



GEAR GAGES



**WILLRICH PRECISION
INSTRUMENT**
THINK MEASUREMENT... THINK WILLRICH

Ph 866-945-5742 email:sales@willrich.com

GEAR GAUGES ZM2, ZM3, ZM6, ZM7, AV, EG

Gear Gauges

Internal Gear Gauges: range between balls: $M_i=3.5$ to 333 mm External Gear Gauges: range over balls: $M_a=0$ - 140 mm.

Checking of measuring size between or over balls.
Detecting of conicity and ovality.

Applicable for internal and external gear gauges (straight-sided or helical) and for gears with even or odd numbered teeth.

Ma



Mi



Internal Gear Gauges

The mechanical configuration of DIATEST internal gear gauges generally corresponds to the principle of split ball probes for sizes $M_i=3.5$ to 26.1 mm and to the principle of plunger probes for sizes $M_i=26.0$ to 333.0 mm. Internal gear gauges are comparative gauges which can be used in conjunction with regular accessories for split ball and plunger probes: right angle attachments, depth extensions, checking stands with floating holders etc.

Measuring process

To set the gauge use measured sample components or setting masters. Setting masters cannot be provided by DIATEST. Introduce the gauge into the measured component / setting master and determine the minimum size (reversal point) by swinging to and from and set the indicator to zero. This procedure is then repeated in the component, here the reversal point shows the deviation to the setting master. The digital indicator MDU-M125 stores the minimum value during the oscillation through the component. The size M_i can be displayed absolutely or relatively (to the setting master).

Enquiries

For enquiries please always state the dimension between balls (M_i) and the ball diameter. In certain cases it may be advisable to provide a sample component.

Ball anvils and ball plungers with carbide balls

Price group 1	Ø 1,000 - 1,500 - 2,000 - 2,500 - 3,000 - 3,500 - 4,000 - 4,500 - 5,000
Price group 2	Ø 0,500 - 0,551 - 0,620 - 0,623 - 0,630 - 0,722 - 0,862 - 0,895 - 0,965 - 1,100 - 1,118 - 1,125 - 1,250 - 1,350 - 1,372 - 1,385 - 1,524 - 1,540 - 1,600 - 1,650 - 1,700 - 1,750 - 1,782 - 1,800 - 1,829 - 1,900 - 2,032 - 2,250 - 2,284 - 2,386 - 2,438 - 2,667 - 2,704 - 2,713 - 2,721 - 2,743 - 2,750 - 3,048 - 3,250 - 3,400 - 3,658 - 4,835 - 5,250 - 5,486 - 5,500 - 6,000 - 6,096 - 6,350 - 6,500 - 7,000
Price group 3	Ø 7,500 - 8,000 - 8,500 - 9,000 - 9,500 - 10,000

Other ball Ø on request.

Ball anvils for dial indicators KS-MU-*. Special ball anvils, gauge slides and special plungers on request.

*add ball Ø

T-ZM2 UND T-ZM3

T-ZM2 AND T-ZM3

■

Split-ball system T-ZM2 and T-ZM3

For dimensions between balls M_i from 3.5 to 26.1 mm the split-ball system is needed. We distinguish between the following systems:

- T-ZM2: The carbide balls are fixed to the split ball probe and are NOT interchangeable.
- T-ZM3: The carbide balls are fitted to the probe using ball anvils and are interchangeable.

In the following table you can find the corresponding split ball probes.

T-ZM2

Dimension (M_i)		Order Code
Range (mm)	Range (inch)	
3,5 – 4,1	0.138 – 0.161	T-ZM2-4,0-*
4,0 – 4,6	0.157 – 0.181	T-ZM2-4,5-*
4,5 – 5,1	0.177 – 0.200	T-ZM2-5,0-*
5,0 – 5,6	0.197 – 0.220	T-ZM2-5,5-*
5,5 – 6,1	0.216 – 0.240	T-ZM2-6,0-*
6,0 – 6,6	0.236 – 0.260	T-ZM2-6,5-*
6,5 – 7,1	0.256 – 0.280	T-ZM2-7,0-*
7,0 – 7,6	0.276 – 0.300	T-ZM2-7,5-*
7,5 – 8,1	0.295 – 0.319	T-ZM2-8,0-*
8,0 – 8,6	0.315 – 0.339	T-ZM2-8,5-*
8,5 – 9,1	0.335 – 0.358	T-ZM2-9,0-*
9,0 – 9,6	0.354 – 0.378	T-ZM2-9,5-*

* = add ball $\varnothing$ (balls not interchangeable).
Suitable needle: N2-270 (steel), NHM2-270 (carbide).

