid.

Stempel Seal	Datum Date	Leiter des Kalibrierlaboratoriums Head of the calibration laboratory	Bearbeiter Person in charge
	10. Dezember 2003	 Dipl.-Ing. (FH) Martin Wombacher	 H. Gaßner

KOLB & BAUMANN GMBH & CO. KG
 FABRIK FÜR PRÄZISIONSMESSTECHNIK
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Calibration of gauge blocks within the scope of the German Calibration Service DKD

General

- The expert committee "Length" of the DKD have worked out and partially released the guideline DKD-R-4-3 Calibration of measuring tools for geometric measured value. The subject of these sheets is to describe the scope of calibration based on metrological requirements and through which satisfactory results can be achieved even under consideration of economical aspects.

Field of application

- The guideline DKD-R 4-3 sheet 3.1 was definitely released for gauge blocks. This sheet describes three scopes of calibration (options). The options are to be chosen according to the use of the gauge blocks as
 - **Reference Gauge Blocks (Option 5.3.1):**
These are gauge blocks used for the calibration of other gauge blocks.
 - **Gauge Blocks in use (Option 5.3.2):**
These are gauge blocks used for setting measuring instruments and for the calibration of measuring tools.
 - **Used Gauge Blocks (Option 5.3.3):**
These are gauge blocks which are mainly used in production.

Scopes of calibration according and uncertainties of measurement

- **Option 5.3.1: Full calibration**
Visual control – rework if necessary – wringing of both measuring surfaces – Determination of the deviation of the central size from the nominal size, as well as f_o and f_u – minimum 3 measuring cycles; smallest possible uncertainty of measurement $U = 0,05 \mu\text{m} + 0,5 \cdot 10^{-6} \cdot L$ with $k = 2$, depending on test piece and length.
- **Option 5.3.2: Reduced calibration**
Visual control – rework if necessary – flatness of both measuring surfaces – Determination of the deviation of the central size from the nominal size, as well as f_o and f_u – minimum 2 measuring cycles; smallest possible uncertainty of measurement $U = 0,08 \mu\text{m} + 0,5 \cdot 10^{-6} \cdot L$ with $k = 2$, depending on test piece and length.
- **Option 5.3.3: Minimal calibration**
Visual control – rework – Determination of the deviation of the central size from the nominal size, as well as f_o and f_u – minimum 2 measuring cycles; smallest possible uncertainty of measurement $U = 0,1 \mu\text{m} + 0,8 \cdot 10^{-6} \cdot L$ with $k = 2$, depending on test piece and length.

A statement as to whether sent-in gauge blocks are suitable for calibration can be made only during the calibration procedure. If you failed to specify the option according to the field of application we will carry through a calibration with the smallest possible uncertainty of measurement depending on the state of the gauge blocks. A subsequent modification is not possible.

In case of any deviation from your calibration request we shall contact you by phone the soonest possible in order to avoid unnecessary costs.





Calibration Service for gauge blocks of steel, carbide and ceramic

–traceable to National Standards via our own DKD-laboratory,
in accordance with DIN/ISO 9000–9004

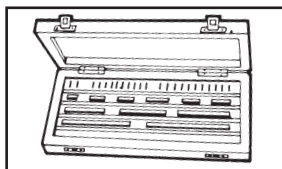
DKD-K-
01301

A consequence from the European Market is the introduction of uniform standards and guidelines for Quality Assurance. More and more companies and contractors have to comply with the EN 29000 (DIN/ISO 9000–9004). In this connection gauge blocks are thus an important connecting link for the traceability to National Standards of the length measuring practice. In order to meet the requirements of DIN/ISO 9000 it is imperative to know their actual condition and to control them constantly.

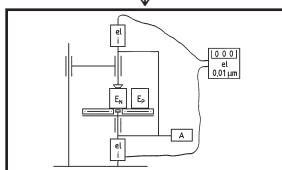
This is where the KOBA Calibration Service can help you.

Since the rate of wear on individual gauge blocks differs, depending on how much use is made of them and what they are used for, it is not possible to lay down any standard interval between checks. **However, a one year interval has proved satisfactory in practice.**

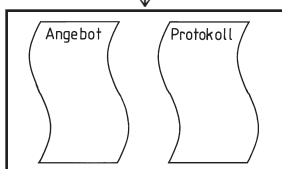
Calibration sequence



Your are sending a gauge block set for re-calibration.



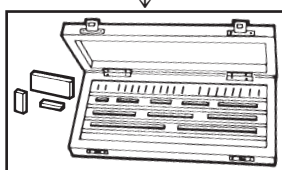
Gauge block are cleaned, de-magnetized, measuring faces are smoothed and then checked against DKD-calibrated masters by five-points-measurement.



A calibration certificate with the actual findings is drawn up and sent to you together with an offer for the replacement of worn gauge blocks.



You decide, to which grade we shall replace.



We will return the set inspected and partly replaced together with a new calibration certificate including the findings of the replaced gauge blocks and separately all the worn gauge blocks which still can be used for less important jobs.

Advantages

- The entire set is of only one grade of accuracy
- Smallest possible number of replacements
- Costs are low
- Assured standards for your quality control

When buying gauge blocks do not forget the calibration service. Without it cheap blocks may end up costing you a lot of money.

Everything from one source. Fast, competent, from one supplier, direct.

KOBA-Kalibrier-Service

Kalibrierlaboratorium für die Messgröße Länge
KOBA-Calibration-Service / Service de Contrôle KOBA

Page 2 of calibration certificate No. 12345 dated 09.12.03

Nominal size	Deviation of central length from nominal size	Deviation from central length	Tol. class	Serial No.	Rem.
mm	µm	fo µm	fu µm		

0.50
1.0
1.0005
1.001
1.002
1.003
1.004
1.005
1.006
1.007
1.008
1.009
1.01
1.02
1.03
1.04
1.05
1.06
1.07
1.08
1.09
1.10
1.11
1.12
1.13
1.14
1.15
1.16
1.17
1.18
1.19
1.20
1.21
1.22
1.23
1.24
1.25
1.26
1.27
1.28
1.29
1.30
1.31
1.32

Kobu & Daumann GmbH
Fabrik für Präzisions-Messungstechnik
Kalibrierlaboratorium des

KOBA-Kalibrier-Service

Kalibrierlaboratorium für die Messgröße Länge
KOBA-Calibration-Service / Service de Contrôle KOBA

Calibration certificate No.: 12345

Client: Specimen

Client No.: 67890

Client Order No.: 12121

Works Order No.: B453987

Objekt of calibration: Gauge block set out of steel, 122-pieces, Tolerance class 0

Size: 0.50 - 100 mm

Manufacturer's logo: KOBA

Serial No.: various

Test procedure: Measuring of the centre deviation and the variation range by comparison against gauge blocks in accordance with DIN EN ISO 3650

Measurement standard: Measuring equipment: TRISA UPC, Serial No.: 4561; Gauge block set, Serial No.: 86137
DKD-certificate No. 1711 DKD-K-01301 01-04

Uncertainty: $U = 0,1 \mu m + 0,6 \times 10^{-6} \times L$; with $k = 2$

Result: All pieces refer to the standard

Number of pages: 2

Aschaffenburg, 09.12.03 inspected by: Endemann

Kobu & Daumann GmbH / & Co. KG
Fabrik für Präzisions-Messungstechnik
Kalibrierlaboratorium des Deutschen Kalibrier-Servises - Hauptnummer: DKD-K-01301



Endemann

The testing procedure

1. The gauge blocks are cleaned and de-magnetized.
2. Scratches and burrs are removed from the gauge faces and edges. The gauge faces are dressed smooth.
3. The gauge blocks are checked by measurement by comparison against gauge blocks calibrated by the German Calibration Service (five-points-measurement).
4. A KOBA calibration certificate is drawn up, or in other words a record of the results of the measurements is produced.

If desired the measured results can be shown in detail. For this you can select one of four different types of procedures:

- P2: Grades of accuracy, centre deviations.
- P3: Grades of accuracy, centre deviations (as in P2), and variation range.
- P4: Grades of accuracy, centre deviations (as in P2), variation range (as in P3), additionally wringing of both measuring faces to an optical flat to prove wringability. Blue spots are allowed and acceptable.

Once the testing has been completed, you will receive from us a KOBA test report of the kind you opt for together with a quotation for the replacement of gauge blocks which are not suitable for continued use.

Servicing Kit

No. 1901 (0,75 kg) Order No. 2070011902



Contents:

- 1 Cloth
- 1 Chamois Leather
- 1 bottle Special Protective Oil
- 1 Deburring Stone no. 1903-1
- 1 Soft Brush
- 1 Grease Brush
- 1 set Instructions

Deburring Stone

No. 1903-1 Ord.No. 2070011903
Size 50 x 25 x 10 mm (0,05 kg)

No. 1903-2 Ord.No. 2070021903
Size 100 x 25 x 10 mm (0,1 kg)



Smallest burrs and scratches on the measuring surfaces can be remedied with the deburring stone without altering the actual size.

Optical Flat

No. 1904-1 (0,16 kg) Order No. 2880011904



Checking the flatness of measuring faces
45 mm diameter
11 mm thick
0,1 µm flatness accuracy

No. 1904-2

Order No.
2880021904

Optical parallels for checking the parallelism of measuring faces on micrometer calipers

4 pieces of 12.000 / 12.120 / 12.250 / 12.370 mm thickness – diameter 30 mm – flatness < 0,15 µm – parallelism ≤ 0,6 µm – thickness tolerance ± 0,1 mm

Gripping Plier

No. 1907 (0,18 kg) Order No. 2060001907

insulating against heat transfer of the hand and for convenient and easy handling of gauge blocks from 0.5 mm onwards.

The gripping force can be adjusted to take into account the greater weight of the large gauge blocks.



Special Protective Oil

No. 1902 (0,06 kg) Order No. 2070021902



50 ccm



Made in Germany

Gauge Block Clamps

for gauge blocks over 100 mm

No. 1908 (0,2 kg)

Order No.
2060001908



Universal Gauge Block Holder

for individual gauge block combination over 100 mm

No. 1909

Order No.	clamping range
2110011909	0–45
2110021909	0–90
2110031909	0–135
2110041909	0–180
2110051909	0–225



Clamping Stand

No. 2350 (3,7 kg)

Order No. 2160002350

Measuring range 0–100 mm, in combination with micrometer check sets 1010 M / 1010 MP / 1011 Ma / 1011 Mb / 1011 Mc.

Simple and efficient handling while temperature of the hand will be avoided.



Insulating Handles for Long Gauge Blocks

No. 1905 Ord.No. 2060001905
(0,15 kg)



No. 1906 (0,1 kg)
Ord.No. 2060001906



Gauge Block Accessories

are especially designed and manufactured to extend the high degree of gauge block accuracy into the field of fast, accurated temporary gauging, which are used in inspection departments and also in toolroom and machine shops on small batch production to keep gauging costs at a minimum.

The range of possibilities is manifold and below are quoted a number of popular examples.

Internal cylindrical gauge

(instead of plug gauge or cylindrical limit plug gauge)

Spacing or external gauge

(instead of snap gauge or adjustable limit snap gauge)

Precision height gauge (instead of height marking instrument)

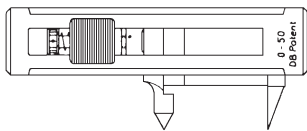
Precision marking compasses

Setting gauge for bore gauging instruments

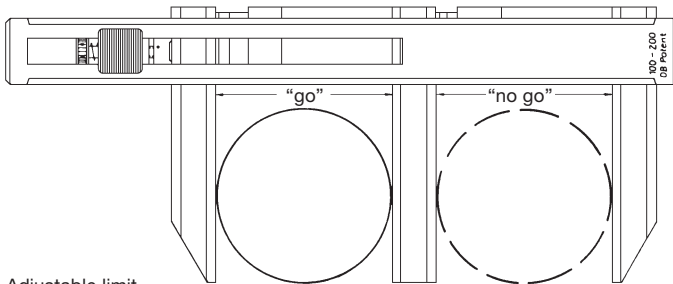
Master gauges for exact graduations, etc.



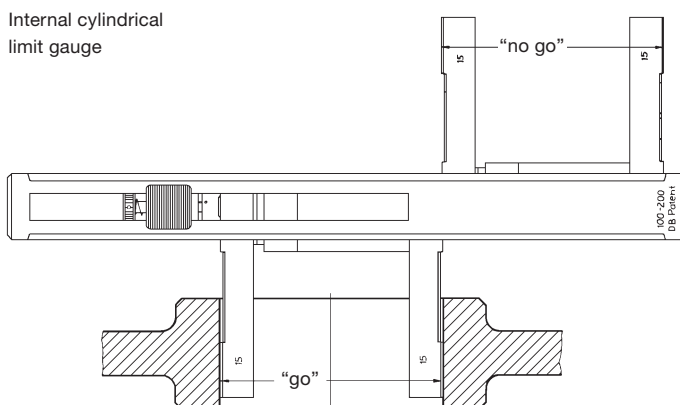
Examples of Gauge Block Accessories used in conjunction with Gauge Blocks



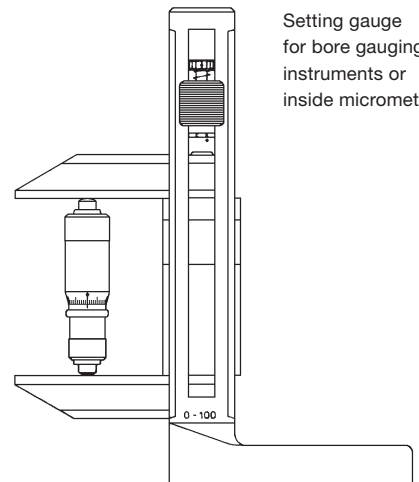
Precision marking
compass points



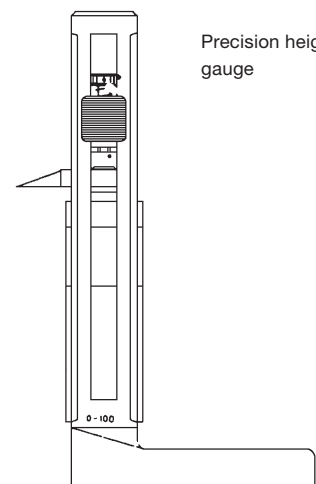
Adjustable limit
snap gauge



Internal cylindrical
limit gauge



Setting gauge
for bore gauging
instruments or
inside micrometers



Precision height
gauge

Gauge Block Holders

with quick adjustment

KOBA developed quick adjusting gauge block holders for use with precision gauge blocks, which are hand made to assure burr free side and fixing surfaces. The rack pattern positive locating groovers provide rapid adjustment and prevent gauge block combination from slipping or moving once in position, thus loading is simple, fast and safe.

The clamping slide and gauge block combination are both secured by the same thumb screw, located on the clamping slide.

On request the range of holders from 100–300 may be increased when supplied with special holes and used in conjunction with expanding block No. 2150 from 0 up. When ordering please state requirements, e.g. 0–500 mm.

Cat. No.	Measuring range mm	Weight kg
2101	0– 50	0,2
2102	0– 100	0,3
2103	0– 200	0,4
2105	100– 200	0,4
2106	100– 300	0,5
2104	0– 300	0,5
2116	200– 400	0,6
2109	300– 500	0,7
2117	400– 600	0,8
2112	500– 800	1,0
2113	800–1000	1,2
2114	1000–1200	1,4
2115	1300–1500	1,6
2118	1800–2000	1,8



Clamping elements for long gauge blocks with pin holes see page 17.

