TESA TECHNOLOGY

Length and Angle Standards

PURCHASING GAUGE BLOCKS CALLS FOR CONFIDENCE

The high accuracy of TESA's gauge blocks is the result of years of experience in producing and making use of these products.

- *Use of high quality raw materials and appropriate heat treatment, thus guaranteeing a durable shape and dimensional stability of the gauge blocks over years.*
- *Very low deviations in flatness and parallelism of the measuring faces, resulting in highly accurate gauges.*
- *Unique flat lapping polish as well as edge rounding techniques, leading to superior wringability.*
- *Proper serial number marked on each gauge block.*

ISO 3650

Gauge blocks with metric nominal lengths conform to ISO 3650:1998. This international standard is based on the ones published either in a region, e.g. the European standard EN ISO 3650:1998 or in a country, e.g. the Swiss standard SN EN ISO 3650, German standard DIN EN ISO 3650 or French standard NF EN ISO 3650. Gauge blocks with imperial nominal lengths comply with BS 4311 - Part 1. Compared to earlier standards, ISO 3650:1998 includes the following main changes :

- *Withdrawal of the accuracy grade 00 (see "Which grade do you need").*
- *Introduction of requirements as regards the uncertainty of measurement in relation to the declaration of conformity of the product according to ISO 14253-1:1998.*
- *Review of some definitions and shortened form of terms according to normative references that are currently applicable (see drawing).*

WHICH MATERIAL DO YOU NEED?

Steel

Steel gauge blocks have proven their reliability for more than a hundred years. This raw material remains the most commonly accepted for length standards.

Steel gauge blocks provide high resistance to wear associated with a good property to adhere to other gauge blocks. However, steel must be protected against corrosion. Provided gauge blocks made from this material are properly handled, they will remain reliable for many years. TESA steel gauge blocks have the following key features:

- *Highly alloyed steel*
- *Hardness guaranteed to 800 HV*
- *Artificially aged for optimum form and dimensional stability*
- *Coefficient of thermal expansion: (11,5 ± 1,0) x 10^{-6} K^{-1}*

Tungsten Carbide

Gauge blocks in tungsten carbide are 10 times as resistant to wear as steel gauges. They are intended for frequent use, also where superior wringing quality is required. TESA tungsten carbide gauge blocks provide:

- *Hardness guaranteed to 1400 HV*
- *Coefficient of thermal expansion: (4,23 ± 0,1) x 10^{-6} K^{-1}*

Ceramic

Ceramic gauge blocks are extremely resistant to wear and scratches. Due to the properties of this material, any minor damage is unlikely to affect the wringability of their measuring faces. Being corrosion resistant, these gauge blocks are insensitive to "rusty hands", amongst other issues. Manufactured from stabilised zirconia, TESA ceramic gauge blocks have the following key features:

- *Non-magnetizable*
- *Hardness guaranteed to 1400 HV*
- *Coefficient of thermal expansion: (9,7 ± 0,8) x 10^{-6} K^{-1}*

WHICH GRADE DO YOU NEED?

Grade 2

*These gauge blocks are commonly used as **Working Standards** in inspection rooms within a manufacturing area to set and calibrate measuring instruments and other equipment as well as to inspect tools, fixtures and machines.*

Grade 1

*Gauge blocks of this class are mainly used as **Working Standards** to set and calibrate plug gauges and measuring instruments in measuring rooms or inspection areas within a manufacturing area.*

Tolerence Grade 0

*These gauge blocks are designated for use as **Company Standards** in calibration laboratories or environmentally controlled inspection rooms to set and calibrate plug gauges as well as measuring equipment.*

Calibration grade K

*Gauge blocks of this tolerance class are intended for use as **Reference Standards** in metrology oriented laboratories of National Institutes, precision measuring rooms and other laboratories of National Calibration Services, whether officially accredited or not.*

They should be used as masters to calibrate gauge blocks, length standards of same accuracy and also measuring instruments.

Precision Grade 00

The new standard ISO 3650 no longer takes this accuracy grade into consideration as the uncertainties of measurement achieved with the procedure applied for calibration usually lead to a disparity against specified tolerances.

The rules to the expression of uncertainty of measurement for proving the conformity or nonconformity of the product with the specification, as stated in the standard ISO 14253- 1:1998, have dictated the decision to withdraw the accuracy grade 00.

A wide experience in practical use of gauge blocks has proven that gauges of the calibration class K could easily replace those of the earlier accuracy grade 00.

