

KR06-M50/M200/M05: Instructions for checking mechanical caliper gauges of the series M50, M200, M05 – absolute measurement

1 Generalities

This instruction follows the checking instructions for caliper gauges according to VDI/VDE/DGQ 2618, page 12.1 and 13.1. The gauges are referred to gauges with absolute measurement and adjustable zero point.

2 Terms

Terms of length testing techniques see DIN 1319, part 1 and 2 (see also fig. 1) and International Vocabulary of Basic and General Terms in Metrology.

2.1 Range of application A_{wb}

The range of application is the sum of regulating and measuring range (z.B.: H 2M..)

2.2 Range of indication A_{zb}

The range of indication is the range between the highest and the lowest indication.

2.3 Measuring range M_{eb}

The measuring range is defined as the range of values of the measurable variable, in which given or stipulated margins of error will not be exceeded.

2.4 Total motion G_h

The total motion of the movable caliper arm consists of the range of indication and the free motion.

2.5 Scale interval S_{kw}

The scale interval represents the modification of the value of the measurable variable, which causes the indication to change by one scale part. The scale interval is indicated in the unit of the measurable variable. The scale interval was also called graduation.

2.6 Deviation in the measuring range f_M

The deviation in the measuring range (range of deviation) f_M represents the distance of ordinates between the highest and the lowest position in the deviation diagram, when the movable caliper arm closes. The tolerance field G for f_M is symmetrically positioned to the zero line.

2.7 Deviation in the partial measuring range f_t

The deviation in the measuring range (range of deviation) f_t represents the distance of ordinates between the highest and the lowest position in the deviation diagram, when the movable caliper arm closes. The tolerance field G for f_t is symmetrically positioned to the zero line.

2.8 Repeat precision f_w

The repeat precision f_w is a characteristic value for deviations of the measured quantity within the measuring range in the same motion direction of the movable caliper arm (usually n is 5). This margin of error is designated as repeat limit r .

2.9 Measuring force F_{min} , F_{max}

When the caliper arm closes, the measuring force F_{min}/F_{max} is determined at the top of the movable caliper arm. The gauge must be held in vertical position.

2.10 Torsional force of the bezel

The torsional bezel should neither exceed nor fall below a certain defined range of torsional force. The torsional force is measured in Ncm.

3 Characteristics for checking

The values of table 1 and 2 must not be exceeded within the measuring range. These values are valid for the vertical measuring position of the instruments for internal measurement (H) and for the instruments for external measurement (D).

Attention!

The above mentioned error parameters imply the correct handling of the gauge. Errors, which are due to incorrect handling such as extreme motion of the caliper arms, application in temperatures below 10°C and above 30°C are excluded.

Gauges used out of the reference temperature the zero point has to be adjusted. Extremely loadings are fast and jerky actuating of the arms, as well as tight hitting against the limit stop in the case.

– **IP 65 tightness must be guaranteed:** Tightness checking with measuring instrument CETA 81

3.1 Reading

Division scales (scale ring, scale)

The division scale is to be arranged by lines with marginal sharpness. These lines should clearly contrast with the ground. All lines should be straight, directed to the rotation of the pointer axis and arranged centrally. Accentuated lines should be longer than the others.

The distance of the centers of adjacent lines (scale spacing) should not be smaller than 0.75 mm, measured from a circle described by the tip of the pointer. The width of the lines should be 20 % of the scale spacing width. The deviation of the medium width of one line within one scale must not exceed ± 0.03 scale spacing.

The scale interval has to be indicated with value and unity in mm using the following symbol: $\Rightarrow \parallel \Leftarrow 0.01\text{mm}$.

The dial gauge should have a turnable (adjustable) scale for the zero positioning. The eccentricity of the scale ring to the pointer axis has to be ≤ 0.25 mm (except for device series M05).