Example T-ZM2

Dimension M_i = 5,75 mm
Ball $\varnothing$ = 2,000 mm
Split ball probe T-ZM2-6,0-2,000



T-ZM2 AND T-ZM3

T-ZM3

Dimension (Mi)		Order Code
Range (mm)	Range (inch)	
9,3 – 10,6	0.366 – 0.417	T-ZM3-10
10,3 – 11,6	0.406 – 0.457	T-ZM3-11
11,3 – 12,6	0.455 – 0.496	T-ZM3-12
12,3 – 13,6	0.484 – 0.535	T-ZM3-13
13,3 – 14,6	0.524 – 0.575	T-ZM3-14
14,5 – 16,1	0.571 – 0.634	T-ZM3-10
15,5 – 17,1	0.61 – 0.673	T-ZM3-11
16,5 – 18,1	0.65 – 0.713	T-ZM3-12
17,5 – 19,1	0.689 – 0.752	T-ZM3-13
18,5 – 20,1	0.728 – 0.791	T-ZM3-14
19,5 – 21,1	0.768 – 0.831	T-ZM3-15
20,5 – 22,1	0.807 – 0.87	T-ZM3-16
21,5 – 23,1	0.846 – 0.909	T-ZM3-17
22,5 – 24,1	0.886 – 0.949	T-ZM3-18
23,5 – 25,1	0.925 – 0.988	T-ZM3-19
24,5 – 26,1	0.965 – 1.028	T-ZM3-20



K Use short ball anvil KS-ZM3-K-ball Ø.

Use standard ball anvil KS-ZM3-Ø from Mi=14.5 mm.

Attention: You always require 2 ball anvils for each probe. Suitable

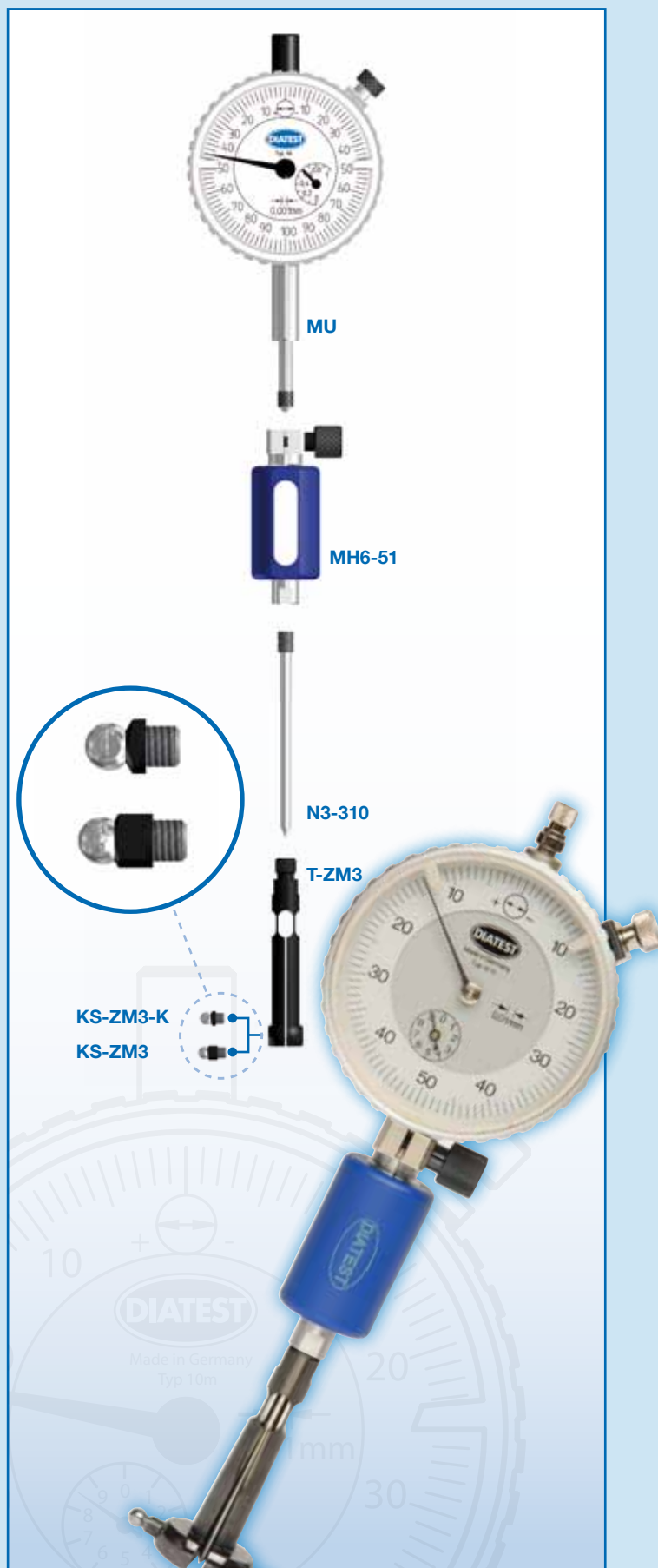
needle: N3-310 (steel), NHM3-310 (carbide).