As a result, gauge blocks of grade 00 are no longer available.

CERTIFICATE OF CALIBRATION AND TRACEABILITY.

All set compositions from TESA are supplied with a certificate of calibration issued by the accredited calibration laboratory of a national calibration service.

This service can either be the Swiss calibration service (SCS), British calibration service (UKAS) or Deutsche Akkreditierungsstelle (DAkkS) depending on the manufacturer.

Accreditation is the authenticated assurance of the skills of the calibration laboratories as well as of the full traceability to national standards that conform with the International System of Units (SI).

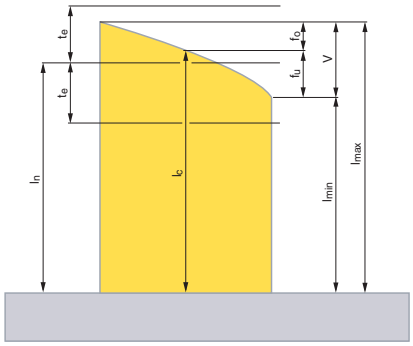
This is for any reference standard or measuring equipment being used.

Owing to a multilateral agreement (MLA), any certificates of calibration issued by the members of the European Cooperation for Accreditation of Laboratories (EA) is internationally accepted.

DELIVERIES

TESA gauge blocks can be delivered individually or in full sets with nominal lengths as listed in this section. Additional gauge sets and lengths can be made available upon request. Since individual gauge blocks could no be listed in their whole here, any inquiry or purchase order should specify :

- *Desired nominal length*
- *Chosen material*
- *Calibration grade or any other grade*



Nominal length l_n; Central length l_c; Variation v with f_o and f_u; Limit deviations t_e at any point proceeding from the nominal length.

Limit Deviations and Tolerances

	Limit deviations t_e			
	Tolerances t_v			
	Flatness tolerances t_f			
Nomianl length	Calibration grades and other grades			
	K	0	1	2
	Flatness tolerance t_f			
mm	µm	µm	µm	µm
0,5 = l_n = 150	0,05	0,1	0,15	0,25
150 < l_n = 500	0,1	0,15	0,18	0,25
500 < l_n = 1000	0,15	0,18	0,2	0,25

	Calibration grade K		Grade 0		Grade 1		Grade 2	
Nominal length	Limit deviation of length at any point from nominal length	Tolerance for the variation in length	Limit deviation of length at any point from nominal length	Tolerance for the variation in length	Limit deviation of length at any point from nominal length	Tolerance for the variation in length	Limit deviation of length at any point from nominal length	Tolerance for the variation in length
LIMIT DEVIATIONS AND TOLERANCES ACCORDING TO ISO 3650								
mm	± t_e µm	t_v µm	± t_e µm	t_v µm	± t_e µm	t_v µm	± t_e µm	t_v µm
0,5 = l_n ≤ 10	0,2	0,05	0,12	0,1	0,2	0,16	0,45	0,3
10 < l_n ≤ 25	0,3	0,05	0,14	0,1	0,3	0,16	0,6	0,3
25 < l_n ≤ 50	0,4	0,06	0,2	0,1	0,4	0,18	0,8	0,3
50 < l_n ≤ 75	0,5	0,06	0,25	0,12	0,5	0,18	1,0	0,35
75 < l_n ≤ 100	0,6	0,07	0,3	0,12	0,6	0,2	1,2	0,35
100 < l_n ≤ 150	0,8	0,08	0,4	0,14	0,8	0,2	1,6	0,4
150 < l_n ≤ 200	1,0	0,09	0,5	0,16	1,0	0,25	2,0	0,4
200 < l_n ≤ 250	1,2	0,1	0,6	0,16	1,2	0,25	2,4	0,45
250 < l_n ≤ 300	1,4	0,1	0,7	0,18	1,4	0,25	2,8	0,5
300 < l_n ≤ 400	1,8	0,12	0,9	0,2	1,8	0,3	3,6	0,5
400 < l_n ≤ 500	2,2	0,14	1,1	0,25	2,2	0,35	4,4	0,6
500 < l_n ≤ 600	2,6	0,16	1,3	0,25	2,6	0,40	5,0	0,7
600 < l_n ≤ 700	3,0	0,18	1,5	0,3	3,0	0,45	6,0	0,7
700 < l_n ≤ 850	3,4	0,2	1,7	0,3	3,4	0,5	6,5	0,8
800 < l_n ≤ 900	3,8	0,2	1,9	0,35	3,8	0,5	7,5	0,9
900 < l_n ≤ 1000	4,2	0,25	2,0	0,4	4,2	0,6	8,0	1,0
LIMIT DEVIATIONS AND TOLERANCES ACCORDING TO BS 4311, PART 1:1993								
in	± t_e µin	t_v µin	± t_e µin	t_v µin	± t_e µin	t_v µin	± t_e µin	t_v µin
l_n ≤ 0.4	5	2	5	4	10	6	20	12
0.4 < l_n ≤ 1	6	2	6	4	12	6	25	12
1 < l_n ≤ 1	8	3	8	4	15	7	30	12
2 < l_n ≤ 3	10	3	10	5	20	7	40	14
3 < l_n ≤ 4	12	3	12	5	25	8	50	14
LIMIT DEVIATIONS AND TOLERANCES ACCORDING TO FACTORY STANDARD FOR GAUGE BLOCKS OVER 4 IN								
in	± t_e µin	t_v µin	± t_e µin	t_v µin	± t_e µin	t_v µin	± t_e µin	t_v µin
4 < l_n ≤ 6	31	3	15	5	31	8	63	16
6 < l_n ≤ 8	40	3	20	6	40	10	79	16
8 < l_n ≤ 10	47	4	23	6	47	10	95	18
10 < l_n ≤ 12	55	4	28	7	55	10	110	20
12 < l_n ≤ 16	70	5	35	8	70	12	140	20
16 < l_n ≤ 20	87	5	43	10	87	14	174	24