Cleanness and quality of the scale print, bezel

The field of the scale lines applies as a operating field. Visible breaks of the lines, colour specks or dust particles more than 0,1mm are not admissible. The breaks must not exceed 2/3 of the line diameter. The rest of the scale and bezel applies as a design field. Max. 2 visible colour specks not more than 0,2mm are admissible. The colour specks on the bezel or glass must not exceed 0,1mm.

If colour specks and dust particles in the operation field, design field and on the bezel are in tolerance are only allowed one time per gauge in the different fields and not together (plural pieces are not allowed).

Range of indication

Against the figures indicated in the table 1 and 2, the gauges are allowed to deviate from the following values:

For inch gauges the conversion table should be used.

Gauge	Max-value (mm)	Min-value (mm)
H	+0.3	+0.1/ -0.3
D	+0.3/ -0.1	see 3.2

Torsional force of the bezel

The torsional force has to be checked with a torsional force checking caliper with a special cap. Before checking the bezel must be turned and the measurement can be done.

The measuring results have to be read while turning the bezel.

Permissible values:

M50/M200/M05. → 10 – 40 Ncm

Tolerance marks

While turning the bezel the tolerance marks of the series M50/M200 are not allowed to slide at the case.

The automatic interlock of the tolerance marks has to be strong enough so that a moving of the tolerance marks are not possible during the measurement or by modification of the bezel.

Distance and height of the pointer

The small pointer has to be adjusted that a sliding at the scale or the big pointer is not possible. The distance between both elements is min. 0,2mm.

The big pointer has to be adjusted that a sliding at the scale or at the bezel or at the small pointer is not possible. The distance between these elements is min. 0,2mm.

The min. distances are to be guaranteed for the complete rotation.

The big pointer must not wobble.

3.2 Movement, adjustment and measuring force

Movement

The movement should be free of visible dirt and chips particles.

Insignificant friction variation of the movement because of the process tolerance are permissible, as long as they are within the limiting value.

Noises caused by the rack gear have no affect on the accuracy of the caliper gauge. This is no reason for a complaint.

A quality statement is the deviation diagramm supplied with each gauge.

Identification

Similarly to the standard for dial gauges VDI/VDE/DGQ 2618 page 12.1 and 13.1 the checking is done in steps which correspond to the decuple of the scale interval (up to 200 times). Block gauges and ring gauges are used to determine fM, ft (will be handed out on customers request), and fw. A fully automatically checking device is also used to determine these values. Its calibration is annually revised. Being checked through the DAkkS (German calibration service), all gauges and devices correspond to the national length standard.

The repeatability fw is checked by means of 5 measurements of the same measure in the first third of the measuring range.

Attention: Usually all gauges are electronically adjusted with error limits. For manual calibration the tolerance limits of the certificate are valid. Variations due to the operator are considered. In case of failure of the electronic adjustment a B1 certificate based on manual inspection is provided.

The following test points are considered for B1 certificates:

Measuring range ≤ 20mm 5 test points (mm-scale)

Pointer position at the beginning of the measuring range

A deviation of the big pointer at the beginning of the measuring range or „0“ is admissible.

Because of different transmissions and kinematics the following max. deviations must not be exceeded:

Serie M05 = +/- 1 scale lines

Serie M50 (H../D..) = +/- 3 scale lines

Serie M200 (H../D..) = +/- 2 scale lines

A deviation of the small pointer of ± 1 pointer width at the beginning of the measuring range or „0“ is admissible

Measuring force

The measuring force for the series M50/M200 (H../D..) and M05 is made by means of a flat spiral tension spring.

The force is defined by the spring inset point and the spring. The measuring force can be determined by a force-sending device.

Reference temperature

The reference temperature is 20 +/- 3°C

3.3 Measuring arms and contacts

Measuring arms

Measuring arms made of stainless steel are usually not coated.

Measuring arms made of quality flat steel are coated for surface protection.

Concerning surface irregularities a visual check is made.

Measuring contacts

All ball measuring contacts made of stainless steel are provided with a carbide ball which are fixed by inductive soldering. The quality is visual checked.

All chisel measuring contacts are made of stainless steel and are tempered.