The Order No. for these products consists of:

A 6 digit basic number 211000 and next to it is the 4 digit Cat. No.

Example: Gauge block holder 0–100 mm = 2110002102

Measuring Jaws

with cylindrical shoulder for inside and outside measurements



Made in Germany

Nominal sizes (dia. of shoulder of 1 pair of jaws)	Maximum gauge depth mm	Cat. No.	Weight kg ea. pair
4 mm	8	2204	0,03
10 mm	15	2210	0,05
16 mm	20	2216	0,07
20 mm	40	2220	0,10
30 mm	65	2230	0,20
40 mm	95	2240	0,35

The Order No. for these products consists of:

A 6 digit basic number 212000 and next to it is the 4 digit Cat. No.

Example: Measuring jaws 20 mm = 2120002220

The permissible deviation of the nominal diameter is equal to the double of the permissible center deviation of a gauge block of the same nominal size in Grade 2.



Control Points



Weight ea.
pair: 0.05 kg

Cat. No. 2330 / Order No. 2130002330
For checking of graduations and of exact
distances between points and lines.

Scriber Point



Cat. No. 2322 / Order No. 2130002322

For forming an accurate height gauge:
scriber point, gauge block holder, base,
gauge blocks.

Centre Point



Weight: 0.03 kg

Cat. No. 2321 / Order No. 2130002322
For forming marking compasses: centre
point, scriber point, gauge block holder,
gauge blocks.

Plane Jaws



for outside
measurements only

Cat. No.	Height abt. mm	Width mm	Length mm	Weight each pair kg
2301	20	9	100	0,18
2302	20	9	125	0,23

Suitable for forming snap gauges or adjustable limit snap gauges

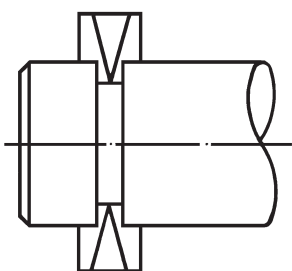
Plane Parallel Jaws



for inside and outside
measurements
(not for internal diameter)

Cat. No.	Height (Grade 2) mm	Width mm	Length mm	Weight each pair kg
2304	20	9	100	0,20
2305	20	9	125	0,24

Knife Edge Jaws



Cat. No.	Max. measurable diameter mm	Length overall mm	Weight each pair abt. kg
2310	26	55	0,07

The Order No. for these products consists of:
A 6 digit basic number 212000 and next to it is the
4 digit Cat. No.

Example: Plane jaws 100 mm = 2120002301

Base



Cat. No. 2340

Order No. 2160002340

Weight: 0,92 kg

The base is used in conjunction with gauge block holders 2101–2113.
The desired size combination being built into the gauge block holder
after which the holder is secured vertically upon the base by a holding
screw.

Sets of Accessories for Gauge Blocks

Not illustrated

Set No. 2004 M		mm	Cat. No.
1 pair	of measuring jaws	in all 40	2240
1	Gauge block holder	0–300	2104
1	Gauge block holder	300–500	2109
Weight incl. case abt. 2,5 kg		Ord. No. 2150002004	



Set No. 2010 M



Made in Germany

Not illustrated

Set No. 2010 M		mm	Cat. No.
1 pair	of measuring jaws	in all 4	2204
1 pair	of measuring jaws	in all 10	2210
1	scriber point	–	2322
1	centre point	–	2321
1	base	–	2340
1	Gauge block holder	0– 50	2101
1	Gauge block holder	0–100	2102
1	Gauge block holder	100–200	2105
Weight incl. case abt. 3 kg		Ord. No. 2150002010	

Set No. 2014 M		mm	Cat. No.
1 pair	of measuring jaws	in all 4	2204
1 pair	of measuring jaws	in all 10	2210
1 pair	of measuring jaws	in all 16	2216
1 pair	of measuring jaws	in all 20	2220
1	scriber point	–	2322
1	centre point	–	2321
1	base	–	2340
1	Gauge block holder	0– 50	2101
1	Gauge block holder	0–100	2102
1	Gauge block holder	100–200	2105
Weight incl. case abt. 3,2 kg		Ord. No. 2150002014	



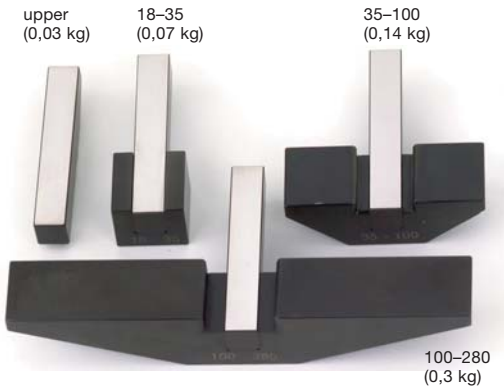
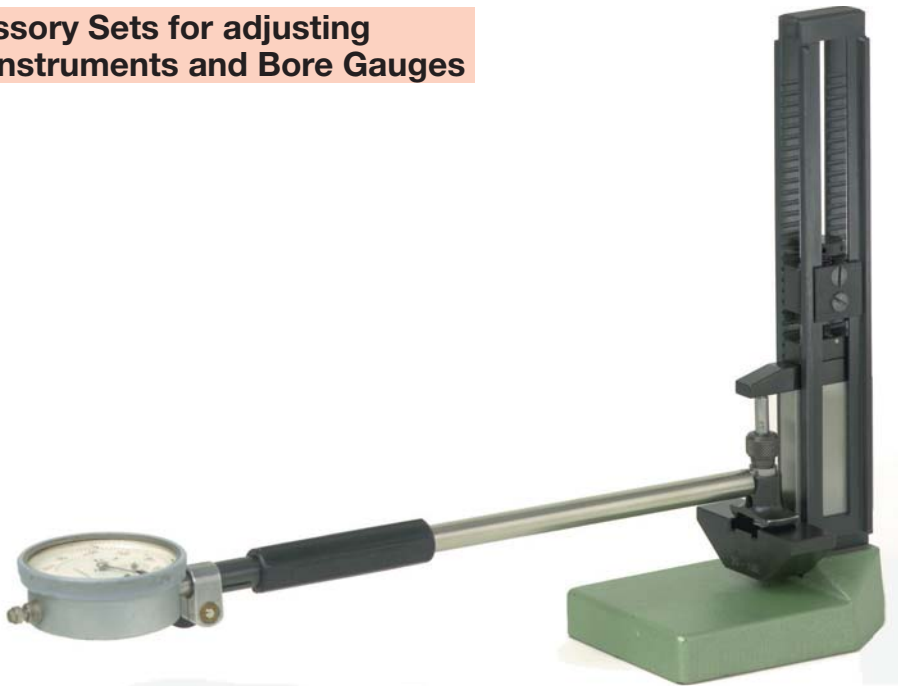
Set No. 2023 M

Set No. 2023 M		mm	Cat. No.
1 pair	of measuring jaws	in all 4	2204
1 pair	of measuring jaws	in all 10	2210
1 pair	of measuring jaws	in all 16	2216
1 pair	of measuring jaws	in all 20	2220
1 pair	of measuring jaws	in all 30	2230
1 pair	of measuring jaws	in all 40	2240
1 pair	of plain parallel jaws	100	2304
1 pair	of knife edge jaws	26	2310
1	scriber point	–	2322
1	centre point	–	2321
1	base	–	2340
1	Gauge block holder	0– 50	2101
1	Gauge block holder	0–100	2102
1	Gauge block holder	100–200	2105
1	Gauge block holder	200–400	2116
Weight incl. case abt. 5 kg		Ord. No. 2150002023	

Gauge Block Accessory Sets for adjusting Internal Precision Instruments and Bore Gauges



Made in Germany



Designation	Measuring Range	Cat. No. Ord. No.
upper measuring jaws	all	2521 2120002521
lower measuring jaws	18- 35	2522 2120002522
lower measuring jaws	35-100	2523 2120002523
lower measuring jaws	100-280	2524 2120002524
lower measuring jaws *	280-510	2525 2120002525

* not illustrated

Set No. Ord. No.	Contents	Measuring Range
2505-1 2150012505	1 upper measuring jaw 1 lower measuring jaw 18- 35 1 lower measuring jaw 35-100 1 Gauge block holder 0-100 1 base	up to 100 mm
2510 2150002510	2 upper measuring jaw 1 lower measuring jaw 18- 35 1 lower measuring jaw 35-100 1 lower measuring jaw 100-280 1 Gauge block holder 0- 50 1 Gauge block holder 0-100 1 Gauge block holder 100-200 1 Gauge block holder 100-300 1 base	up to 280 mm
2505-2 2150022505 not illustrated	1 upper measuring jaw 1 lower measuring jaw 100-280 1 lower measuring jaw 280-510 1 Gauge block holder 100-600 1 base	100 up to 510

2505-1
(2,1 kg)



2510 (4,3 kg)



Parts may be ordered at random leaving open spaces in storing cases if desired.



Your Contact Persons at KOBA

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Your partner for: QA, EDP, R&D

as well as technical consultation

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Excerpts from our delivery programme:

Gauge Blocks

Gauge Block Accessories

Angle Gauges

Flat Gauges according to works standard specifications and client's drawing

Master setting pieces

Thread Gauges

Spline Gauges

Plug Gauges

Ring Gauges

Snap Gauges

Step Gauge Koba-step, patent

Sphere Plate Koba-check

Ball Bar up to 8 m

Ball Cube Koba-Q3

Optical scale Koba-optima

Opto-tactile standards

and our services:

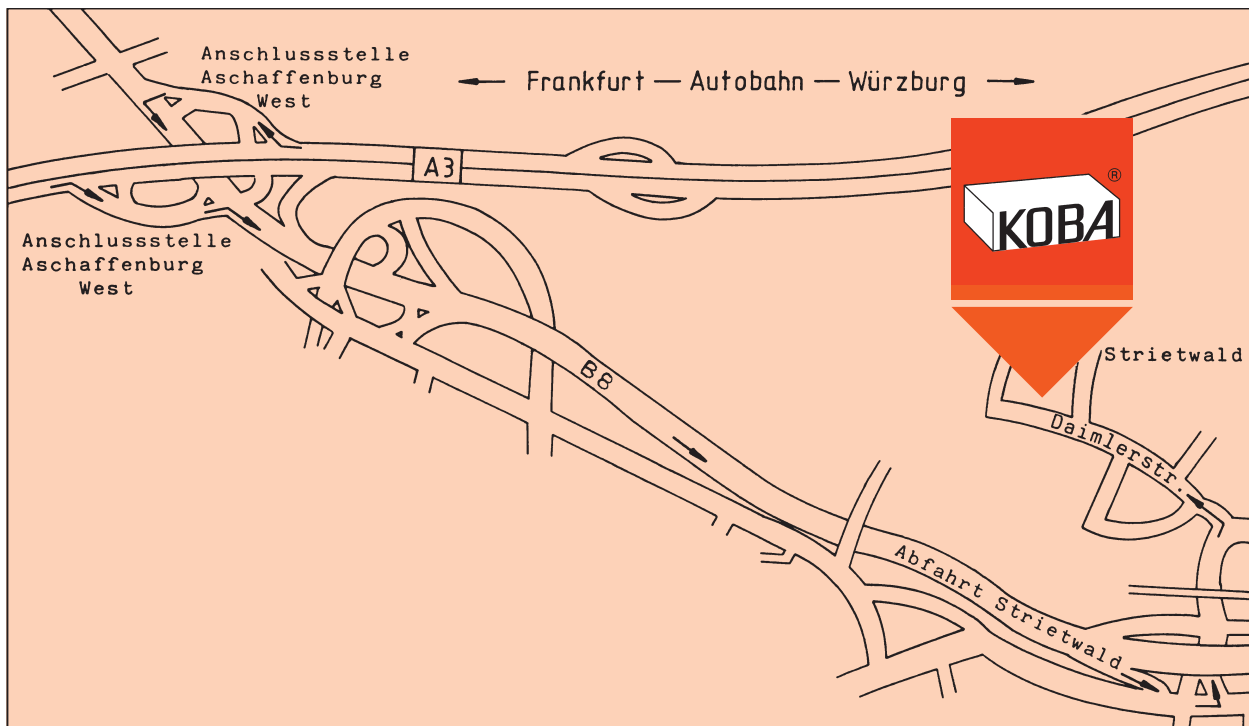
Koba-calibration service for gauge blocks and gauges

DKD-calibration as per accreditations

Monitoring of coordinate measuring machines

All orders received are subject to our terms of delivery and sale which are kept at your disposal

How to find our factory



KOLB & BAUMANN GMBH & CO. KG
PRECISION MEASURING TOOLS MAKERS
DE-63741 ASCHAFFENBURG · DAIMLERSTR. 24
GERMANY

PHONE +49 (6021) 34 63-0 · FAX +49 (6021) 34 63-40

Internet <http://www.koba.de> · e-mail: messzeuge@koba.de





Made in Germany



KOBA-step

PRECISION STEP GAUGE

+

GUK-S

**DATA-ANALYSIS SOFTWARE
=**

**A COMPLETE SYSTEM FOR
MONITORING COORDINATE
MEASURING MACHINES**

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PRECISION MEASURING TOOLS MAKERS
DE-63741 ASCHAFFENBURG · DAIMLERSTR. 24
GERMANY

PHONE +49 (6021) 34 63-0 · FAX +49 (6021) 34 63-40
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Catalogue No. 6100/E/01/2006

Contents	Page
Step gauges for checking the accuracy of co-ordinate measuring machines	3
Graphic representation and analysis	4
Comparison between the test standards gauge blocks and step gauges	4
Special features and advantages of the KOBA-step	4
Accessoires	6
Calibration	6
Alignment of the KOBA-step	6
Practical use	8
Conducting formal acceptance procedures and monitoring the precisions of machine tools and robotic dimensional-gauging systems	9

Contents	Page
A complete monitoring system: KOBA-step + GUK-S analysis software	10
Standard nominal lengths	13
PTB-Calibration Certificate	14
Gauge faces of ceramic	15
KOBA-step mini	16
KOBA-step: A brief review	17
References	17
Excerpt from our delivery programme and services	18
Your Contact Persons at KOBA	19

Step gauges for checking the accuracy of co-ordinate measuring machines

In industrial metrology, actual physical bodies of known length which can be contacted by mechanical sensors have an important part to play as reference standards when measuring geometrical parameters.

They have become particularly important for assessing the accuracy of two and three-axis co-ordinate measuring machines which employ mechanical sensors. Checking the length measurements uncertainty has proved to be a highly informative and economical method for the acceptance testing and ongoing monitoring of co-ordinate measuring machines. In this case the step gauge can be used in an enormous variety of ways, giving, for example, the advantages of uni-directional and bi-directional targetting and of measurements from all the gauge faces along a line of measurement in succession while needing only a short time for preparation and measurement. Local errors can be detected in the co-ordinate measuring machine and characteristics can be derived for individual co-ordinate axes of the machine.

With the aid of the length measurement uncertainty, the manufacturer or user can specify and check the accuracy of a co-ordinate measuring machine to establish its suitability for length measurement. This fundamental task in metrology is of particular importance due to the fact that in practice the majority of measuring requirements are for the measurement of lengths.