Example T-ZM3

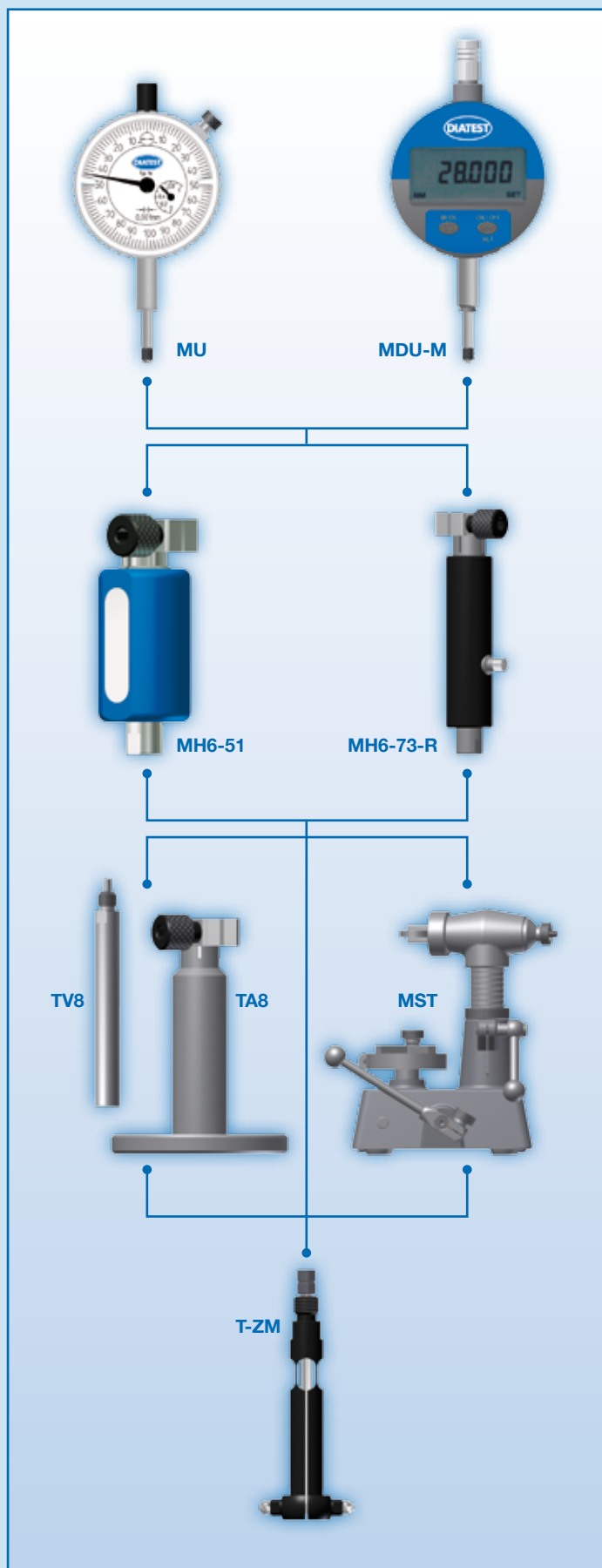
Dimension Mi =
12,000 mm Kugel / Ball

Ø = 2,000 mm / Split ball
probe
T-ZM3-12 :

/ Ball anvils: 2 p. KS-
ZM3-K-2,000



DECISION TREE



MU	Mechanical indicator
MDU-M	Digital indicator with min.-detection
MH6-	Standard indicator holder e.g. MH6-51
MH6-73-R	Indicator holder with gauging pressure retraction
TV	Depth extension TV8
TA	Depth Stop TA8-..for clamping on TV (only in combination with TV8)
MST	Checking stands (also with floating holder SH-T). With SH-T as an option for better centering with larger components
T-ZM	Split ball for gear gauging



DIATEST Tip
BMD for gear gauging,
see page 11

MK-ZM6 AND MK-ZM7

From dimensions between balls $M_i=26.0$ mm you can use the plunger probe system. Plunger probes MK-ZM6 and MK-ZM7 are equipped with a live (KT-ZM-...) and a fixed measuring contact (KS-ZM67-...). They are assembled to the required dimension M_i using extensions (ZS-A to ZS-E-Plus) and by fitting ball anvils of different lengths (KS-ZM67-0 to KS-ZM67-4).



DIATEST Tip

The use of a digital indicator capturing the min.-value facilitates the reading of the absolute measured value. The measured data can be transmitted to a peripheral by cable or by radio.