Flat measuring contacts made of stainless steel or aluminium. The surface is hard anodized.

Interchangeability

If there is a possibility the gauges have interchangeable measuring contacts. Minor display deviations that may occur when replacing a measuring contact due to manufacturing tolerances are compensated for by rotating the scale ring.

Positions tolerance of the measuring contacts

The gauges with ball contacts or chisel contacts have an admissible position tolerance deviation of max. +/- 0,2mm due to the axle.

A parallelism deviation of max. 0,01mm for chisel contact is admissible.

The check is made with a test piece 1-2mm. The test piece is touched with both outer chisel points. The deviation must be max. 0,01mm.

Documentation

The checking values can be memorized in a diagram. After the final test and acceptance, the gauges must be correctly marked with the identification number of the testing record. It may be given to the customer as:

- manufacturer certificate M according to DIN 55350 (Typ B1 and C).

Table 1: Admissible deviations Gauges with mm – scaling

No.	Type	Measuring range [mm]	Range of application [mm]	Total motion [mm]	Scale interval [mm]	G [mm]	G _t [mm]	r [mm]	F _{min} [N]	F _{max} [N]	Measuring uncertainty [mm] B1	Measuring uncertainty [mm] C	Certificate Typ	Note
1	H102	2.5 – 12.5	2.4 – 12.8	2.4 – 12.8	0.005	0.015	0.012	0.005	0.8	1.2	0.003		B1	
2	H105	5 – 15	4.7 – 15.3	4.7 – 15.3	0.005	0.015	0.012	0.005	0.8	1.2	0.003	0.002	C (B1)	
3	H210	10 – 30	9.5 – 30.5	9.5 – 30.5	0.01	0.03	0.015	0.01	1.1	1.6	0.004	0.002	C (B1)	
4	H220	20 – 40	19.5 – 40.5	19.5 – 40.5	0.01	0.03	0.015	0.01	1.1	1.6	0.004	0.002	C (B1)	
5	H230	30 – 50	29.5 – 50.5	29.5 – 50.5	0.01	0.03	0.015	0.01	1.1	1.6	0.004	0.002	C (B1)	
6	H240	40 – 60	39.5 – 60.5	39.5 – 60.5	0.01	0.03	0.015	0.01	1.1	1.6	0.004	0.002	C (B1)	
7	H250	50 – 70	49.5 – 70.5	49.5 – 70.5	0.01	0.03	0.015	0.01	1.1	1.6	0.004	0.002	C (B1)	
8	H260	60 – 80	59.5 – 80.5	59.5 – 80.5	0.01	0.03	0.015	0.01	1.1	1.6	0.005	0.002	C (B1)	
9	H270	70 – 90	69.5 – 90.5	69.5 – 90.5	0.01	0.03	0.015	0.01	1.1	1.6	0.004	0.002	C (B1)	
10	H280	80 – 100	79.5 – 100.5	79.5 – 100.5	0.01	0.03	0.015	0.01	1.1	1.6	0.004	0.002	C (B1)	
11	H2M50	50 – 100	49.5 – 100.5	49.5 – 100.5	0.01	0.03	0.025	0.015	1.1	1.6	0.005	0.002	4x C (B1)	* Awb
12	H2M90	90 – 140	89.5 – 140.5	89.5 – 140.5	0.01	0.03	0.025	0.015	1.1	1.6	0.005	0.002	4x C (B1)	* Awb
13	H2M130	130 – 180	129.5 – 180.5	129.5 – 180.5	0.01	0.03	0.025	0.015	1.1	1.6	0.005	0.002	4x C (B1)	* Awb
21	H415	15 – 65	14.8 – 65.5	14.8 – 65.5	0.05	0.05	0.04	0.025	0.9	1.9	0.004	0.002	C (B1)	
22	H440	40 – 90	39.5 – 90.5	39.5 – 90.5	0.05	0.05	0.04	0.025	0.9	1.9	0.004	0.002	C (B1)	
23	H470	70 – 120	69.5 – 120.5	69.5 – 120.5	0.05	0.05	0.04	0.025	0.9	1.9	0.004	0.002	C (B1)	
24	H4100	100 – 150	99.5 – 150.5	99.5 – 150.5	0.05	0.05	0.04	0.025	0.9	1.9	0.004	0.002	C (B1)	
25	H4130	130 – 180	129.5 – 180.5	129.5 – 180.5	0.05	0.05	0.04	0.025	0.9	1.9	0.004	0.002	C (B1)	
26	H4150	150 – 200	149.5 – 200.5	149.5 – 200.5	0.05	0.05		0.025	0.9	1.9	0.004		B1	
27	H4M180	180 – 310	179.5 – 310.5	179.5 – 310.5	0.05	0.15		0.075	0.9	1.9	0.004		3x B1	* Awb
28	H4M300	300 – 430	299.5 – 430.5	299.5 – 430.5	0.05	0.15		0.075	0.9	1.9	0.004		3x B1	* Awb
29	H850	50 – 150	49.5 – 150.5	49.5 – 150.5	0.1	0.15		0.1	0.8	2.0	0.004		B1	
30	H870	70 – 170	69.5 – 170.5	69.5 – 170.5	0.1	0.15		0.1	0.8	2.0	0.004		B1	