"Length measurement uncertainty" is defined by VDI/VDE guideline 2617, part 2.1 as the uncertainty with which a co-ordinate measuring machine allows the precisely known distance between two points on two mutually parallel gauge faces situated in succession along a line of measurement to be remeasured. Fig. 1 shows a measurement of this kind being made, taking as an example an individual parallel gauge block with an outside length L_e which is arranged obliquely in three dimensions and whose length is remeasured by successive contacts with the block with the probe head in positions I and II.

On the step gauge, spacings of different kinds for making test measurement are all available simultaneously, as follows:

- Outside dimension L_e e.g. with the probe head in positions I and II (Fig. 2)
- Inside dimension L_i e.g. with probe head in positions III and IV (Fig. 3)
- Rear-face to rear-face dimension L_s e.g. with probe head in positions III and V (Fig. 3)
- Front-face to front-face dimension L_s e.g. with probe head in positions VI and IV (Fig. 3)
- Positional length (L_p of a gauge face from the datum gauge face, e.g. with probe head in positions VI and 0 (Fig. 3)

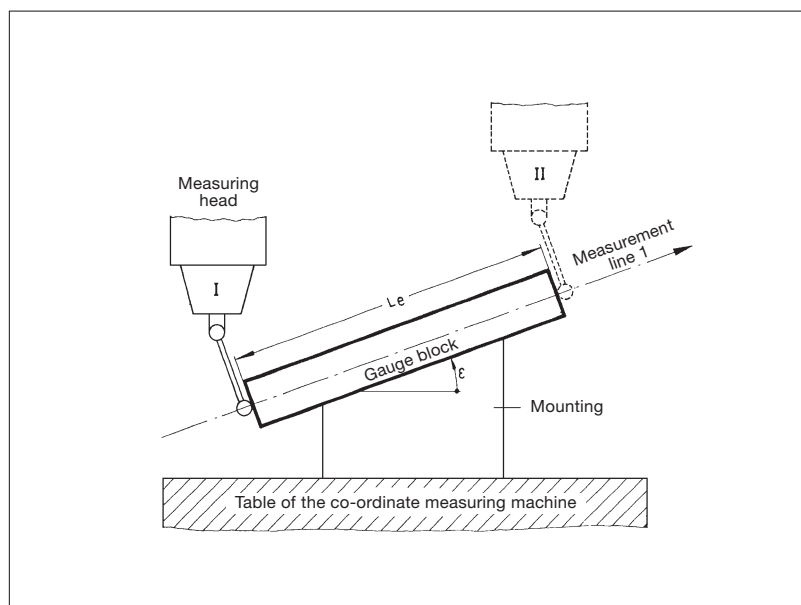
The illustrations show only one of many options available for each type and size of spacing. In magnitude, the differences between the length value L_a indicated by the co-ordinate measuring machine or printed or displayed by its output processor and the true value L_r of the measurement uncertainty U : $|L_a - L_r| \leq U$ in at least 95 % of all cases.

What this means is that L_a can be both larger and smaller than L_r .

The value of the length measurement uncertainty is generally given in the form of a length-dependent formula: $U = A + K \cdot L \leq B$.

A distinction should be made between the figure u_1 specified for one-dimensional test measurements along a co-ordinate axis (with terms A_1, K_1, B_1), the figure u_2 for two-dimensional test measurements made diagonally in a co-ordinate plane (with terms A_2, K_2, B_2) and the figure u_3 for three-dimensional test measurements made diagonally in the three-dimensional space defined by the co-ordinates (with terms A_3, K_3, B_3).

Fig. 1:
Individual gauge block arranged obliquely in three dimensions on the table of a co-ordinate measuring machine, showing an outside dimension L_e being measured.



Graphic representation and analysis

Length measurement uncertainty plot

For the purposes of graphic analysis, the differences $\Delta L = L_a - L_r$ which are found are plotted, with the correct signs, for the individual measured lengths and runs in a length measurement uncertainty grid (Fig. 4). The top and bottom boundary lines produce a funnel-shaped outline with the neck of the funnel measuring $2A$ (A = figure specified by manufacturer for length measurement uncertainty irrespective of length). 95 % of all the test measurements must lie within or on the boundaries. A quantitative analysis is made simply by counting the number of measurements which lie outside the boundary lines.

Gauge face position plot

With the step gauge it is also possible to test the positions L_p of the gauge faces as distances from the datum face. If the relevant length errors ΔL_p given by position measurement in line with VDI guideline 2617 Part 3 are entered in a plot, then it is possible to see both the position of the test length and also the sequence if for example the measurement points in a run are connected by straight lines. With a set of individual gauge blocks this is not possible because they do not have any true common reference point and are not situated on a measurement line.

For analysis use is made of a gauge face position grid (Fig. 5) (similar to the length measurement uncertainty grid). The outline is symmetrical and similar in shape to a butterfly with a width across the waist of $1A$. The parameters in this case correspond to the appropriate figures A_1 , K_1 , B_1 and so on. As this grid is moved along the measured length L , at least 95 % of all the measurements must always lie within or on the boundary lines, meaning that all the measurement points must do so consistently whatever the position of the waist. This ensures that any pairing of two gauge faces (even from different runs) in the form of outside, inside or face-to-face dimensions will also lie inside the funnel of the length measurement uncertainty grid. Thus, the grid forms a combined graphic expression of both the equations given above for all points of measurement.

Comparison between the test standards gauge blocks and step gauges

Apart from the step gauge, the reference standards which lengths are known with the greatest accuracy are parallel gauge blocks. These however are relatively flexible and have to be mounted at the AIRY points (symmetrical spacing $a = 0.57735 \cdot L$) so that they are free of bending moments if this parallelism of the gauge faces is to be maintained. The gauge blocks for the individual test lengths can be individually placed one behind the other for shorter lengths and next to one another for longer lengths. However, when this is done there is no way of obtaining the different gauge points along a line of measurement which are desirable for measurement purposes.

Special features and advantages of the KOBA-step

The step gauge is of castellated configuration and in it a large number of forward and backward facing gauge faces are lined up along a single line of measurement. This line of measurement is the same for measurements between any faces and the position of the workpiece, that is to say the orientation of the carrying body, only has to be determined once to find this line. There are numerous possible combinations in various positions along the measurement line, that actual number of different interface dimensions for a step gauge with 26 castellations (= KOBA-step with a nominal size of 1020 mm) being 1326.

The special feature of the KOBA-step step gauge is the fact that the actual gauge points are situated on the neutral fibre of the carrying body and this means that there are no first-order changes in length if the state of bending changes.

The configuration of the carrying body and the fact that the line of measurement is situated on the neutral fibre prevents any increase in the distance between the gauge faces at the points where the carrying body is supported and prevents them from moving closer together at intervening points. In the KOBA-step step gauge, which is neutral in bending, cylindrical gauge blocks are fixed in position individually in an internal longitudinal groove formed in a rugged steel carrying body of square section (55 x 55 mm). The axis of the gauge blocks is situated on the fibre of the carrying body which is neutral in bending and they form a series of castellations. The arrangement which has been adopted provides excellent protection for the gauge faces. The strength of the carrying body and the fact that the lengths do not vary if there are changes in the bending to which it is subject mean that the KOBA-step step gauge can be mounted in a wide variety of fashions, e.g. cantilevered with so-called zero position support or with support at the Besselpoints.

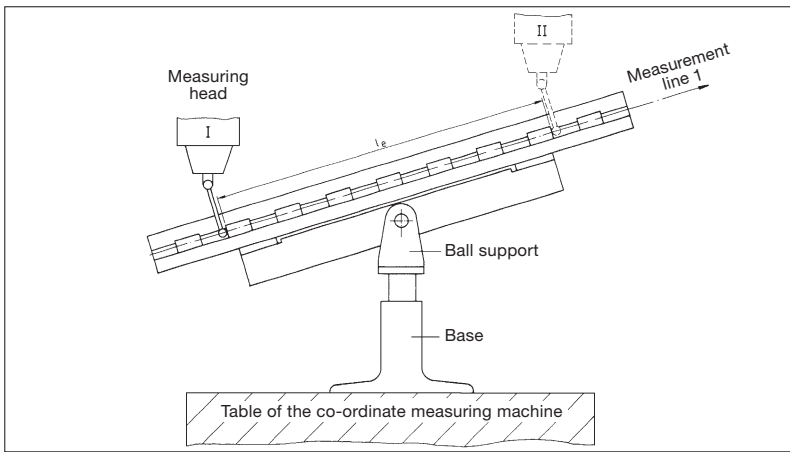


Fig. 2:
Castellated step gauge arranged obliquely in three dimensions on the table of a co-ordinate measuring machine, with an outside length L_e being measured

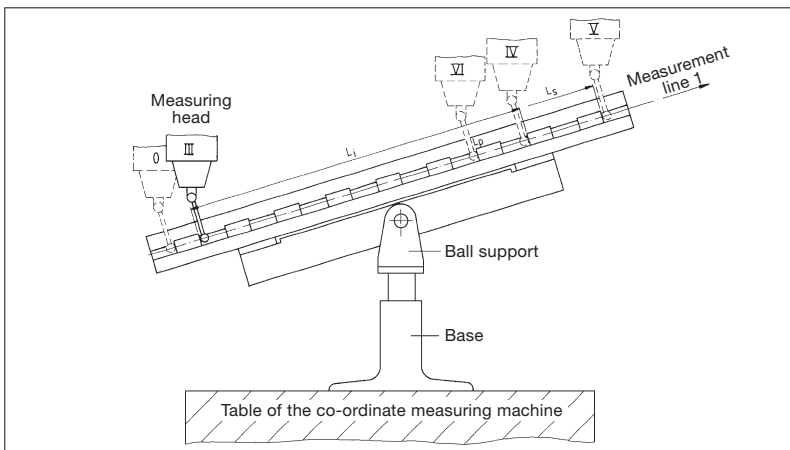


Fig. 3:
Step gauge arranged obliquely in three dimensions on the table of a co-ordinate measuring machine, showing measurement of an inside dimension L_i , of an outside dimension L_s or of the position L_p of a gauge face as a distance from the datum face

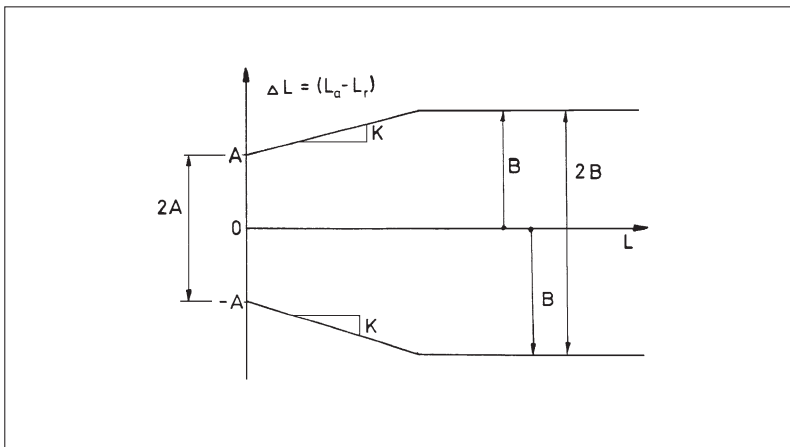


Fig. 4:
Length measurement uncertainty grid with funnel-shaped boundary lines, for the formula

$$U = A + K \cdot L \leq B$$

with the possibility of different plots for U_1 , U_2 , U_3 which represent one, two and three-dimensional length measurement uncertainties

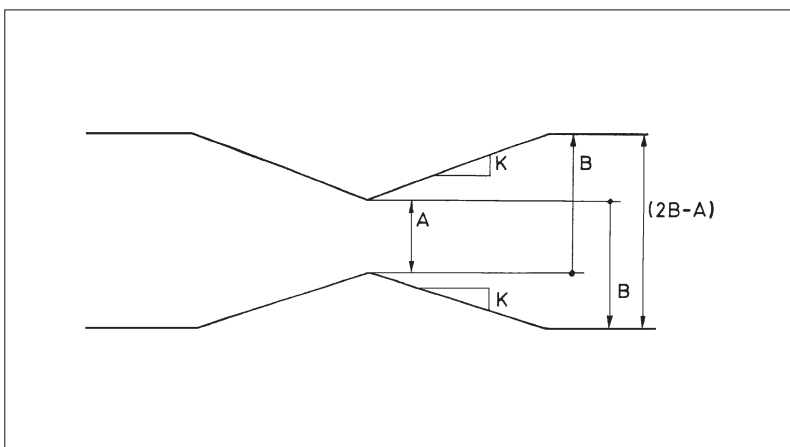


Fig. 5:
Sliding gauge face position grid of symmetrical butterfly-shaped configuration to represent the length measurement uncertainty

$$U = A + K \cdot L \leq B$$

with the possibility of different plots for U_1 , U_2 , U_3 which represent one, two and three-dimensional length measurement uncertainties

Accessories

The range of accessories available which are needed for use with the step gauge, such as swivel support, and base allows the gauge body to be mounted on the co-ordinate measuring machine in such a way as to be free of torsion. A support of this kind produces a particularly stable connection between the step gauge and the table of the co-ordinate measuring machine (Fig. 7, 9 and 10).

The combination of the step gauge and its accessories produces a complete system for making an overall check on the co-ordinate measuring machine.

One particularly important point is that the procedure of checking the co-ordinate measuring machine can be carried out fully automatically under computer control.

Traceability

Since the acceptance or refusal of a co-ordinate measuring machine may depend on the outcome of the length measurement uncertainty test, it is advisable always to use officially calibrated testing equipment in order to avoid unpleasant surprises and wrong interpretations. The KOBA-step step gauge is available with both PTB Calibration Certificate of the Physikalisch-Technische Bundesanstalt, comp. page 15 and DKD calibration-certificate (German Calibration Service-DKD).

The length measurement uncertainties which can currently be achieved with the step gauge are

PTB: $U = 0,2 \mu\text{m} + 0,8 \cdot 10^{-6} \cdot L$ (length)

DKD: $U = 0,2 \mu\text{m} + 0,5 \cdot 10^{-6} \cdot L$ (length)

Works Calibration: $U = 0,6 \mu\text{m} + 1,5 \cdot 10^{-6} \cdot L$ (length)

Recalibration

As is normal with all measurement standards, the KOBA-step step gauge should be recalibrated after a certain period. We recommend the following recalibration intervals:

First recalibration after one to two years and each successive recalibration after two to three years.

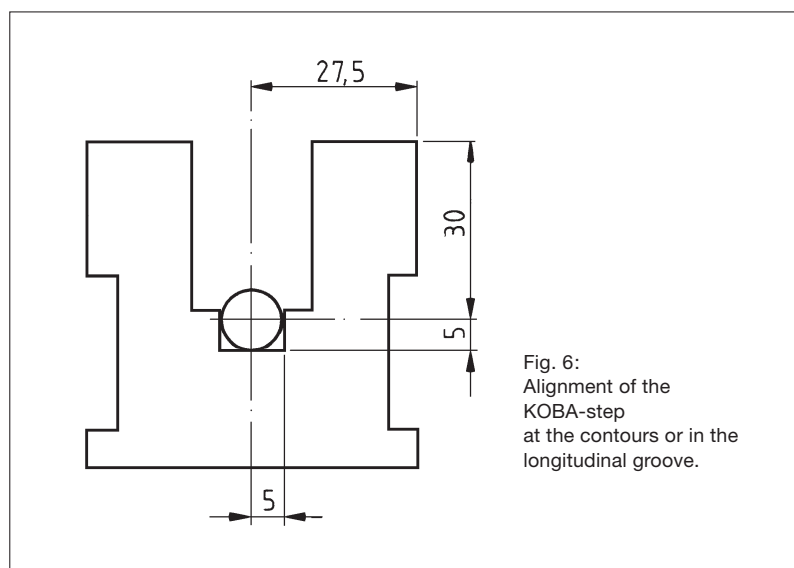
Alignment of the KOBA-step

To define the position and orientation of the KOBA-step resp. the measuring line within the measuring volume, we recommend proceeding as follows:

As the carrying body with the fixed cylindrical gauge blocks has been designed symmetrically to both sides, one of the external side surface and the upper external surface at the end of the large U-groove can be used for the alignment.