GAUGE BLOCKS

Gauge Block Set M32, M47, M88, M112 and M122.

Nominal lengths 1 ÷ 100 mm in steel, carbide or ceramic.

Grades K, 0, 1 and 2 available in all sets. Steel gauges to all grades with DAkkS certificate. Carbide or ceramic gauges to all grades with UKAS certificate.

ISO 3650

Limit deviations t_e, see Table

Tolerances t_v, see Table

see Table

Steel: highly alloyed, wear resistant. Tungsten carbide: wear resistant and stable. Ceramic: stabilised zirconia, extremely resistant to wear and scratches

Steel: $(11,5 \pm 1,0) \times 10^{-6} K^{-1}$ Tungsten carbide: $(4,23 \pm 0,1) \times 10^{-6} K^{-1}$ Ceramic: $(9,7 \pm 0,8) \times 10^{-6} K^{-1}$

Steel gauges to all grades with DAkkS certificate. Carbide or ceramic gauges to all grades with UKAS certificate

TESA Gauge Block Set M32, Metric

		Grade
0651516027	Steel	K
0651515027	Steel	0
0651511027	Steel	1
0651512028	Steel	2

Set compositions

mm	Steps, mm	Pieces
1,005	–	1
1,01 ÷ 1,09	0,01	9
1,1 ÷ 1,9	0,1	9
1,0 ÷ 9,0	1,0	9
10, 20, 30, 60	–	4

TESA Gauge Block Set M47, Metric

		Grade
0651516021	Steel	K
0651515021	Steel	0
0651511021	Steel	1
0651512021	Steel	2

Set compositions

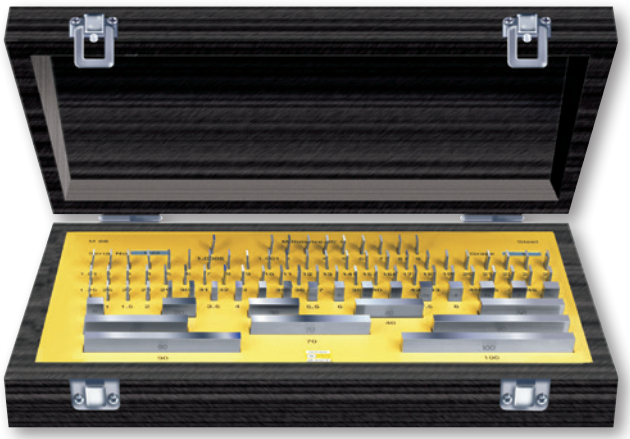
mm	Steps, mm	Pieces
1,005	–	1
1,01 ÷ 1,09	0,01	9
1,1 ÷ 1,9	0,1	9
1,0 ÷ 24,0	1,0	24
25 ÷ 100	25	4

TESA Gauge Block Set M88, Metric

		Grade
0651516014	Steel	K
0651515014	Steel	0
0651511014	Steel	1
0651512014	Steel	2