MK-ZM6 UND MK-ZM7

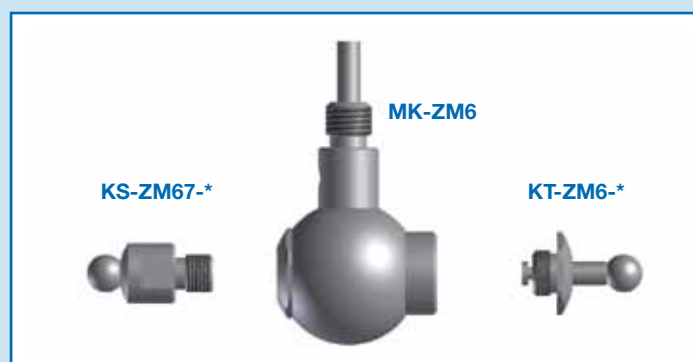
MK-ZM6 AND MK-ZM7

ZM6

Dimension - Mi (mm metric)	Ball anvil KS-ZM67-(?)-*				Extension ZS-*		
26,0 - 29,0	1						
28,5 - 31,5		2					
31,0 - 34,0			3				
33,5 - 36,5				4			
36,0 - 39,0	1				A		
38,5 - 41,5		2			A		
41,0 - 44,0			3		A		
43,5 - 46,5				4	A		
46,0 - 49,0	1					B	
47,0 - 60,0				0			
48,5 - 51,5		2				B	
51,0 - 54,0			3			B	
53,5 - 56,5				4		B	
56,0 - 59,0	1				A	B	
57,0 - 70,0				0	A		
58,5 - 61,5		2			A	B	
61,0 - 64,0			3		A	B	
63,5 - 66,5				4	A	B	
66,0 - 69,0	1						C
67,0 - 80,0				0		B	
68,5 - 71,5		2					C
71,0 - 74,0			3				C
73,5 - 76,5				4			C
76,0 - 79,0	1				A		C
77,0 - 90,0				0	A	B	
78,5 - 81,5		2			A		C
81,0 - 84,0			3		A		C
83,5 - 86,5				4	A		C
86,0 - 89,0	1					B	C
87,0 - 100,0				0			C
88,5 - 91,5		2				B	C
91,0 - 94,0			3			B	C
93,5 - 96,5				4		B	C
96,0 - 99,0	1				A	B	C
97,0 - 110,0				0	A		C
98,5 - 101,5		2			A	B	C
101,0 - 104,0			3		A	B	C
103,5 - 106,5				4	A	B	C
107,0 - 120,0				0		B	C
117,0 - 130,0				0	A	B	C

ZM7

Dimension - Mi (mm metric)	Ball anvil KS-ZM67-(?)-*				Extension ZS-*		
48,5 - 51,5	1						
51,0 - 54,0		2					
53,5 - 56,5			3				
56,0 - 59,0				4			
58,5 - 61,5	1				A		
61,0 - 64,0		2			A		
63,5 - 66,5			3		A		
66,0 - 69,0				4	A		
68,5 - 71,5	1					B	
70,0 - 83,0				0			
71,0 - 74,0		2				B	
73,5 - 76,5			3			B	
76,0 - 79,0				4		B	
78,5 - 81,5	1				A	B	
80,0 - 93,0				0	A		
81,0 - 84,0		2			A	B	
83,5 - 86,5			3		A	B	
86,0 - 89,0				4	A	B	
88,5 - 91,5	1						C
90,0 - 103,0				0		B	
91,0 - 94,0		2					C
93,5 - 96,5			3				C
96,0 - 99,0				4			C
98,5 - 101,5	1				A		C
100,0 - 113,0				0	A	B	
101,0 - 104,0		2			A		C
103,5 - 106,5			3		A		C
106,0 - 109,0				4	A		C
108,5 - 111,5	1					B	C
110,0 - 123,0				0			C
111,0 - 114,0		2				B	C
113,5 - 116,5			3			B	C
116,0 - 119,0				4		B	C
118,5 - 121,5	1				A	B	C
120,0 - 133,0				0	A		C
121,0 - 124,0		2			A	B	C
123,5 - 126,5			3		A	B	C
126,0 - 129,0				4	A	B	C
128,5 - 131,5	1						D
130,0 - 143,0				0		B	C
131,0 - 134,0		2					D
133,5 - 136,5			3				D
136,0 - 139,0				4			D
138,5 - 141,5	1				A		D
140,0 - 153,0				0	A	B	C
141,0 - 144,0		2			A		D
143,5 - 146,5			3		A		D
146,0 - 149,0				4	A		D
148,5 - 151,5	1						E
150,0 - 163,0				0			D
151,0 - 154,0		2					E
153,5 - 156,5			3				E
156,0 - 159,0				4			E
158,5 - 161,5	1				A		E