Any points which are as large as possible can be sensed at the side surface and at the upper external surface likewise. Both planes so defined are squared off mathematically. A parallel line 27,5 mm to the side surface and 30 mm to the upper surface is the measurement line situated on the neutral fibre.

It is also possible to use both ends of the 7 x 10 mm interior groove for the alignment and proceed in a similar way as mentioned before. The distance from the wall of the groove and the floor of the groove to the line of measurement is 5 mm in both directions.



Cross drills for easy contacting
of the measuring faces.

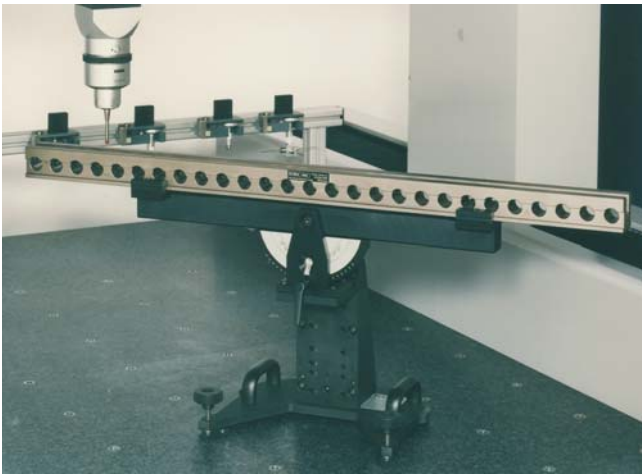


Fig. 7:
Koba-step aligned horizontally along the X-Y plane diagonal, approx. 500 mm above the table, stylus probe vertical.
Accessory: Base and swivel support.



Fig. 8:
Koba-step aligned along the X-axis (lying flat on the table with no accessories used), stylus probe vertical.



Fig. 9:
Koba-step aligned horizontally along the XY-diagonal plane, same accessory as above, turned round 90°, stylus probe horizontal; Contacting through crossdrills.



Fig. 10:
Koba-step aligned vertically along the Z-axis (standing in the base), stylus probe horizontal.



Size 1

Size 2

Fig. 11:
KOBA-step vertically orientated along the Z-axis (standing in the base) stylus probe horizontal (not shown).
In this alignment also suitable to check height gauges.



Fig. 12:
KOBA-step aligned vertically for checking height gauges.

Practical Use

Practical experience in using the KOBA-step step gauge for checking the accuracy of co-ordinate measuring machines and assessing and interpreting the results has demonstrated the usefulness and potentially high information yield of the “length measurement uncertainty” method. The advantage lies in the fact that the measurement is carried out at precision gauge faces using the normal gauging procedure and in the main, the machine manufacturer’s standard processing software. Since the unidirectional and bi-directional gauging of inside and outside dimensions, dimensions between similarly orientated surfaces, and successive dimensions from a given point occur even in the routine measurement of work pieces and since the measurements which have been obtained can be correlated with one another as desired even after the event, it is good idea to make full use of the opportunities offered by the step gauge. What is more, a series of measurements at all the gauge faces in succession provides a large amount of interrelated information and requires only a short time for measurement.

Since the length measurement uncertainty characteristic very much depends on the geometry of the co-ordinate measuring machine, the lines along which measurements are made should be as follows:

- 3 to 4 measurement lines which are diagonal in three dimensions (i.e. along the diagonals of an inscribed cube – at a gradient of approximately 35° – or along the diagonals of the cuboid representing the measured space).
- 2 diagonal lines of measurement in each co-ordinate plane (i.e. along the diagonals of a square – at a gradient of 45° – or the diagonals of a rectangle).
- At least one line of measurement parallel to each co-ordinate axis.

At least 18 suitable lines of measurement have to be selected in order to arrive at a complete definition of the 18 geometrical cuboid characteristics of the entire measurement volume.

It has to be stressed in particular that reliable measurement results for the complex system cannot be achieved unless the stylus probes are included. Checking of the co-ordinate measuring machine without mechanically contacting, i.e.: without using a probe, will therefore not result in an comprehensive statement about the accuracy of the measuring machine.

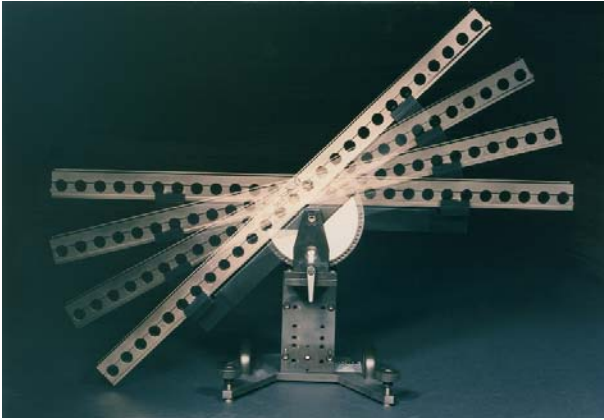


Fig. 13: KOBA-step with swivel support and base, illustrated at various angular inclinations (stylus probe not shown).



Fig. 14: KOBA-step, equipped with swivel support base Size 1 for accommodating 1020 mm length step-gauge (stylus probe not shown).

Another KOBA-step application area:

Conducting formal acceptance procedures and monitoring the precisions of machine tools and robotic dimensional-gauging systems

The step gauge KOBA-step may be used for checking the positioning accuracies of machine tools and articulated-arm robotic dimensional-gauging systems, an application area where they offer the same elegant approach and speed as in checking co-ordinate measuring machines. The accessory items required here are those described above, a swivel support and base.

Regular use of the KOBA-step for monitoring dimensional-gauging precisions of machine tools is essential to total quality assurance. Total quality assurance demands more than mere precision dimensional gauging of finished work and components; regularly monitoring the dimensional-gauging precisions of the machine tools employed in their fabrication is indispensable. Finished products must be machined to within prescribed dimensional tolerances if they are to pass final acceptance checks. Regular monitoring of machine tool dimensional-gauging precisions provides valuable information on the degrees to which work/component dimensional tolerances are being maintained in machining operations.



Fig. 15: KOBA-step installed on a swivel support and base, shown here spanning the major diagonal of the workspace of a vertical milling machine equipped with a dimensional-gauging head.



Fig. 16: KOBA-step, shown here horizontally aligned along the X-axis of the rotary bed of a machine tool equipped with a dimensional-gauging head.



Fig. 17: KOBA-step, shown here aligned vertically for checking the Z-axis of a machine tool equipped with a dimensional-gauging head.



Fig. 18: KOBA-step, shown here installed on a flexible machining center for verifying its positioning accuracy (the center's dimensional-gauging head is integrated into its tool chuck).

A complete monitoring system: KOBAS-step precision step gauge + GUK-S analysis software

Complete systems for monitoring dimensional-gauging precisions, consisting of the KOBAS-step step-gauge plus the GUK-S software package, provide facilities for verifying and documenting dimensional-gauging precisions of co-ordinate measuring machines, as well as for detecting drifts in these precisions, both in conjunction with formal equipment acceptance procedures, and with routine equipment performance monitoring. The GUK-S software package provides documentary proof of compliance with proper dimensional-gauging equipment monitoring procedures, as specified under ISO 9000pp thereby establishing a basis for centralized acquisition of dimensional-gauging-precision verification data, as well as for conducting comparisons of the precisions of items of dimensional-gauging equipment from various manufacturers.

Users receive fully documented statements as to whether components checked in preceding verification periods have been correctly gauged, along with projections as to whether components will be correctly gauged over subsequent verification periods. Users are thus able to reliably establish that manufacturing quality control statistics have not been falsified by defective dimensional-gauging equipment, and may optimize their fabrication precisions by feeding back the results of dimensional gauging verification runs into their fabrication operations.

What is GUK? – What does GUK offer?

GUK is a registered trade mark of iti GmbH for programmes to monitor accuracy of CMMs using the test standards step gauge or sphere plate, which match the measuring volume of CMM with regard to accuracy and dimension.

The formal verification according to VDI/VDE 2617, Sheet 2.1, that a CMM (tested randomly overall or during test with inadequately small test standards also only in a selected partial area at few positions) is adjusted in such a way that it complies with the specifications of the manufacturer under ideal measuring and ambient conditions is not sufficient for us!

The content of this type of test is mainly based on the acceptance verification and at the most is suitable only for verification of orderly execution of installation and service tasks on the machine.

GUK offers the conscientious user (without extra effort during measurement) along with standard evaluation according to VDI/VDE 2617, Sheet 2.1, a comprehensive analysis of monitored measurements, for e.g. by evaluation of all measuring point combinations or by mentioning "position deviation" based on the position of the measuring surface touched first. This is done in order to make a safe statement about:

- which length measurement uncertainty
- under present real measuring and ambient conditions
- independent of the position of the measuring location in measuring volume of the measuring machine

is actually achieved. This is precisely the information which the user requires to avoid recourse on account of inaccurate measurements.

Additionally GUK offers (as long as not already done in individual cases during measurement) the selective elimination of temperature effects so that it can be detected to what extent do the deviations come from non-ideal temperature relations or from deviations of the measuring machine itself. With that it is clear, whether, if necessary, a decisive improvement can be made

- by an adjustment on behalf of the manufacturer or
- by improvement of local measuring and ambient conditions.

This reliable information serves as a basis for deciding the introduction of efficient measures of improvement for costconscious users.

Naturally, the decisive evaluation algorithms of GUK-system are tested and certified by the Physikalisch-Technische Bundesanstalt in Braunschweig (PTB) to the extent required by the users.

Dimensional-gauging-precision verification and monitoring using the GUK-S software package

Procedures for verifying dimensional-gauging precisions of items of equipment with the KOBAS-step step gauge (Fig. 19) involve using the equipment's own profiling/gauging software to run a conventional CNC-routine specifically prepared for this purpose. No special operator knowledge or training is required to perform these procedures. Results of verification runs are saved to data-transfer files as they are acquired. Once verification runs have been concluded, the GUK-S software package takes over the results and compares the dimensional-gauging precisions determined to the limiting tolerances specified by the equipment's manufacturer and documents any departures from these specifications in the form of equipment dimensional-gauging-precision protocols and dimensional gauging-error plots. The programme system GUK-S runs under MS-Windows as well as on the computer of the CMM or any external PC, to which measuring values from the CMM can be transferred either online, on a diskette or via network. It is the advantage of using an external PC that several different CMM in a plant can be managed at one place.

Dimensional-gauging-precision monitoring protocols

The protocol (Fig. 20) output upon conclusion of dimensional-gauging precision verification runs include all of the data needed for generating and analyzing historical records of dimensional-gauging precision verification runs. Automatic comparisons of nominal dimensions measured using KOBAS-step step gauges with accurate dimensional data taken from their calibration certificates are employed in computing dimensional-gauging errors for output to a printer. The message „CMM ok“ will be output if all dimensional-gauging errors fall within prescribed tolerance bands.

Protocols may then be signed by the verifying operator and inserted into the checked item of equipment's file.

Conducting analyses of equipment dimensional-gauging performance using dimensional-gauging-error plots in compliance with VDI/VDE 2617, Sheet 2.1

Operators may view dimensional-gauging-error plots (Fig. 21) for both current and immediately preceding verification runs on-screen, or may output them to a printer. The protocol states how often measurement deviations are outside of the given tolerance bands.

Comprehensive evaluation of all combinations of measuring points

As an alternative to the evaluation according to VDI/VDE 2617, Sheet 2.1, all combinations of measurement points (e.g. 4950 combinations for 50 measured lengths only resp. 100 measurement points) can be evaluated. With this, a reliable statement can be made with regard to the length uncertainty of the CMM for plenty of lengths at any possible locations within the measuring range.

Deviations from position

In addition, the deviation from position from every measurement point in respect to the first measurement point can be displayed. This helps in detecting the reasons for striking deviations in measurement.

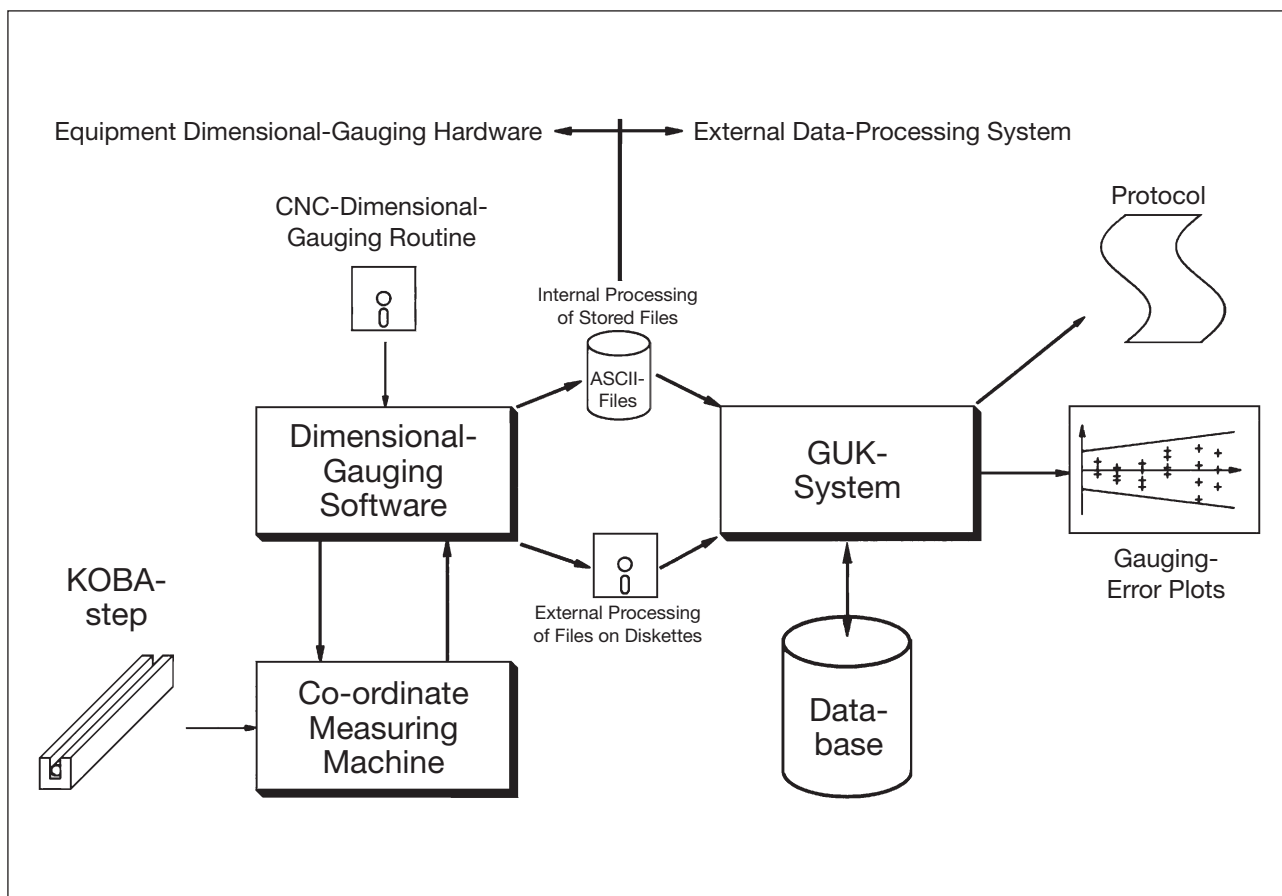


Figure 19: Block schematic of the interfacing of the GUK-S dimensional-gauging-precision monitoring system to a co-ordinate measuring machine.