C Certificate: based upon machine inspection, PC print, inspection uncertainty for $k=2$
 B1 Certificate: based upon manual inspection, PC print, inspection uncertainty for $k=2$
 * Awb Range of application indicated, not measuring range

Table 1: Admissible deviations Gauges with mm – scaling (continue)

No.	Type	Measuring range [mm]	Range of application [mm]	Total motion [mm]	Scale interval [mm]	G [mm]	G _t [mm]	r [mm]	F _{min} [N]	F _{max} [N]	Measuring uncertainty [mm] B1	Measuring uncertainty [mm] C	Certificate Typ	Note
31	D110	0 – 10	0 – 10.5	0 – 10.5	0.005	0.015	0.010	0.005	1.2	1.6	0.003	0,002	C (B1)	
32	D110S	0 – 10	0 – 10.5	0 – 10.5	0.005	0.015	0.010	0.005	1.2	1.6	0.003	0.002	C (B1)	
33	D110T	0 – 10	0 – 10.5	0 – 10.5	0.005	0.020		0.005	1.2	1.6	0.003		B1	TØ6
34	D1R10	0 – 10	0 – 10.5	0 – 10.5	0.005	0.015	0.010	0.005	1.2	1.6	0.003	0.002	C (B1)	
35	D1R10S	0 – 10	0 – 10.5	0 – 10.5	0.005	0.015	0.010	0.005	1.2	1.6	0.003	0.002	C (B1)	
36	D220	0 – 20	0 – 20.5	0 – 20.5	0.01	0.03	0.015	0.01	1.1	1.6	0.004	0.002	C (B1)	
37	D220S	0 – 20	0 – 20.5	0 – 20.5	0.01	0.03	0.015	0.01	1.1	1.6	0.004	0.002	C (B1)	
38	D220T	0 – 20	0 – 20.5	0 – 20.5	0.01	0.04		0.01	1.1	1.6	0.004		B1	TØ10
39	D2R20	0 – 20	0 – 20.5	0 – 20.5	0.01	0.03	0.015	0.01	1.1	1.6	0.004	0.002	C (B1)	
40	D2R20S	0 – 20	0 – 20.5	0 – 20.5	0.01	0.03	0.015	0.01	1.1	1.6	0.004	0.002	C (B1)	
41	D450	0 – 50	0 – 50.5	0 – 50.5	0.05	0.05	0.04	0.025	0.8	1.7	0.004	0.002	C (B1)	
42	D450S	0 – 50	0 – 50.5	0 – 50.5	0.05	0.05	0.04	0.025	0.8	1.7	0.004	0.002	C (B1)	
43	D450T	0 – 50	0 – 50.5	0 – 50.5	0.05	0.10		0.05	0.8	1.7	0.004		B1	TØ50
44	D4R50	0 – 50	0 – 50.5	0 – 50.5	0.05	0.05	0.04	0.025	0.8	1.7	0.004	0.002	C (B1)	
45	D4R50S	0 – 50	0 – 50.5	0 – 50.5	0.05	0.05	0.04	0.025	0.8	1.7	0.004	0.002	C (B1)	
46	D450B	0 – 50	0 – 50.5	0 – 50.5	0.05	0.075		0.05	0.8	1.7	0.005		B1	
47	D450F	0 – 50	0 – 50.5	0 – 50.5	0.05	0.075		0.05	0.8	1.7	0.005		B1	
48	D4100	50 – 100	49.5 – 100.5	49.5 – 100.5	0.05	0.075		0.05	0.8	1.7	0.005		B1	
49	D4150	100 – 150	99.5 – 150.5	99.5 – 150.5	0.05	0.075		0.05	0.8	1.7	0.005		B1	
50	D8100	0 – 100	0 – 101	0 – 101	0.1	0.15		0.1	0.8	1.8	0.005		B1	
51	D8100T	0 – 100	0 – 101	0 – 101	0.1	0.15		0.1	0.8	1.8	0.005		B1	TØ50
52	D8R100	0 – 100	0 – 101	0 – 101	0.1	0.15		0.1	0.8	1.8	0.005		B1	
53	E110D	0 – 2	0 – 10.5	0 – 10.5	0.01	0.03		0.1	0.1	1.3	0.003		B1	
54	E110W	0 – 2	0 – 10.5	0 – 10.5	0.01	0.03		0.015	0.1	0.4	0.003		B1	
55	E110K	0 – 10	0 – 10.5	0 – 10.5	0.1	0.1		0.05	1.0	1.5	0.003		B1	
56	E110F	0 – 10	0 – 10.5	0 – 10.5	0.1	0.1		0.05	1.0	1.5	0.003		B1	
57	E110N	0 – 10	0 – 10.5	0 – 10.5	0.1	0.1		0.05	1.0	1.5	0.003		B1	
58	E110R	0 – 10	0 – 10.5	0 – 10.5	0.1	0.1		0.05	1.0	1.5	0.003		B1	
59	E110T	0 – 10	0 – 10.5	0 – 10.5	0.1	0.1		0.05	1.0	1.5	0.003		B1	TØ10