Set compositions

mm	Steps, mm	Pieces
1,0005	–	1
1,001 ÷ 1,009	0,001	9
1,01 ÷ 1,49	0,01	49
0,5 ÷ 9,5	0,5	19
10 ÷ 100	10	10



TESA Gauge Block Set M112, Metric

		Grade
0651516012	Steel	K
0651515012	Steel	0
0651511012	Steel	1
0651512012	Steel	2

Set compositions

mm	Steps, mm	Pieces
1,0005	–	1
1,001 ÷ 1,009	0,001	9
1,01 ÷ 1,49	0,01	49
0,5 ÷ 24,5	0,5	49
25 ÷ 100	25	4

TESA Gauge Block Set M122, Metric

		Grade
0651516011	Steel	K
0651515011	Steel	0
0651511011	Steel	1
0651512011	Steel	2

Set compositions

mm	Steps, mm	Pieces
1,0005	–	1
1,001 ÷ 1,009	0,001	9
1,01 ÷ 1,49	0,01	49
1,6 ÷ 1,9	0,1	4
0,5 ÷ 24,5	0,5	49
30 ÷ 100	10	8
25, 75	–	2

Special Versions

Available on request :

- Tungsten carbide gauge block set
- Ceramic gauge block set
- TESA maintenance kit

ISO 3650

Limit deviations t_s, see Table

Tolerances t_v, see Table

see Table

Steel: highly alloyed, wear resistant. Tungsten carbide: wear resistant and stable. Ceramic: stabilised zirconia, extremely resistant to wear and scratches

Steel: $(11,5 \pm 1,0) \times 10^{-6} K^{-1}$ Tungsten carbide: $(4,23 \pm 0,1) \times 10^{-6} K^{-1}$ Ceramic: $(9,7 \pm 0,8) \times 10^{-6} K^{-1}$

Steel gauges to all grades with DAkkS certificate. Carbide or ceramic gauges to all grades with UKAS certificate

Diameter and thickness as shown in table

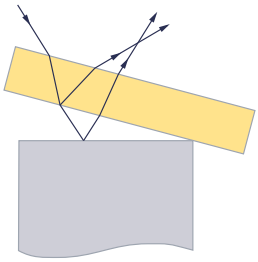
Optical flats with 2 flat measuring faces. No guaranty can be given for parallelism.

ACCESSORIES FOR GAUGE BLOCKS

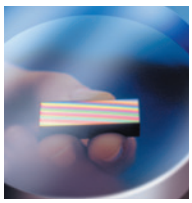
The interference lenses allow visual inspection of the surface of the gauge blocks.

TESA Optical Flats

Used for examining flatness and adhesion of gauge blocks or any other test pieces having flat faces with same high grade of accuracy.



NO	⌀ mm	Thickness, mm	µm
02530050	50	15	0,125
02530075	75	20	0,125



Light source: 35 W sodium lamp, 89% monochromatic, colour yellow, wavelength 0,575 µm

Surface plate: 0,5 µm

Surface plate: 2,5 µm

406 x 406 x 355 mm (W x D x H)

Surface plate in hardened steel

Case in lacquered wood

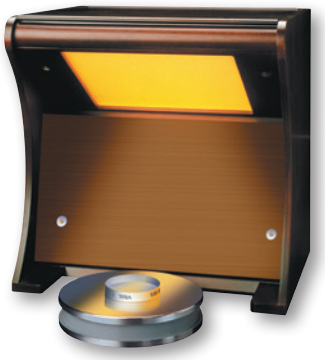
TESA Monochromatic Light Unit

For use with optical flats or optical parallels to measure both the flatness and parallelism of the measuring faces by interferometry.

Monochromatic light source providing high-contrast interference fringes.

This light unit uses a single wavelength so that bright/light fringes only are visible.

The light source at the rear of the case also permits a visual examination, e.g. with the aid of a knife-edge or bevelled straight edge.



NO		V
0652500422	Universal monochromatic light	210 ÷ 230
STANDARD ACCESSORIES:		
0651570269	200 mm dia. surface plate, lapped and polished measuring face	
0652500424	Sodium light bulb (spare lamp)	

Brown & Sharpe Angle Gauges

For setting and calibration purposes – Smallest step to 15' (1/4°).

30"

Width:
6,35 mm (1/4 in)
Length:
≥ 76,2 mm (3 in)

Hardened steel

NO		Set Composition
06769002	Precision angle block set	15' / 30' / 1° / 2° / 3° / 4° / 5° / 10° / 15° / 20° / 25° / 30°