Protocol for
Monitoring the accuracy of a CMM by step gauge
of 01.04.2004 by iti GmbH ©iti GmbH, Barsbüttel

Instrument: CMM #1 : Mustergerät
Identification No. : iti-Test
Location of CMM : Meßraum iti
Year of Manufacture : 2002
Max. range of measurement : 800 mm
Permiss. dev. of length
-constant term : 1,50 µm
-term proport. to dist. : 3,00 µm/1000 mm Length
-up to a maximum of : 4,00 µm
Therm. exp. coeff. scale : 7,80 µm/m K

References: Ring Gauge
-Identification No. : iti 10123
-calibrated Diameter : 30,00140 mm
-Therm. expans. coeff. : 11,5 µm/m K
Sphere
-Identification No. : iti 10123
-calibrated Diameter : 29,99670 mm
-Therm. expans. coeff. : 5,5 µm/m K
Step Gauge #4
-Type : Koba-Step 1020
-Identification No. : 031103/43K
-Year of Manufacture : 2003
-Max Test Range : 1020mm
-Calibration Date : 07.11.2003
-No. of calib. Certif. : 0562 DKD-K-05307 03-11
-Therm. expans. coeff. : 11,50 µm/m K

Inspection #5: Date / Time : 01.04.2004 / 11:17
Auditor : H.-H. Plath
Probe diameter : 4,9987 mm
Azimuth : 50°
Elevation : 35°
Temperature of CMM
-when measuring ring : 20,2 °C
-when measuring sphere : 20,2 °C
-when meas. step gauge : 20,3 °C
Temperat. of ring gauge : 20,3 °C
Temperat. of sphere : 20,3 °C
Temperat. of step gauge : 20,4 °C
Compensat. of temperatur. : Automatically by CMM
Option of evaluation : VDI/VDE 2617 - ISO 10360

Test scope: Ring Measurement : Executed, see page 2
Sphere Measurement : Executed, see page 2
Step gauge measurement : Executed, see page 2
and annex if any

.....
(Date) (Seal / Signatures of Auditor)

Fig. 20: Dimensional-gauging-precision monitoring protocols (example).

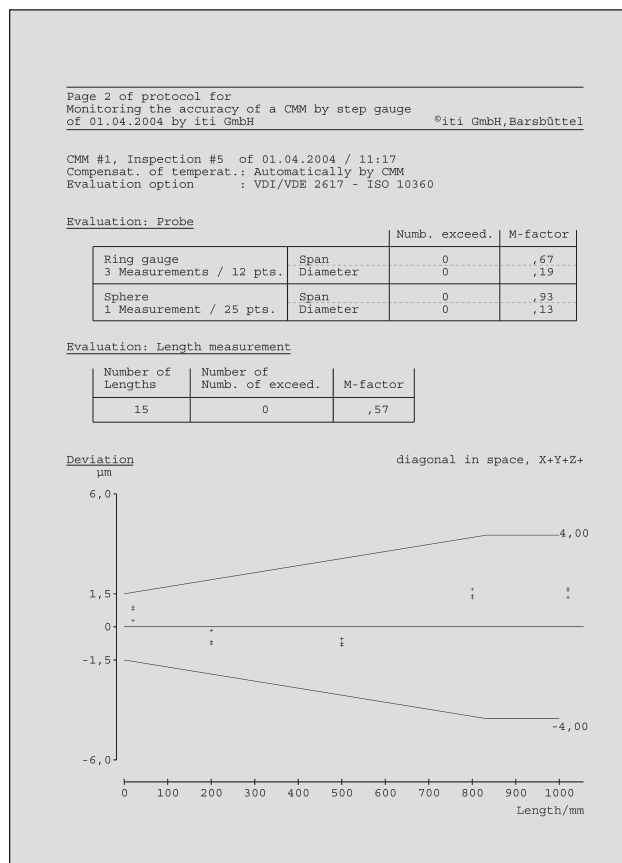


Fig. 21: Length measurement uncertainty protocol.

CMM #1, Inspection #5 of 01.04.2004 / 11:17
Compensat. of temperat.: Automatically by CMM
Evaluation option : All combinat. of meas.pts.

Evaluation: Probe

		Numb. exceed.	M-factor
Ring gauge	Span	0	,67
3 Measurements / 12 pts.	Diameter	0	,19
Sphere	Span	0	,93
1 Measurement / 25 pts.	Diameter	0	,13

Evaluation: Length measurement

Number of Lengths	Number of Numb. of exceed.	M-factor
435	0	,97

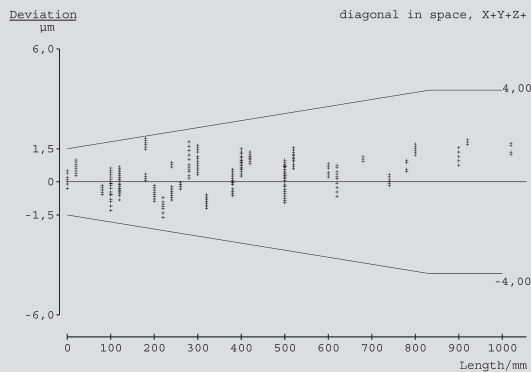


Fig. 22: Evaluation of all combinations of measuring points, independent from where measurement was made in the volume.

The GUK-S software package was developed by:

iti Ingenieurbüro für Technik und Informatik GmbH
Ellerhoop 6
D-22885 Barsbüttel
Germany
Tel.: +49 (40) 67 08 10 46 · Fax: +49 (40) 67 08 10 47
e-mail: iti-gmbh@t-online.de

We will be pleased to answer any questions you may have, or to provide any further information you may require.

Standard nominal lengths

nominal length mm	number of gauge faces	overall length	weight kg
420	22	480	6.5
620	32	680	9.5
1020	52	1080	15.0
1540	78	1600	23.0
2020	102	2080	30.0

The nominal length of a step gauge is the distance from the first gauge face to the last gauge face.
Special sizes on enquiry, at present available with length up to 2500 mm.

Following characteristics identical for all lengths listed:

Cross-section of holder:
55 x 55 mm

Cross-section of cylindrical gauge blocks:
10 mm diameter

Length of castellations:
20 mm

Space between castellations:
20 mm

Contents of sets

Set N° 5/420

Contents: 1 off Step gauge, nominal length 420 mm	}	housed in storage box
2 off fixing clamps		housed in storage box
1 off swivel support for 420 mm		housed in storage box
1 off Base size 1		housed in storage box

Set N° 5/620

Contents: 1 off Step gauge, nominal length 620 mm	}	housed in storage box
2 off fixing clamps		housed in storage box
1 off swivel support for 620 mm		housed in storage box
1 off Base size 1		housed in storage box

Set N° 5/1020

Contents: 1 off Step gauge, nominal length 1020 mm	}	housed in storage box
2 off fixing clamps		housed in storage box
1 off swivel support for 1020 mm		housed in storage box
1 off Base size 1		housed in storage box

Set N° 5/1540

Contents: 1 off Step gauge, nominal length 1540 mm	}	housed in storage box
2 off fixing clamps		
1 off swivel support for 1540 mm		
1 off Base size 2		with 2 transport cases

Set N° 5/2020

Contents: 1 off Step gauge, nominal length 2020 mm	}	housed in storage box
2 off fixing clamps		
1 off swivel support for 2020 mm		
1 off Base size 2		with 2 transport cases

The step gauge Koba-step can be aligned with all requested orientations – horizontally, vertically, diagonally and obliquely. With the swivel support angles can

be set from -45° to $+45^\circ$ in steps of 5° . The base may be used as a holder for the swivel support as well as for the vertical alignment of the Koba-step.

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

Kalibrierschein
Calibration certificate

1020 mm step gauge

Gegenstand:
Object:

Hersteller:
Manufacturer:

Typ:
Type:

Kennnummer:
Serial number:

Auftraggeber:
Applicant:

Anzahl der Seiten:
Number of pages:

Geschäftszeichen:
Reference No.:

Kalibrierzeichen:
Calibration mark:

Datum der Kalibrierung:
Date of calibration:

Im Auftrag:
By order:

Koib & Baumann GmbH & Co. KG
Daimlerstraße 24
D-63741 Aschaffenburg

KOBA-step

9907 S21

PTB

Indian Institute of Technology
Marg Sactor III
Delhi 110 045

Physikalisch-Technische Bundesanstalt

Seite 2 zum Kalibrierschein vom 2000-07-19, Kalibrierzeichen: 4857 PTB 00
Page 2 of calibration certificate of 2000-07-19, calibration mark: 4857 PTB 00
* in case of dispute, only the original German text shall be valid.

The center-to-center distances between the measuring faces and the measuring face 0 were measured. During the measurements, the step gauge was supported in the marked points B₁ and B₂. The step gauge was aligned to the flanks and the base of the ground groove in which the cylinders of the step gauge are positioned. Alignment was carried out only at the ends of the step gauge. The spacing between the measuring line and the flanks was 4,8 mm and

PTB

Physikalisch-Technische Bundesanstalt

Seite 3 zum Kalibrierschein vom 2000-07-19, Kalibrierzeichen: 4857 PTB 00
Page 3 of calibration certificate of 2000-07-19, calibration mark: 4857 PTB 00
* in case of dispute, only the original German text shall be valid.

Stufenendmass - KOBA-step 9907 S21 - distances between the measuring faces

Measuring face	Distances to the measuring face 0	Measuring face	Distances to the measuring face 0
0	0,0000	1	19,9997
2	39,8687	3	59,8691
4	79,9335	5	99,9342
6	119,9179	7	139,9188
8	159,8919	9	179,8927
10	199,9824	11	219,9834
12	239,9857	13	259,9864
14	279,9346	15	299,9355
16	319,9411	17	339,9420
18	359,9149	19	379,9158
20	399,9113	21	419,9123
22	439,8632	23	459,8640
24	479,8743	25	499,8755
26	519,8413	27	539,8419
28	559,9513	29	579,9518
30	599,9730	31	619,9737
32	639,8662	33	659,8666
34	680,0008	35	700,0021
36	719,8326	37	739,8339
38	759,8925	39	779,8940
40	799,9300	41	819,9315
42	839,8752	43	859,8765
44	880,0224	45	900,0237
46	919,9112	47	939,9121
48	959,9656	49	979,9661
50	999,9274	51	1019,9285

Distances are given in the table (Page 3).

reference temperature 20 °C (ITS-90)

ing the calibration work. To reduce

near expansion coefficient $\alpha_t =$

specimen temperature during the

temperature measurement : 0,03

s to (L is the distance between

L

obtained by multiplying the

It has been determined in

certainty in Measurement"

lies within the assigned

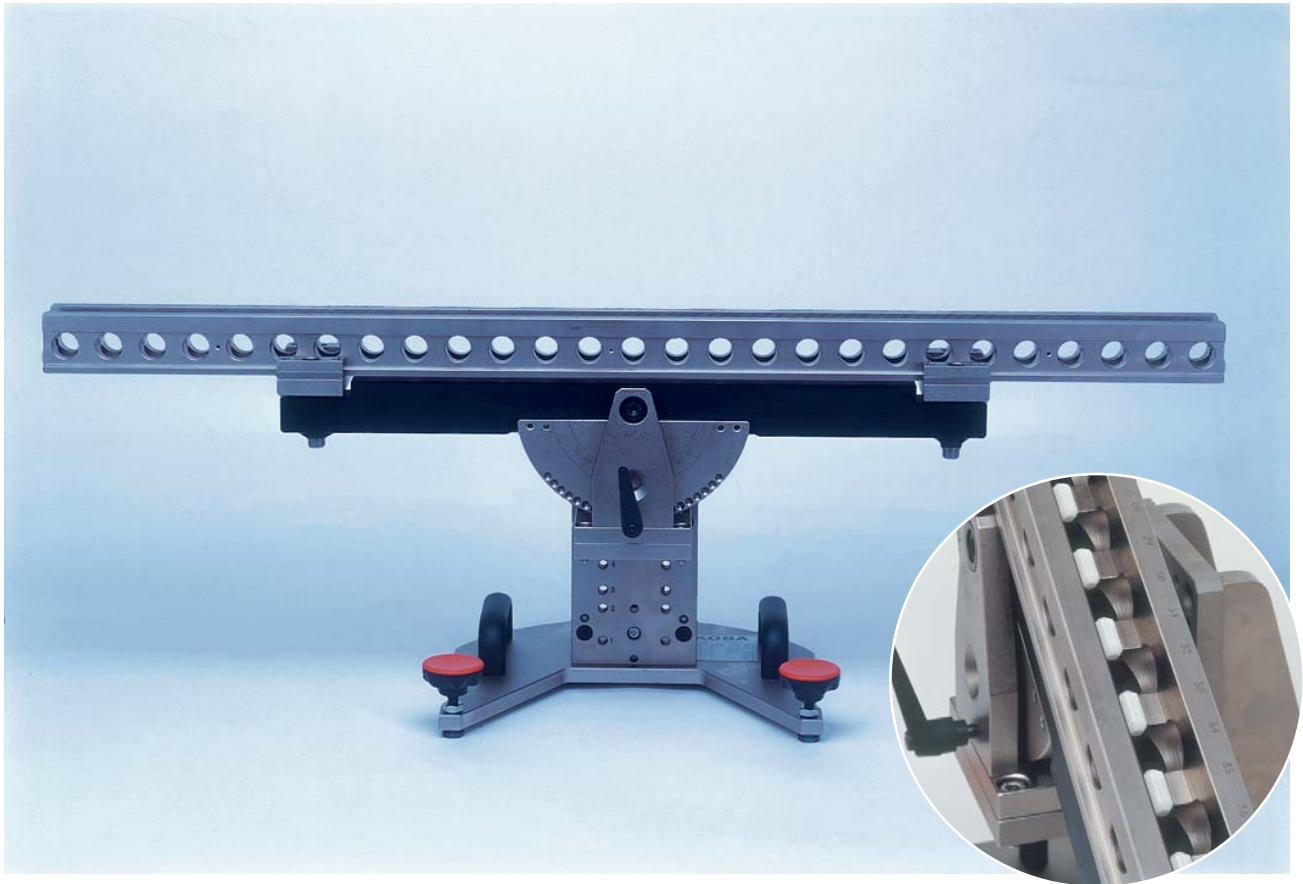
%.

d to the specimen.

PTB

Ideal

Standard design with gauge faces of ceramic



Advantages :

- corrosion resistant
- Stable in size
- less cleaning
- coefficient of expansion similar to steel (zirkonia)
- wear resistance similar to carbide
- less extra charges

Existing step gauges with cylindrical steel gauge blocks can be exchanged against ceramic. However, a re-calibration is necessary then.