C Certificate: based upon machine inspection, PC print, inspection uncertainty for k=2

B1 Certificate: based upon manual inspection, PC print, inspection uncertainty for k=2

TØ Diameter flat measuring contact

Table 2: Admissible deviations Gauges with inch – scaling

No..	Type	Measuring range [inch]	Range of application [inch]	Total motion [inch]	Scale interval [inch]	G [inch]	G _t [inch]	r [inch]	F _{min} [N]	F _{max} [N]	Measuring uncertainty [inch] B1	Measuring uncertainty [inch] C	Certificate Typ	Note
1	H602	.10 – 50	.094 – .51	.094 – .51	.0002	.0008		.0002	0.8	1.2	.00012		B1	
2	H605	.20 – 60	.19 – .61	.19 – .61	.0002	.0008	.0005	.0002	0.8	1.2	.00012	.00008	C (B1)	
3	H710	.40 – 1.2	.38 – 1.22	.38 – 1.22	.0005	.0015	.0010	.0005	1.1	1.6	.0002	.00008	C (B1)	
4	H720	.80 – 1.60	.78 – 1.62	.78 – 1.62	.0005	.0015	.0010	.0005	1.1	1.6	.0002	.00008	C (B1)	
5	H730	1.20 – 2.00	1.18 – 2.02	1.18 – 2.02	.0005	.0015	.0010	.0005	1.1	1.6	.0002	.00008	C (B1)	
6	H740	1.60 – 2.40	1.58 – 2.42	1.58 – 2.42	.0005	.0015	.0010	.0005	1.1	1.6	.0002	.00008	C (B1)	
7	H750	2.00 – 2.80	1.98 – 2.82	1.98 – 2.82	.0005	.0015	.0010	.0005	1.1	1.6	.0002	.00008	C (B1)	
8	H760	2.40 – 3.20	2.38 – 3.22	2.38 – 3.22	.0005	.0015	.0010	.0005	1.1	1.6	.0002	.00008	C (B1)	
9	H770	2.80 – 3.60	2.78 – 3.62	2.78 – 3.62	.0005	.0015	.0010	.0005	1.1	1.6	.0002	.00008	C (B1)	
10	H780	3.20 – 4.00	3.18 – 4.02	3.18 – 4.02	.0005	.0015	.0010	.0005	1.1	1.6	.0002	.00008	C (B1)	
11	H7M50	2.00 – 4.00	1.98 – 4.02	3.58 – 5.62	.0005	.0015	.0010	.001	1.1	1.6	.0002	.00008	4x C (B1)	* Awb
12	H7M90	3.60 – 5.60	3.58 – 5.62	3.58 – 5.62	.0005	.0015	.0010	.001	1.1	1.6	.0002	.00008	4x C (B1)	* Awb
13	H7M130	5.20 – 7.20	5.18 – 7.22	5.18 – 7.22	.0005	.0015	.0010	.001	1.1	1.6	.0002	.00008	4x C (B1)	* Awb
14	H915	.60 – 2.6	.58 – 2.62	.58 – 2.62	.001	.002	.0015	.001	0.9	1.9	.0002	.00008	C (B1)	
15	H940	1.6 – 3.6	1.58 – 3.62	1.58 – 3.62	.001	.002	.0015	.001	0.9	1.9	.0002	.00008	C (B1)	
16	H970	2.8 – 4.8	2.78 – 4.82	2.78 – 4.82	.001	.002	.0015	.001	0.9	1.9	.0002	.00008	C (B1)	
17	H9100	4.0 – 6.0	3.98 – 6.02	3.98 – 6.02	.001	.002	.0015	.001	0.9	1.9	.0002	.00008	C (B1)	