MK-ZM6 UND MK-ZM7

MK-ZM6 AND MK-ZM7

ZM7

Dimension - Mi (mm metric)	Ball anvil KS-ZM67-(?)-*				Extension ZS-*			
160,0 - 173,0				0	A			D
161,0 - 164,0		2			A			E
163,5 - 166,5			3		A			E
166,0 - 169,0				4	A			E
168,5 - 171,5	1					B		E
170,0 - 183,0				0				E
171,0 - 174,0		2				B		E
173,5 - 176,5			3			B		E
176,0 - 179,0				4		B		E
178,5 - 181,5	1				A	B		E
180,0 - 193,0				0	A			E
181,0 - 184,0		2			A	B		E
183,5 - 186,5			3		A	B		E
186,0 - 189,0				4	A	B		E
188,5 - 191,5	1						C	E
190,0 - 203,0				0		B		E
191,0 - 194,0		2					C	E
193,5 - 196,5			3				C	E
196,0 - 199,0				4			C	E
198,5 - 201,5	1				A		C	E
200,0 - 213,0				0	A	B		E
201,0 - 204,0		2			A		C	E
203,5 - 206,5			3		A		C	E
206,0 - 209,0				4	A		C	E
208,5 - 211,5	1					B	C	E
210,0 - 223,0				0			C	E
211,0 - 214,0		2				B	C	E
213,5 - 216,5			3			B	C	E
216,0 - 219,0				4		B	C	E
218,5 - 221,5	1				A	B	C	E
220,0 - 233,0				0	A		C	E
221,0 - 224,0		2			A	B	C	E
223,5 - 226,5			3		A	B	C	E
226,0 - 229,0				4	A	B	C	E
228,5 - 231,5	1						D	E
230,0 - 243,0				0		B	C	E
231,0 - 234,0		2					D	E
233,5 - 236,5			3				D	E
236,0 - 239,0				4			D	E
238,5 - 241,5	1				A		D	E
240,0 - 253,0				0	A	B	C	E
241,0 - 244,0		2			A		D	E
243,5 - 246,5			3		A		D	E
246,0 - 249,0				4	A		D	E
248,5 - 251,5	1					B	D	E
250,0 - 263,0				0			D	E
251,0 - 254,0		2				B	D	E
253,5 - 256,5			3			B	D	E
256,0 - 259,0				4		B	D	E
258,5 - 261,5	1				A	B	D	E
260,0 - 273,0				0	A		D	E
261,0 - 264,0		2			A	B	D	E
263,5 - 266,5			3		A	B	D	E
266,0 - 269,0				4	A	B	D	E

ZM7

Dimension - Mi (mm metric)	Ball anvil KS-ZM67-(?)-*				Extension ZS-*			
268,5 - 271,5	1						C	D
270,0 - 283,0				0		B		D
271,0 - 274,0		2					C	D
273,5 - 276,5			3				C	D
276,0 - 279,0				4			C	D
278,5 - 281,5	1				A		C	D
280,0 - 293,0				0	A	B		D
281,0 - 284,0		2			A		C	D
283,5 - 286,5			3		A		C	D
286,0 - 289,0				4	A		C	D
288,5 - 291,5	1					B	C	D
290,0 - 303,0				0			C	D
291,0 - 294,0		2				B	C	D
293,5 - 296,5			3			B	C	D
296,0 - 299,0				4		B	C	D
298,5 - 301,5	1				A	B	C	D
300,0 - 313,0				0	A		C	D
301,0 - 304,0		2			A	B	C	D
303,5 - 306,5			3		A	B	C	D
306,0 - 309,0				4	A	B	C	D
310,0 - 323,0				0		B	C	D
320,0 - 333,0				0	A	B	C	D

Examples

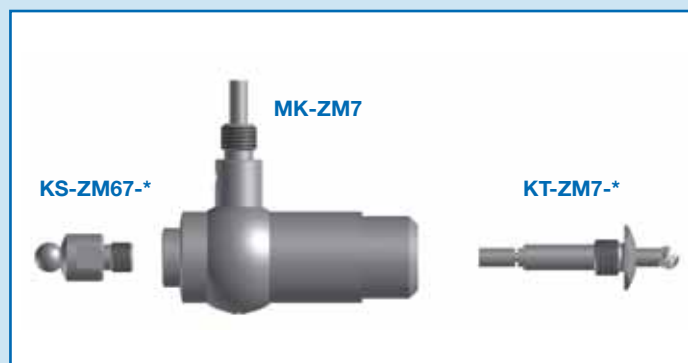
- a) Mi=48 mm, ball-Ø = 6,000 mm
for Mi=48,0 - 49,0 mm you require:
- **MK-ZM-6** Gauge Head Ball
 - **Plunger**
KT-ZM-6-6,000 ball-Ø) Ball Anvil
 - **KS-ZM-67-1-6,000** ball-Ø)