KOBA-step *mini*

System for the calibration and monitoring of multi-sensor measuring instruments and coordinate measuring instruments of small measuring volume

Special features

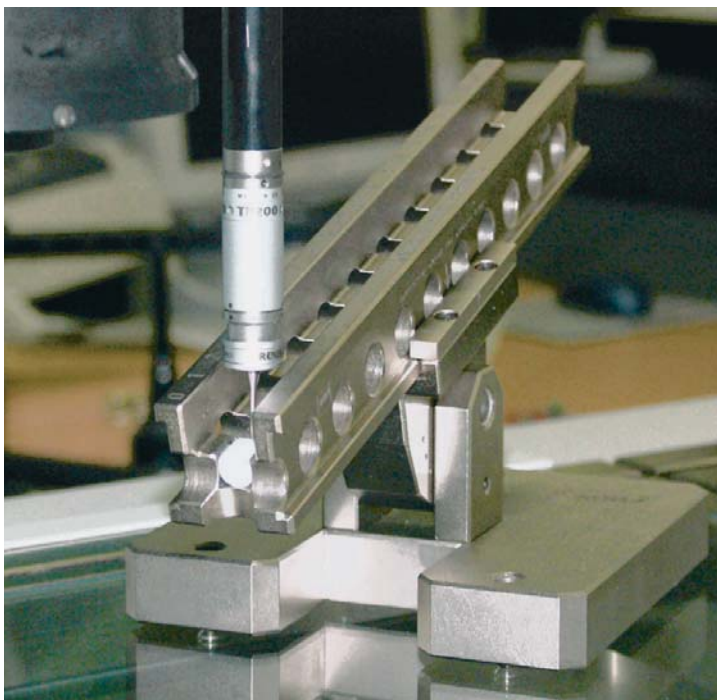
The KOBA-step *mini* is a step gauge of the "KOBA-step" type but with harmoniously reduced cross-section and resized gauge block distance according to the measuring length and measuring task. The methodical advantages such as embedding of the cylindrical gauge blocks in the neutral fibre of the carrying body and the good access from three sides have been maintained. The length and distances of the gauge blocks were reduced to 10 mm

according to the total lengths which allow to recognize local errors of the measuring instrument.

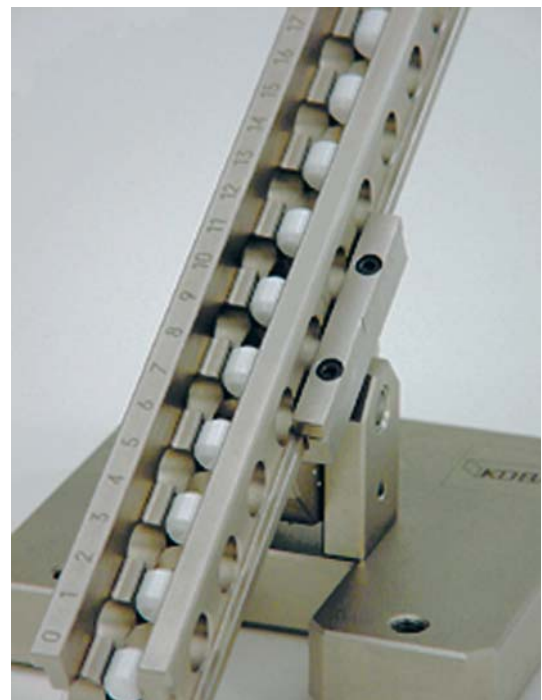
The cylindrical gauge blocks are made of zirconia ceramic thus free of corrosion and wear.

The system is completed by the swivel support included in the delivery and by which the KOBA-step *mini* can be mounted horizontally, vertically or in the volume.

The traceability to the National Length Standard is guaranteed by works calibration or through DKD or PTB.



KOBA-step *mini* on the measuring instrument positioned in the volume



Ceramic gauge blocks on the neutral fibre

Scope of supply:

KOBA-step *mini* with probing elements in zirconia ceramic, base and swivel mechanism for positioning from 0° to 90° (horizontally or vertically) as well as aluminium storage case

Standard lengths

Nominal length mm	Number of castellations/ probing faces	Division mm	Overall length mm
210	11/22	10	220
310	16/32	10	320

A brief review of the **KOBA-step** step gauge

For the first time, this gauge block combines the advantages which step gauges offer the user with the ability to meet the stringent metrological demands which a precision measurement standard has to meet:

- ▶ Available with various standard nominal lengths (210, 310, 420, 620, 1020, 1540 and 2020 mm) with even steps (castellation/gap = 10/10 mm, from 420 mm = 20/20 mm), also with different standard lengths and uneven steps (however, castellation = 10 mm, from 420 mm = 20 mm) for an optimal adjustment to the measurement task.
 - ▶ Stainless finish guaranteed by special surface treatment.
 - ▶ The gauge faces used are the specially machined end faces of cylindrical gauge blocks which are inset solidly into position in a groove by a special process.
 - ▶ Gauge faces lapped for correct sensing.
 - ▶ Gauge faces of ceramic to prevent wear.
 - ▶ Carrying body specially aged for longterm stability.
 - ▶ Solid connection between the cylindrical gauge blocks with gauge faces and the carrying body.
 - ▶ Cylindrical gauge blocks deeply inset to protect them against damage, length 20 mm.
 - ▶ Gauge faces conically reduced to 5 mm diameter, hence easy to clean.
 - ▶ The centres of the gauge faces are located on the fibre of the carrying body which is neutral in bending. As a result changes in bending stress due to different horizontal or inclined or vertical orientations have an effect on the distances between the gauge faces which is so small that it can be ignored completely.
- ▶ Because of the configuration adopted, the bending characteristics in the two principal planes are identical, and it is therefore equally possible for the gauge block to be orientated with the groove facing upwards (e.g. for vertical quills) or to one side (e.g. for horizontal quills) or downwards (e.g. for underfloor measuring machines with vertical quills operating from below). The measurements to determine the position of the carrying body in space can be carried out on the precision-machined rectangular groove.
 - ▶ The longitudinal grooves in the side faces allow a wide variety of orientations and mounting methods on the table of the machine.
 - ▶ The material of the carrying body determines its expansion characteristics ($\alpha = 11,5 \cdot 10^{-6}/^{\circ}\text{C}$).
 - ▶ The accuracy required is of a standard not achieved hitherto and is ensured by the use of a special laser interferometer comparator which gives the precise position of each gauge face. The numerical value (Actual value according to the Calibration chart) representing the position is not generally a whole-number decimal and qualifies immediately to direct the co-ordinate measuring machine and resp. for the evaluation of the length measurement uncertainty.
 - ▶ Additional reliability in everyday use because the length of each individual cylindrical gauge block is known and does not vary and must be re-measured accurately by the co-ordinate measuring machine itself with the step gauge in any position and orientation.
 - ▶ Cross drills between the castellations for easy sensing of the measuring faces.

References:

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- [3] VDI-Bericht 529: Koordinaten-Meßtechnik,
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von Prüfkörpern und Koordinaten-Meßgeräten
anhand von Streckenmessungen,
Rechteck- und Quader-Kennwerten
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Heft 10/1985, Seite 353–366
- [6] M. Weck – Werkzeugmaschinen Band 4,
Meßtechnische Untersuchung und Beurteilung
VDI-Verlag Düsseldorf



**Excerpt
from our delivery
programme
and services:**

Gauge Blocks
of steel, carbide and ceramic

Accessories

Sphere Plate KOBA-check

Ball Bar

Ball Cube

KOBA-Optima

Thread Gauges

Plug Gauges

Snap Gauges

Taper Gauges

Ring Gauges

Feeler Gauges

Angle Gauge Blocks

Spline Gauges

Precision Parts

DKD-German Calibration Service

KOBA-Inspection Service



Your Contact Persons at KOBA

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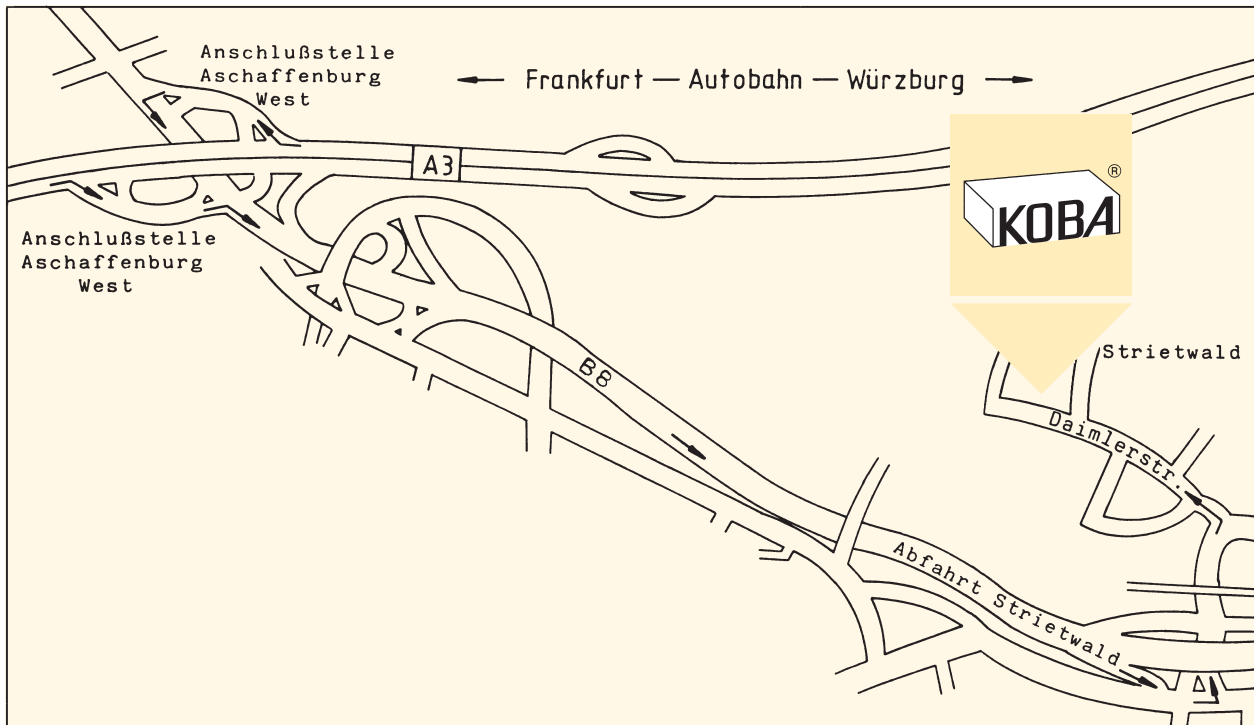


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How to find our factory



KOLB & BAUMANN GMBH & CO. KG
PRECISION MEASURING TOOLS MAKERS
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GERMANY

PHONE +49 (6021) 34 63-0 · FAX +49 (6021) 34 63-40
Internet <http://www.koba.de> · e-mail: messzeuge@koba.de





Made in Germany

Optical scale **KOBA-optima II**

System for traceability
and monitoring of
photogrammetry and
theodolite systems



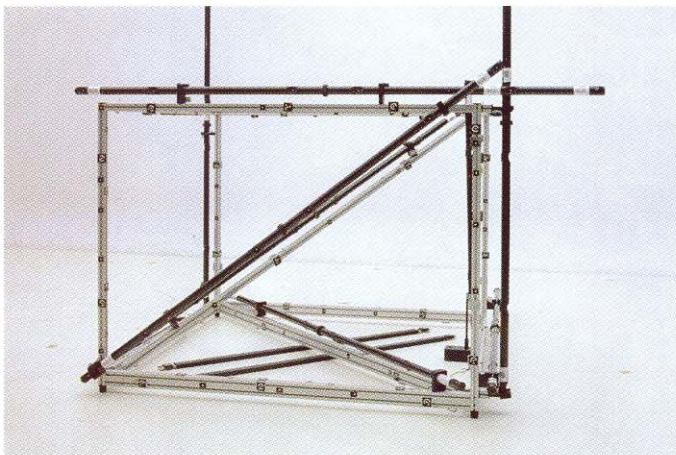
DELIVERY PROGRAMME AND SERVICE:

- Gauge blocks
- Gauge block accessories
- Step gauge KOBA-step
- Sphere plate KOBA-check
- Ball Bar
- Thread gauges
- Cylindrical gauges
- Flat gauges
- Precision parts
- Spline gauges
- KOBA-calibration service
- DKD-calibration laboratory

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PRECISION MEASURING TOOLS MAKERS
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FEDERAL REPUBLIC OF GERMANY
PHONE +49 (60 21) 34 63-0 · FAX +49 (60 21) 34 63-40
Internet <http://www.koba.de> · e-mail: messzeuge@koba.de

Properties:

- high short and long term stability
- thermal coefficient of expansion close to zero
- simplest handling
- low weight
- conforms to VDI/VDE 2634
- standard that can be calibrated to DKD



Range of applications:

- traceability of measurements done with photogrammetry or theodolite systems
- calibration of photogrammetry or theodolite systems

Features:

- stable two-part scale body out of CFC-tube which is non-sensitive to humidity, screw joint with best reproduction
- six CFC-target holder with 130° opening
- high precision targets out of glass with chromium layer designed as blind with Ø 10 mm and concentrically positioned rings of 1.25 mm internal diameter and 0.25 mm hairline.
- 15 individual measuring distances (up to 2588 mm length) on a single scale
- highest rigidity at low weight by using high-module carbon fibre
- flexible fastening clips for universal arrangement of the scales in the measuring volume





**Prüf-
mittel-
überwachung**

Qualitäts

**Ihr Partner
bei der
sicherung**

DIN/ISO 9000ff

**DKD-Kalibrierlabor
K-01301**

**KOBA-
Kalibrier-Service**





Kalibrier-Service für Parallelendmaße aus Stahl, Hartmetall und Keramik

– rückgeführt gemäß DIN/ISO 9000 bis 9004 auf nationale Normale über unser eigenes DKD-Prüflabor.

DKD-K-01301

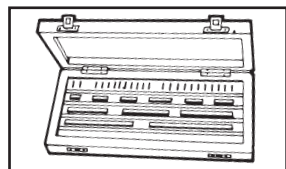
Alles aus einer Hand. Schnell, kompetent, direkt vom Hersteller.

Eine Konsequenz, die der europäische Binnenmarkt mit sich bringt, sind einheitliche Normen und Richtlinien für den QS-Bereich. Mehr und mehr Unternehmen, auch Zulieferbetriebe, werden so an die EN 29000 (DIN/ISO 9000 bis 9004) gebunden. Parallelendmaße sind in diesem Zusammenhang ein wichtiges Glied in der Kette der Rückführbarkeit auf nationale Normale der Längenmesstechnik. Ihre laufende Überwachung und die Kenntnis des Istzustandes sind unabdingbare Voraussetzungen zur Erfüllung der Forderungen nach DIN/ISO 9000 bis 9004.

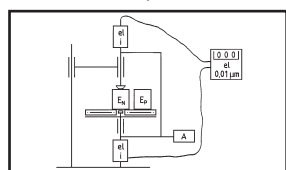
Hierbei hilft Ihnen der Koba-Kalibrier-Service.