18	H9130	5.2 – 7.2	5.18 – 7.22	5.18 – 7.22	.001	.002	.0015	.001	0.9	1.9	.0002	.00008	C (B1)	

C Certificate: based upon machine inspection, PC print, inspection uncertainty for $k=2$
 B1 Certificate: based upon manual inspection, PC print, inspection uncertainty for $k=2$
 *Awb Range of application indicated, not measuring range

Table 2: Admissible deviations

Gauges with inch – scaling (continue)

No.	Type	Measuring range [inch]	Range of application [inch]	Total motion b [inch]	Scale interval [inch]	G [inch]	G _t [inch]	r [inch]	F _{min} [N]	F _{max} [N]	Measuring uncertainty [inch] B1	Measuring uncertainty [inch] C	Certificate Typ	Note
19	D610	0 – .40	0 – .41	0 – .41	.0002	.0008	.0005	.0002	1.2	1.6	.0002	.00008	C (B1)	
20	D610S	0 – .40	0 – .41	0 – .41	.0002	.0008	.0005	.0002	1.2	1.6	.0002	.00008	C (B1)	
21	D610T	0 – .40	0 – .41	0 – .41	.0002	.0010		.0004	1.2	1.6	.0002		B1	TØ6
22	D6R10	0 – .40	0 – .41	0 – .41	.0002	.0008	.0005	.0002	1.2	1.6	.0002	.00008	C (B1)	
23	D6R10S	0 – .40	0 – .41	0 – .41	.0002	.0008	.0005	.0002	1.2	1.6	.0002	.00008	C (B1)	
24	D720	0 – .80	0 – .82	0 – .82	.0005	.0015	.0010	.0005	1.1	1.6	.0002	.00008	C (B1)	
25	D720S	0 – .80	0 – .82	0 – .82	.0005	.0015	.0010	.0005	1.1	1.6	.0002	.00008	C (B1)	
26	D720T	0 – .80	0 – .82	0 – .82	.0005	.0020		.0010	1.1	1.6	.0002		B1	TØ10
27	D7R20	0 – .80	0 – .82	0 – .82	.0005	.0015	.0010	.0005	1.1	1.6	.0002	.00008	C (B1)	
28	D7R20S	0 – .80	0 – .82	0 – .82	.0005	.0015	.0010	.0005	1.1	1.6	.0002	.00008	C (B1)	
39	D950	0 – 2.0	0 – 2.02	0 – 2.02	.001	.002	.0015	.001	0.8	1.7	.0002	.00008	C (B1)	
30	D950S	0 – 2.0	0 – 2.02	0 – 2.02	.001	.002	.0015	.001	0.8	1.7	.0002	.00008	C (B1)	
31	D950T	0 – 2.0	0 – 2.02	0 – 2.02	.001	.004		.002	0.8	1.7	.0002		B1	TØ50
32	D9R50	0 – 2.0	0 – 2.02	0 – 2.02	.001	.002	.0015	.001	0.8	1.7	.0002	.00008	C (B1)	
33	D9R50S	0 – 2.0	0 – 2.02	0 – 2.02	.001	.002	.0015	.001	0.8	1.7	.0002	.00008	C (B1)	
34	E610D	0 – .08	0 – .40	0 – .41	.0005	.0015		.0005	0.5	1.3	.0002		B1	
35	E610W	0 – .08	0 – .40	0 – .41	.0005	.0015		.0005	0.1	0.4	.0002		B1	