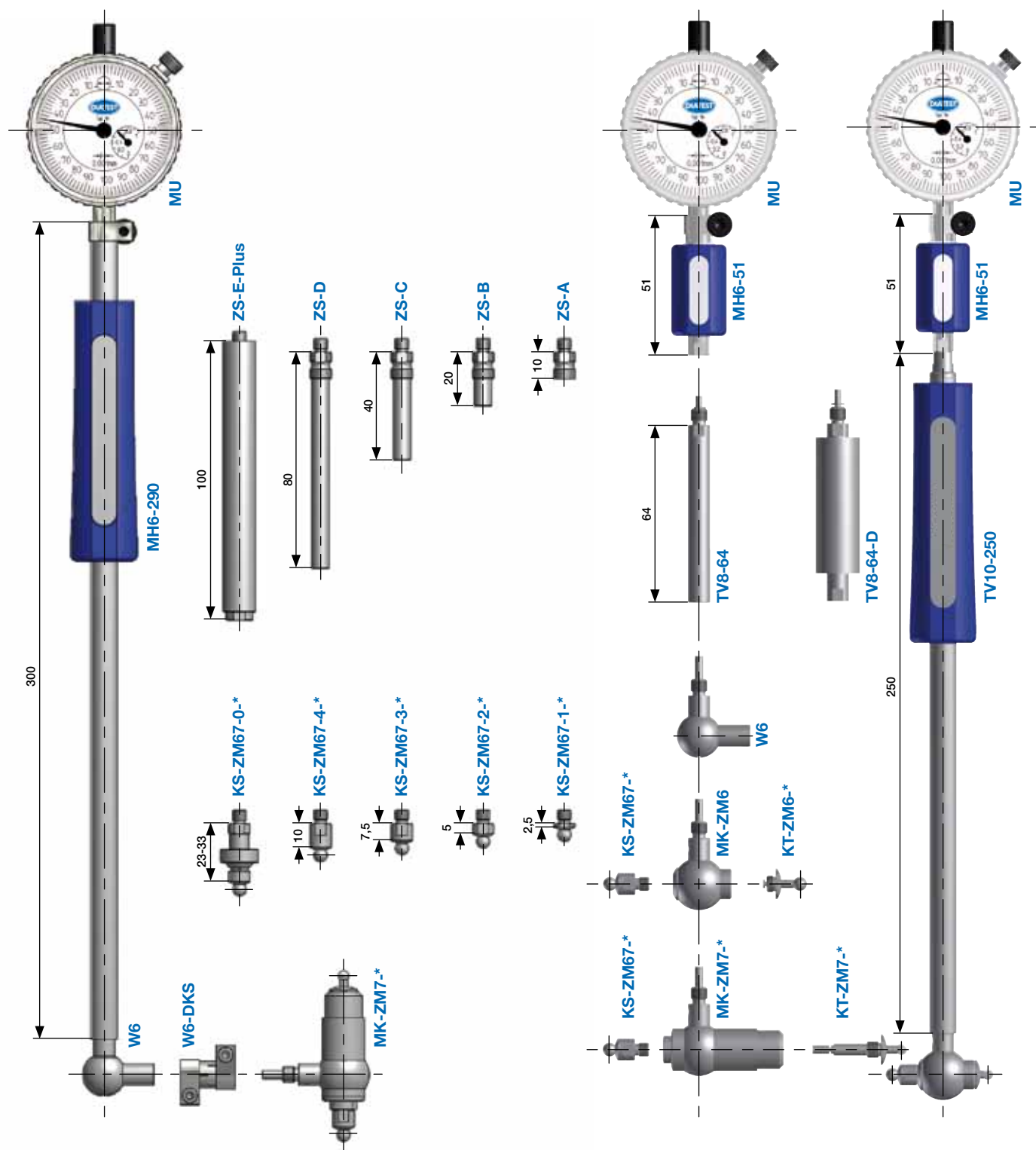
■ **ZS-B** Extension

- b) Mi=192 mm, ball-Ø = 9,000 mm
Für/for Mi=191,0 - 194,0 mm you require:
- **MK-ZM-7** Gauge Head Ball
 - **Plunger**
KT-ZM-7-9,000 (ball-Ø)
 - **Ball Anvil**
KS-ZM-67-2-9,000 (ball-Ø)

Extension

ZS-C & ZS-E-Plus





BMD-IV

BMD-IV

BMD-IV

BMD-IV are especially designed for large series. The guiding cylinder eliminates the search for the reversal point. The nominal size of the guiding cylinder matches the minor diameter of the internal gear. Guide noses avoid twisting of the BMD in the component.

For quotation purposes we require the dimension between balls (Mi), the ball diameter, the number of teeth and the minor diameter of the gear with tolerance.

Types: S and D, special cylinder from Ø 10 mm.

PLEASE NOTE: With order we require a Go component or a fully geared setting master.