Da die einzelnen Parallelendmaße – je nach Gebrauchshäufigkeit und Verwendungszweck – ungleichmäßig stark verschleissen, lässt sich ein einheitlicher Überprüfungszeitraum nicht festlegen. **In der Praxis hat sich jedoch der jährliche Zyklus bewährt.**

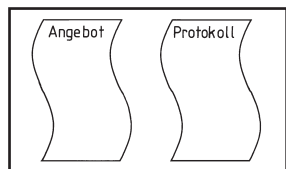
Überprüfungsablauf



Sie senden uns Ihren Endmaßsatz zur Kalibrierung ein.



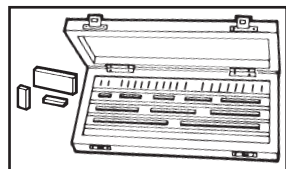
Wir reinigen, entmagnetisieren, glätten die Messflächen und messen die Parallelendmaße gegen DKD-kalibrierte Normale nach der 5-Punkte-Vergleichsmessung.



Wir senden Ihnen den Werks-Kalibrierschein mit den festgestellten Ergebnissen, sowie ein Angebot über den preis-günstigsten Austausch verschlissener Parallelendmaße.



Sie entscheiden, in welchem Genauigkeitsgrad ergänzt werden soll.



Den überprüften und teilweise ergänzten Endmaßsatz senden wir Ihnen zurück. Ein neuer Werks-Kalibrierschein mit den Abmaßen auch der Austauschendmaße wird beigelegt; sowie die abgenutzten Endmaße für untergeordnete Anwendung.

Vorteile

- Ein Genauigkeitsgrad im Satz
- Geringst mögliche Austauschquote
- Geringe Kosten
- Sicherheit für Ihre Qualitätssicherung

Achten Sie beim Einkauf von Parallelendmaßen auf den Kalibrier-Service, denn ohne ihn können billige Parallelendmaße sehr teuer werden.

KOBA-Kalibrier-Service

Kalibrierlaboratorium für die Messgröße Länge

KOBA-Calibration-Service / Service de Contrôle KOBA



Seite 2 zum Kalibrierschein Nr. 12345 vom 28.02.02

Normmaß	Abweichung des Mittenmaßes vom Normmaß	Abweichung vom Mittenmaß	Tol. Kl.	Ident. Nr.	Bem.
---------	--	--------------------------	----------	------------	------

mm

0.50
1.0
1.0005
1.001
1.002
1.003
1.004
1.005
1.006
1.007
1.008
1.009
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1.27
1.28
1.29
1.30
1.31
1.32

KOBA-Kalibrier-Service

Kalibrierlaboratorium für die Messgröße Länge

KOBA-Calibration-Service / Service de Contrôle KOBA



Kalibrierschein Nr.: 12345

Auftraggeber: Mustermann GmbH
Teststraße 1
98765 Musterdorf

Kunden-Nr.: 67890

Auftrag-Nr.: 121212

Satz-Nr.: B03962/330

Kalibriergegenstand: Parallelendmaßsatz aus Stahl,
122-tlg., Tol.Kl. 1

Maßangabe: 0.50 - 100 mm

Hersteller: KOBA

Ident.-Nr.: 86086

Prüfverfahren: Ermittlung der Abweichung des Mittenmaßes vom Normmaß und der Abweichungen vom Mittenmaß durch Vergleichsmessung gemäß DIN EN ISO 3650.

Normale, Anschluß: TESA UPC, Geräte-Nr.: 4561;
Parallelendmaßsatz, Ident.-Nr. 86000
Rückgeführt über DKD-Kalibrierung
1481 DKD-K-01301 12-99

Meßunsicherheit: $U = 0,1 \mu\text{m} + 1 \times 10^{-6} \times L$; mit $k = 2$

Prüfentscheid: Die Prüflinge entsprechen den auf den
Folgeseiten ausgewiesenen
Toleranzklassen

Anzahl der Seiten: 4

Aschaffenburg, den 28.02.02

Prüfer: Endemann



Kalibrierverfahren:

1. Reinigung und Entmagnetisierung der zu überprüfenden Parallelendmaße.
2. Entfernen von Aufwürfen an Messflächen und Kanten. Glätten der Messflächen.
3. Überprüfung der Parallelendmaße mittels Unterschiedsmessung gegen DKD-kalibrierte Parallelendmaße (5-Punkte-Messung).
4. Erstellen eines Koba-Werks-Kalibrierscheins, d. h. Protokollieren der Messergebnisse.

Die Messergebnisse können – je nach Wunsch – detailliert angegeben werden. Es stehen Ihnen hierbei vier Prüfbericht-Varianten zur Auswahl:

- P2: Genauigkeitsgrade und Dokumentation der Mittenmaßabweichung (siehe Abb. oben).
- P3: Genauigkeitsgrade, Mittenmaßabweichung (wie P2) sowie Abweichungsspanne f_0 und f_u .
- P4: Genauigkeitsgrade, Mittenmaßabweichung (wie P2), Abweichungsspanne (wie P3) sowie Anschlag beider Messflächen an Planglas zum Nachweis der Anschlagbarkeit. Zugelassen und als noch gut beurteilt werden Anschläge mit blauen Flecken.

Gemäß Ihrer Entscheidung erhalten Sie nach Abschluss der Überprüfungsarbeiten unseren Koba-Werks-Kalibrierschein zusammen mit einem Angebot über den Austausch unbrauchbarer Parallelendmaße gegen neue.



Kalibrier-Service für Lehren und Messgeräte

Die in der Industrie an die Qualitätssicherung gestellten Anforderungen sind aus wirtschaftlichen Erwägungen, durch gesetzliche Vorschriften (z.B. Produzentenhaftung, Maschinenschutzgesetz) und Auflagen der Auftraggeber (z.B. ISO 9000) ständig gewachsen.

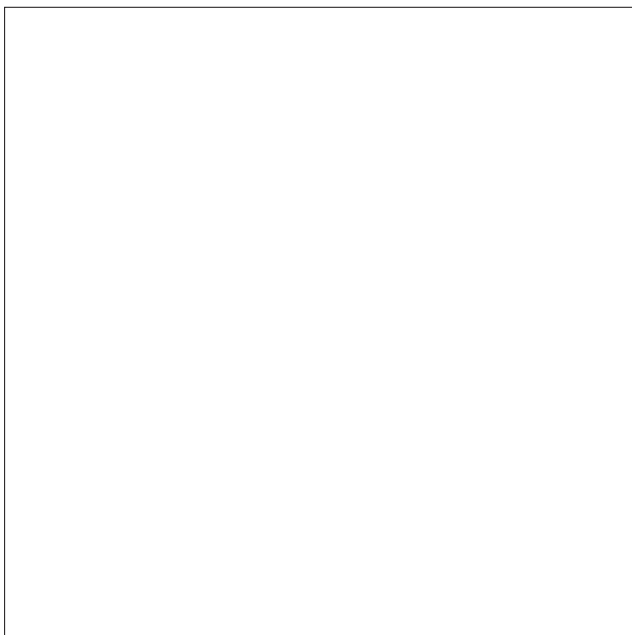
Die geltenden gesetzlichen Bestimmungen und normativen Richtlinien zwingen die Hersteller, Nachweise über alle getroffenen Maßnahmen zur Qualitätssicherung zu erbringen. Hierzu zählt auch die Überwachung der zur Fertigung eingesetzten Prüfmittel. Da Prüfmittel beim Einsatz einem natürlichen Verschleiß unterliegen, ist die Einrichtung eines Überwachungssystems sinnvoll und notwendig.

Um dieser Forderung gerecht zu werden, haben wir den KOBA-Kalibrier-Service eingerichtet. Die zur Prüfung eingesetzten Messgeräte werden regelmäßig mit DKD-kalibrierten Normalen verglichen und gewährleisten deshalb höchste Genauigkeit und garantieren deren Rückführbarkeit.

Wir führen für Sie die Überprüfung folgender Lehren und Messmittel durch:

Gewindelehren	Bügelmessschrauben
Rachenlehren	Messschieber
Lehrdorne	Höhenmessschieber
Lehrringe	Messuhren
Einstellmaße	Feinzeiger
Verzahnungslehren	usw.
Sonderlehren	

Bitte fordern Sie ein Angebot an!



DKD-Endmaßprüfstand

KOBA-Kalibrier-Service

Kalibrierlaboratorium für die Messgröße Länge
KOBA-Calibration-Service / Service de Contrôle KOBA



Kalibrierschein

Nr. : 10000/01/27810

Auftraggeber:

Mustermann GmbH & Co. KG
Postfach 0815
12345 Teststadt

Kunden-Nr.:

Komm.-Nr.:

Kalibriergegenstand:

Maßangabe:

Hersteller:

Prüfverfahren:

Normale, Anschluß:

Meßunsicherheit:

Solimaße / Tol.:

Flankendurchmesser:

Istmaße:

Ebene 3

Ebene 2

Ebene 1

Prüfentscheid:

Aschaffenburg, den 3. Mai 2001

Kobla & Daumann GmbH
Fabrik für Präzisions-Messung
Kalibrierlaboratorium.de

KOBA-Kalibrier-Service

Kalibrierlaboratorium für die Messgröße Länge
KOBA-Calibration-Service / Service de Contrôle KOBA



Kalibrierschein

Nr. : 10000/00/27819

Auftraggeber:

Mustermann GmbH & Co. KG
Postfach 0815
12345 Teststadt

Kunden-Nr.:

10000

Komm.-Nr.:

20000

Kalibriergegenstand:

Kegellehrdorn DIN 2079

Maßangabe:

45

Hersteller:

KOBA

Prüfverfahren:

Ermittlung der Istmaße gemäß VDI/VDE 2618
Bezugstemperatur T=20°C

Normale, Anschluß:

UMM 500 UX - 3D;
Parallelendmaße 65 DKD-K-1301 00-04

Meßunsicherheit:

U 3D = (1.6 + L/300) µm

Messergebnisse:

	Solimaß mm	Toleranz mm	Istmaß mm
Kegel-ø min.	32.400	+0.0035	32.401
Kegel-ø max.	57.150	+0.0035	57.150
Kegellänge	84.858	+0.0120	84.856
Kegelwinkel	16° 35' 40"		16° 35' 45"
Toleranzstufe 2x	0.400	-0.0300	0.391

Prüfentscheid:

Prüfung ist in Ordnung!

Aschaffenburg, den 3. Mai 2001

Prüfer: Hohn

Kobla & Daumann GmbH I & Co. KG
Fabrik für Präzisions-Messung
Kalibrierlaboratorium des Deutschen Kalibrierdienstes - Registrierungsnummer: DKD-K-01301

Dunsterstraße 24
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Telefax (0 60 21) 34 62-40
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<http://www.koba.de>
e-mail: messung@koba.de

Teilansicht Prüflabor



Organisation der Rückführung auf nationale Normale



KOBA-Prüflabor



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Tina Amrhein
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Vertrieb, Leitung Einkauf

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Robert Schuler
Sales, Head of Purchase

Your partner for: procurement of production material, sale of calibration standards for coordinate measuring machines and their calibration

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Robert Schuler
Service commercial, Service des achats

Votre interlocuteur pour :

approvisionnement de matières ; vente d'étalons pour les MMT et de leur étalonnage
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Notizen/Notes:

**Auch das ist KOBA:
This is KOBA as well:**

Parallelendmaße aus Stahl, Hartmetall und Keramik – maßstabil und verschleißfest – weltweit anerkannt

DKD-Kalibrierlaboratorium für Parallelendmaße bis 1000 mm Länge – akkreditiert durch die Physikalisch-Technische Bundesanstalt – PTB

Gauge blocks out of steel, carbide and ceramic – stable in size and wear resistant – world-wide recognition

DKD-Calibration Laboratory for gauge blocks up to a length of 1000 mm – accredited by the Physikalisch-Technische Bundesanstalt – PTB



Kugelplatte KOBA-check als zweidimensionaler Prüfkörper zur laufenden Überwachung von Koordinatenmessgeräten in Verbindung mit der zugehörigen Auswertesoftware.

Sphere plate KOBA-check as a two-dimensional test piece for the permanent monitoring of coordinate measuring instruments together with the relative evaluation software

Überprüfungsnorm KOBA-step zur eindimensionalen Kalibrierung von Koordinatenmessgeräten, Werkzeugmaschinen und Höhenmessgeräten

Inspection standard KOBA-step for one-dimensional calibration of coordinate measuring instruments, machine tools and height gauges

Fragen Sie nach unserem Dienstleistungsangebot zu Ihrem Nutzen

Please ask for our services for your advantage!



Auszug aus unserem Lieferprogramm:

Parallelendmaße
 Endmaßzubehör
 Stufenendmaß Koba-Step patentiert
 Kugelplatte Koba-check
 Kugelstab für KMG mit großem Mes-
 svolumen
 Kugelquader Koba-Q3
 Winkelendmaße
 Flachlehren
 Sinuslineale
 Einstellstücke
 Gewindelehren
 Grenzlehrdorne
 Ringe
 Kegellehren
 Rachenlehren
 Lehren und Vorrichtungen
 Präz.-Messsäulen
 Verzahnungslehren

und unsere Dienstleistungen:

Koba-Kalibrier-Service
 für Parallelendmaße und Lehren
 DKD-Kalibrierungen
 Überwachung von
 Koordinatenmessgeräten

Excerpts from our delivery programme:

Gauge Blocks
 Gauge Block Accessories
 Step Gauge Koba-step, patent
 Sphere Plate Koba-check
 Ball Bar for CMM of large measuring
 volume
 Ball Cube Koba-Q3
 Angle Gauge Blocks
 Feeler Gauges
 Sine Bars
 Master Setting Pieces
 Thread Gauges
 Limit Plug Gauges
 Ring Gauges
 Taper Gauges
 Snap Gauges
 Gauges and Measuring Jigs
 Precision Reference Cylinder
 Spline Gauges

and our services:

Koba-calibration service for gauge
 blocks and gauges
 DKD-calibration
 Monitoring of coordinate measuring
 machines

Extrait de notre gamme de produits :