C Certificate: based upon machine inspection, PC print, inspection uncertainty for k=2

TØ Diameter flat measuring contacts

B1 Certificate: based upon manual inspection, PC print, inspection uncertainty for k=2

Conversion "inch" in "mm" (rounded values)

inch	0.0001	0.0002	0.00025	0.0003	0.0004	0.0005	0.00075	0.001	0.0015	0.002	0.0025	0.003	0.0035	0.004
mm	0.0025	0.005	0.0063	0.0075	0.010	0.013	0.019	0.026	0.039	0.052	0.064	0.076	0.089	0.102

inch	0.005	0.006	0.008	0.010	0.0125	0.015	0.020	0.025	0.030	0.035	0.040	0.045	0.050
mm	0.127	0.152	0.203	0.254	0.317	0.381	0.508	0.635	0.762	0.889	1.016	1.143	1.270

Gauge overlowering and overlifting for measuring machine MTP

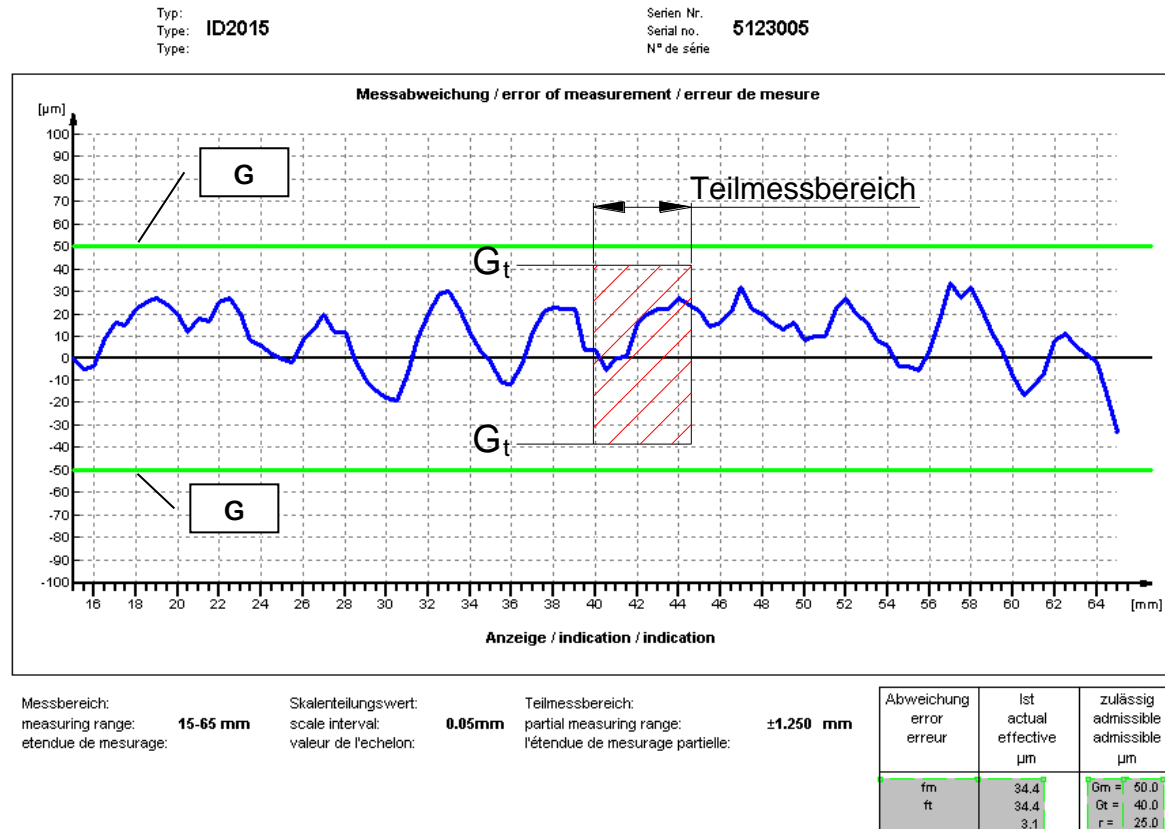
a) Overlifting