OUTSIDE DIAMETER GAUGES AV, EG



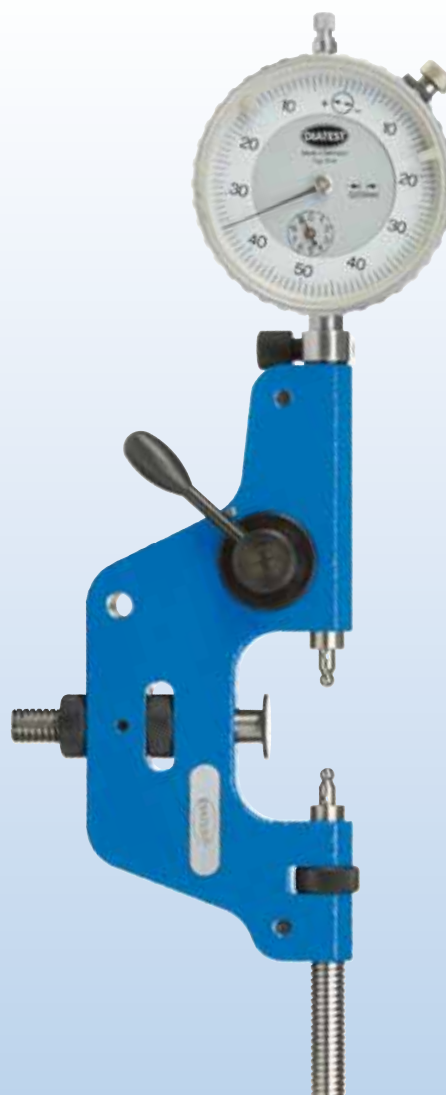
External gear gauge AV

(closed ring); dimension over balls $Ma=10-140$ mm

Range	Order Code
$Ma=10-40$	AV40
$Ma=30-60$	AV60
$Ma=50-80$	AV80
$Ma=70-100$	AV100
$Ma=90-120$	AV120
$Ma=110-140$	AV140

Add a ball plunger KT-ZM7-ball $\emptyset$ and a ball anvil KS-ZM67-2-ball $\emptyset$ to the basic device.

AV gauges with Ma over 140 mm on request.



External gear gauge EG

(open version); dimension over balls $Ma=10-140$ mm

Range	Order Code
$Ma=0-30$	EG30
$Ma=0-70$	EG70
$Ma=30-70$	EG30-70
$Ma=70-140$	EG70-140
Mess-Stativ für EG (optional)	MST-EG

Add 2 pieces KS-MU-ball $\emptyset$ to the basic device. EG gauges with Ma over 140 mm or EG gauges with roller anvils on request.

SPEZIAL MEASURING INSERTS

For many applications specially shaped ball or roller anvils are required for e.g. measuring devices, hand-held measuring instruments etc. The measuring balls or roller anvils are made of carbide.

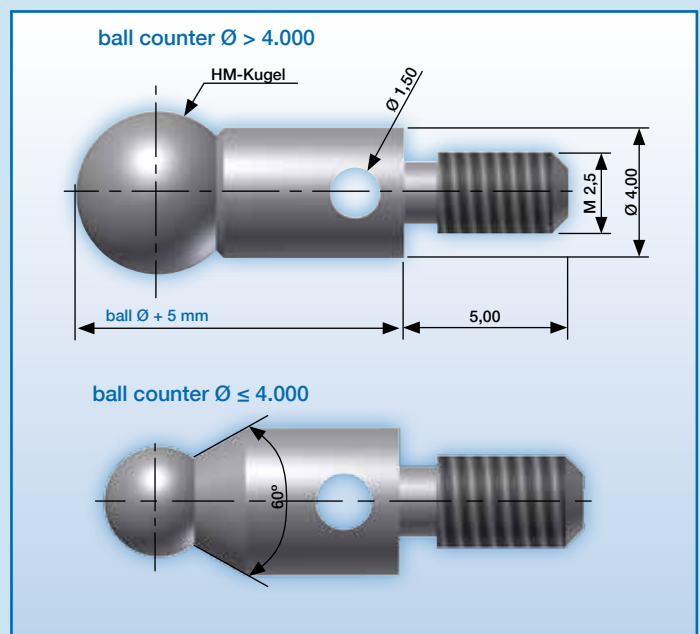
Tolerance of the measuring ball: $\pm 0.001 \text{ mm}$

Tolerance of roller anvil: h6 (more precise on request)