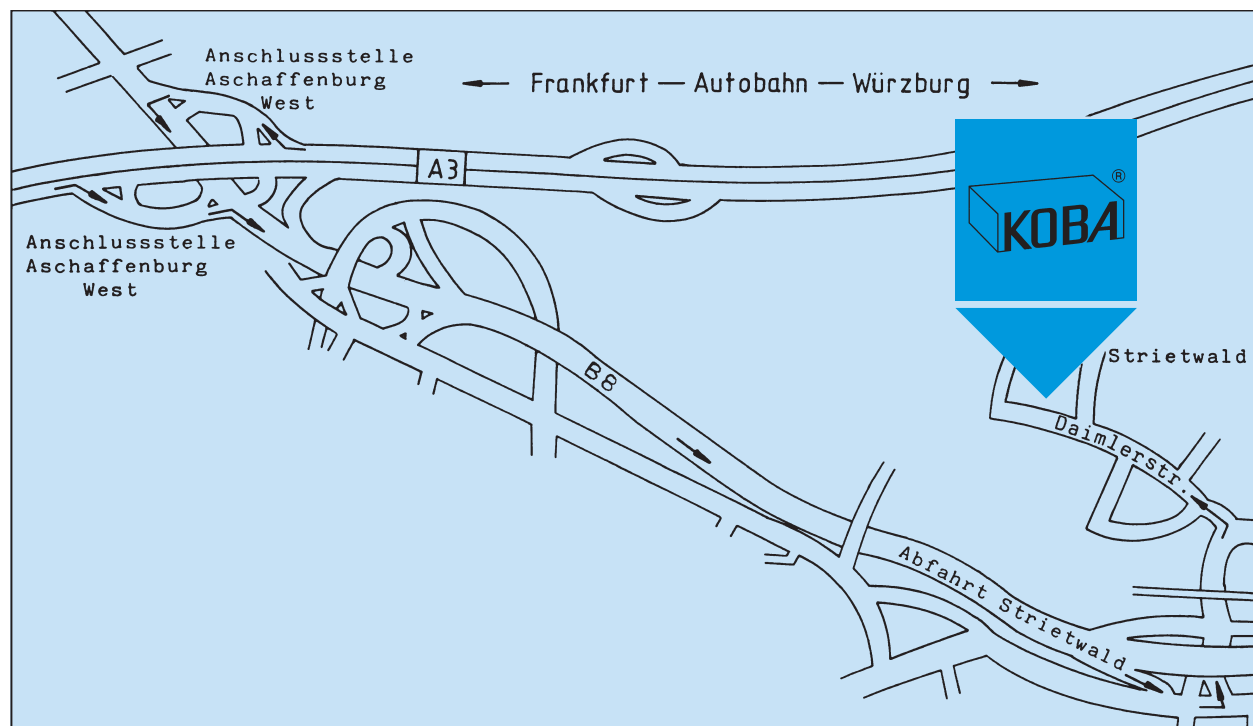
Cales étalons
 Accessoires pour cales étalons
 Cales étalons à gradins brevetées Koba-step
 Plaques à billes Koba-check
 Barres à billes pour appareils de mesures à
 coordonnées pour grands volumes
 Cubes à billes Koba-Q3
 Etalons d'angles
 Jauges plates
 Barres sinus
 Calibres d'ajustage
 Calibres de filetage
 Jauges tampons lisses limites
 Bagues
 Jauges coniques
 Calibres à mâchoires
 Calibres et gabarits
 Cylindres de contrôle
 Calibres à dentures

Nos prestations de services :

Service de Contrôle Koba
 pour cales étalons et calibres
 Etalonnages DKD
 Vérification d'appareils de mesures
 à coordonnées

Es gelten unsere aktuellen Vertrags- und Lieferbedingungen

Wir laden Sie herzlich zu einem Besuch ein:



KOLB & BAUMANN GMBH & CO. KG
PRECISION MEASURING TOOLS MAKERS
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GERMANY

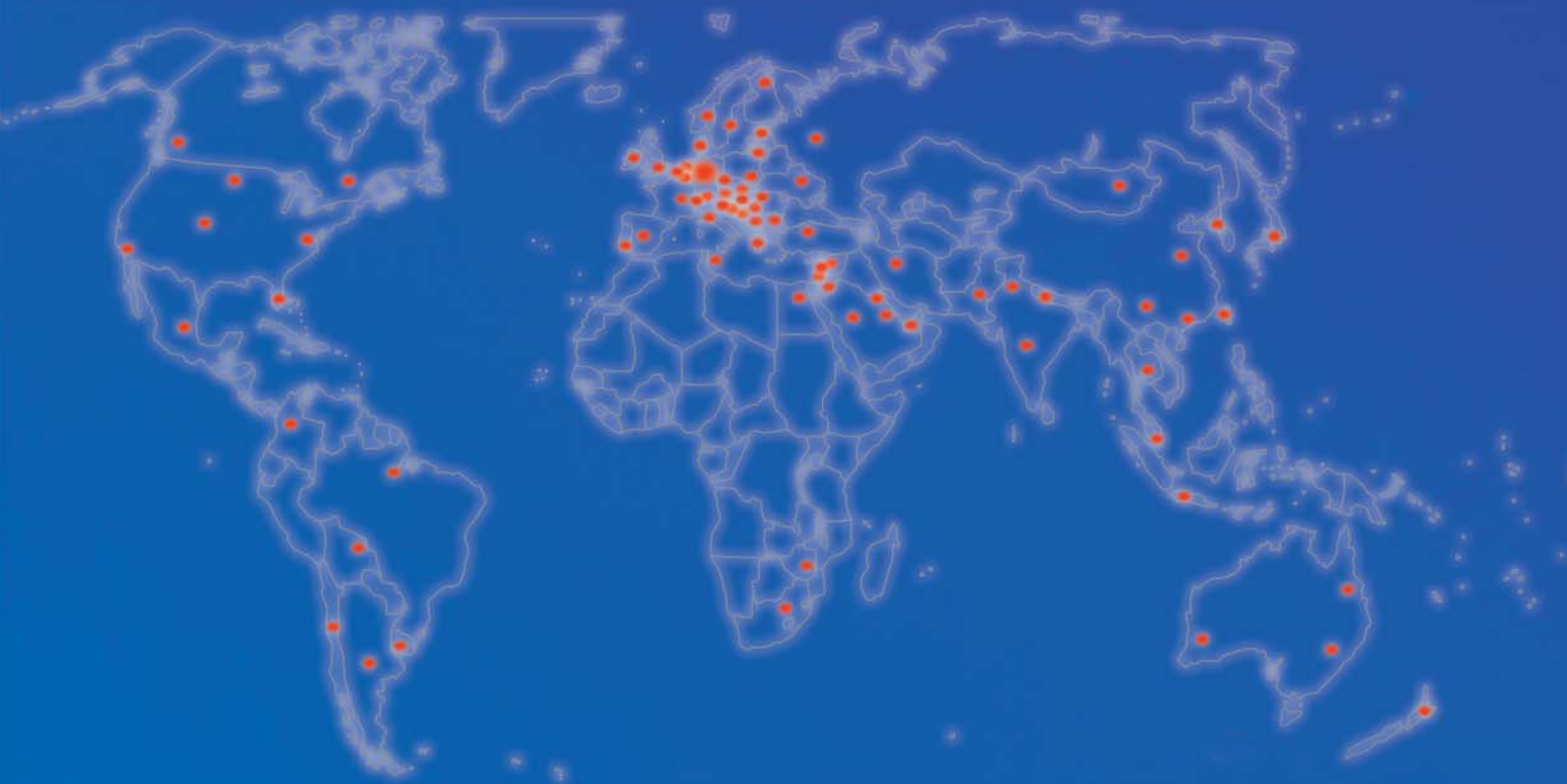
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**Kolb +
Baumann**

High precision products

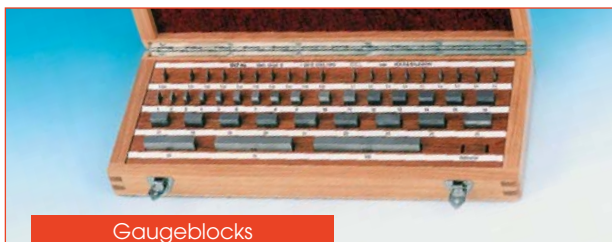


...to every place on earth

**Delivery program
& services**



Gauge blocks and Gauge block accessories



Gaugeblocks

Gauge blocks up to 100 mm

German made gauge blocks out of steel, ceramic or carbide of all sizes and tolerance grades, are available as standard or special sizes, single gauge blocks or sets, standard or customer-specific composition of sets.



Gauge blocks over 100 mm

Gauge blocks between 100 mm and 1000 mm

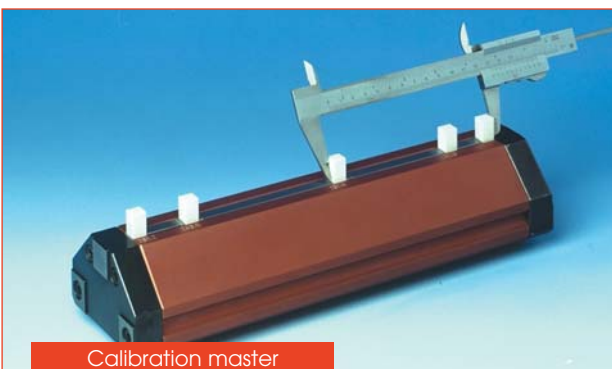
Steel gauge blocks up to 1000 mm are also of our own manufacture. We have supplies in all tolerance grades, made into sets or individual gauge blocks.



Gauge block accessories

Gauge block accessories

Extend the application of gauge blocks into multiple fields. Whether it is used as an internal cylindrical gauge (instead of plug gauge) as a spacing or external gauge (instead of ring gauge) or as a precision marking compass. Using these accessories will keep you flexible in your measuring work.



Calibration master

Calibration master

For the calibration of vernier calipers and marking gauges of nominal sizes up to 300, 500 or 1000 mm. The ceramic gauge blocks are highly wear resistant and make monitoring of these kind of measuring instruments easy.



Clamping stand

Checking of micrometer calipers

Clamping stand for simple and efficient handling of the gauge blocks while checking micrometer calipers. It optimizes the use during monitoring of these measuring instruments.



Ring and plug gauges

Various gauges

Ring gauges

German made ring gauges supplement our delivery program for your benefit. We also offer special sizes and tolerances.



Ring gauge

Feeler gauges

New construction form with gauge members that can be turned around for double lifespan. Go and NotGo ends in steel, carbide or ceramic depending on application and nominal size. Feeler gauges are also available for checking circumferential grooves in bores.



Feeler gauges

Limit snap gauges

Double-ended or Go and NotGo face on a single gap, in steel, carbide or with hard chromed measuring faces.



Snap gauges

Plug-, Ring- and Thread gauges

For checking the limiting sizes of male and female threads with Plug and Ring Gauges. Thread Gauges for fine threads as well as special threads or tapered threads can also be obtained from us.

Plug gauges - like limit plug gauges, rings and measuring pins are available in every requested design. These gauges and measuring pins are available in steel or ceramic.



Various gauges

Spline gauges

Are supplied as Limit plug gauges or Go resp. NotGo ring gauges. Same as setting gauges, master gauges as well as spur or helical gears.



Spline gauges



Precision parts and calibration standards



Precision parts

Precision parts

Are made according to customer's drawings in KOBA's high quality and precision. Tightest tolerances on flatness and parallelism are our strength.



Step gauge KOBA-step

Step gauge KOBA-step

A one-dimensional test body for calibration, monitoring and traceability of coordinate measuring instruments. The test piece fulfills all demands of the ISO 10360 and VDI/VDE guideline 2617 of a calibration standard for the monitoring of CMM's. The step-gauge KOBA-step is successfully in use for years. This is the reason why this calibration standard is recommended by national and international standards for the calibration of coordinate measuring instruments. The evaluation of the calibration data can be done by using the universal GUK-S software.



KOBA-Ball bar

KOBA-Ball bar

Is a one-dimensional test body for monitoring large CMM's. The construction meets the special demands for a test piece of such a size (nominal length up to 8 m). The supporting frame is a carrying body for the real material measure. It is made of rigid CFK/GFK aluminium composite construction that absorbs vibrations. The material measure is realized by a combination of ceramic spheres with a distance rod in between. With this standard artefact we introduce a transportable and dismountable calibration master according to the special demands of large volume column and bridge-type measuring machines. A further field of applications for the ball bar are the new optic-tactile measuring systems such as laser trackers. The evaluation of the calibration data can be done by using the universal GUK-KS software.



Sphere plate

Sphere plate KOBA-check

Represents a two-dimensional material measure for the calibration monitoring and traceability of coordinate measuring machines. The test body fulfills all demands of the ISO 10360 and VDE/VDE guideline 2617 of a calibration standard for the monitoring of CMM's. Reliable statements are possible about accuracies of measurements which can be achieved for the CMM, by applying special evaluation of the measurements. Therefore the sphere plate plays a very important role for the implementation of the "virtual CMM". The evaluation of the calibration data can be done by using the universal GUK-K software.



Calibration standards and calibration service

Ball cube KOBA-Q3

Is a three-dimensional test piece for quick monitoring of coordinate measuring instruments at regular intervals. The test piece is made of high modular carbon fibre and results in a test piece insensitive to temperature and of highest stability in form and size. The test piece is characterized by specially short measuring cycles. The use of the ball cube for monitoring CMM's in production lines avoids long production downtimes. The evaluation of the calibration data can be done by using the universal GUK-Q software.



Kugelquader

Optical scale KOBA-optima

The basic body of the 2700 mm long scale, which can be separated in the center for transport, consists of carbon fibre composite material (CFC). The joining faces are lapped in order to achieve best reproduction. There are six targets in the neutral fibre along the entire length and which can be viewed within a range of 130°. The scale system KOBA-optima is the first artefact for the calibration of optical CMM's and marks the starting point of a new product line. Optical coordinate measuring machines are increasingly used in the field of large measuring volumes and in the detection of free-form surfaces.



KOBA optima

Opto-tactile Calibration Standards

Calibration Standards with diffuse reflecting or highly shining measuring faces. The bases are gauge blocks or measuring spheres in carbide with scratch resistant surface that also allows tactile probing. Also available are classical test pieces like sphere plate with spheres that can be probed optically or tactile. Coordinate measuring instruments with optical or tactile measuring probes can be calibrated with a single standard.



Optisch-taktile Kalibriernormale

German calibration service - DKD

The calibration laboratory N° 01301 has been accredited by the German Calibration Service DKD since 1979. Originally the accreditation only comprised gauge blocks as the most important material measure for the traceability of the unit length. In the course of the years the requirements regarding the calibration of material measures have been substantially extended especially due to quality standards ISO 9000, QS 9000 and VDA 6.



German calibration service



Kolb & Baumann Precision of the fourth generation

1941 - foundation of the company Kolb & Baumann by Mr. Adolf Kolb and his son-in-law August Baumann. With the procurement of lapping machines the hard work of manufacturing of gauge blocks gets easier. The company's own constructions are put into practice. The development of angle gauge blocks and gauge block accessories is added and the KOBÄ-gauge block holder gets a patent.

1962 - Dipl.Ing. Adolf Baumann, son of August Baumann, joins the company. The manufacture of precision parts to customer's drawing steadily increases in addition to the strongly expanding regular products.

1964 - the production area is enlarged by putting up a new building.

1979 - Kolb & Baumann are accredited by the Physikalisch-Technische Bundesanstalt as the 8th DKD-Calibration Laboratory in Germany. In the course of the years the accreditation has been extended for gauge blocks up to 1000 mm and supplemented by cylindrical material measures and measurement equipment.

1984 - the site Daimlerstrasse is the new home of Kolb & Baumann.

1987 - the range of products is extended. Development and manufacture of calibration standards for the coordinate metrology is added. Today Kolb & Baumann as the only word-wide manufacturer offers one, two and three-dimensional test pieces in a wide variety.

1992 - the production site in the Daimlerstrasse has an addition built on.

KOBÄ supplies high precision products into
70 countries around the world.

Kolb & Baumann Customer Service

The standards for quality assurance call for the quality-relevant calibration of measurement equipment. DKD-calibration for many of these measurement equipments are too cost-intensive or there is no DKD-accredited calibration procedure. This is where the KOBÄ-Calibration Service starts. It offers competent and traceable calibrations at moderate charges. Hence the KOBÄ Calibration Service KKS offers calibration services on highest level for a variety of measurement equipments.





Delivery Programme & Services

KOBA-Gauge Blocks - a quality product, backed by 60 years of experience and research.

Gauge Blocks

Gauge Block Accessories

Step-gauge "KOBA-step"

Sphere Plate "KOBA-check"

Ball Bar

Ball Cube

KOBA-optima

Thread Gauges

Plug Gauges

Snap Gauges

Taper Gauges

Ring Gauges

Feeler Gauges

Angle Gauge Blocks

Spline Gauges

Precision Parts

DKD - German Calibration Service

KOBA - Calibration Service



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