Gauges Serie D2... overlifting 1mm
 Gauges Serie D1... overlifting 0.5mm
 Gauges Serie H2... overlifting 1mm
 Gauges Serie H1... overlifting 0.5mm

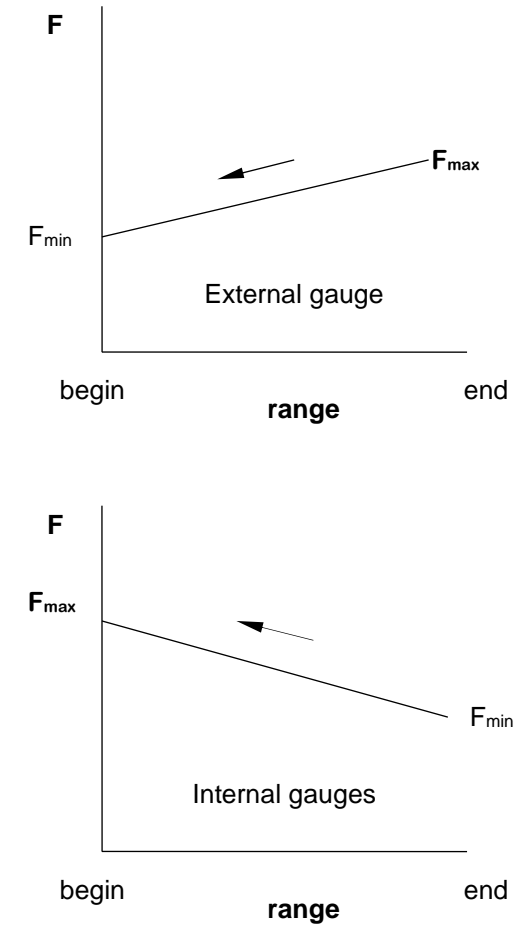
b) Overlowering

Gauges H105 overlowering 0.2mm
 Gauges H210 und H220 overlowering 0.2mm
 Gauges ab H230 overlowering 0.5mm

Pict 1: Error curve for internal and external gauges, caliper arm closes



Pict 2: Curve for the measuring force - closing arm



The partial measuring range corresponds to ± 0.5 turns of the pointer.
 During evaluation it is moved as a „window“ over the measuring range.

Definitions:

- G : maximum admissible deviation in the measuring range
- G_t : maximum admissible deviation in the partial measuring range