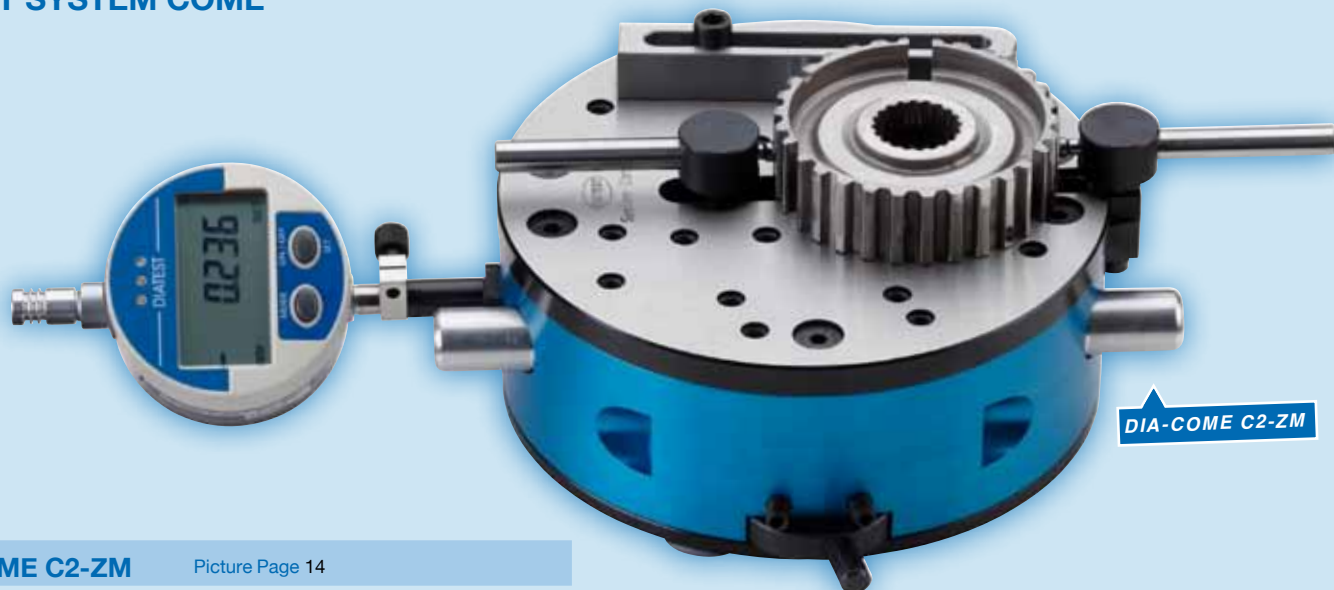
STANDARD MEASURING INSERT WITH BALL

The ball anvil KS-MU is suited for use in e.g. dial indicators and measuring devices. The connection thread M2.5 can be directly screwed onto most dial indicators. The carbide balls have a tolerance of $\pm 0.001 \text{ mm}$.



DIA-TEST SYSTEM COME

DIA-TEST SYSTEM COME



DIA-COME C2-ZM

Picture Page 14

Range of basic gauge	Mi=70 – 120 mm	Ma=0 – 80 mm
Content of basic gauge	Measuring table with 2 supports for ball pins, 1 stop bar <i>Additionally required: 2 ball pins (indicate Ø of balls)</i>	
C2-ZM Kit 1	Mi=18 – 120 mm	Ma=0 – 80 mm
Small work pieces Accessories to basic gauge	1 support for adaptor; 2 adaptors for ball anvil holder; 2 support tables for small work pieces <i>Additionally required: 2 KS-ZM3-Ø (indicate Ø of balls)</i>	
C2-ZM Kit 2	Mi=70 – 120 mm	Ma=0 – 80 mm
High work pieces Accessories to basic gauge	2 x long supports for ball pins	
C2-ZM Kit 3	Mi=70 – 120 mm	Ma=0 – 80 mm
Stop adjustable in height Accessories to basic gauge	1 x basic part; 1 x stop with thread M2,5 (to screw in any type of inserts; inserts are not included!)	
C2-ZM Kit 4	Mi=70 – 120 mm	Ma=80 – 120 mm
Ball anvil support Accessories to basic gauge	2 x supports for ball anvil for e.g. KS-MU-Ø or any other insert with thread M2,5 (KS-MU is not included)	



Measurements Mi and Ma depend on length of ball pins. Standard length is 30 mm.

DIA-COME C2-ZM AL w/o Picture

Range of basic gauge	Mi=70 – 195 mm	Ma=0 – 155 mm
Content of basic gauge	Measuring table with 2 supports for ball pins, 1 stop bar Additionally required: 2 ball pins (indicate Ø of balls)	
C2-ZM Kit 1-4	As for basic gauge	

DIA-COME C2-ZM JS Picture Page 15

Range of basic gauge	Mi=70 – 275 mm	Ma=0 – 245 mm
Content of basic gauge	Measuring table with 2 supports for ball pins, 1 stop bar Additionally required: 2 ball pins (indicate Ø of balls)	
C2-ZM Kit 1-4	As for basic gauge	
C2-ZM-JS Kit 1	Mi=70 – 300 mm	Ma=0 – 275 mm
Accessories to basic gauge	Support of measuring contacts L= 110 mm	

Measuring tables DIA-COME are available in 3 different sizes. They are used to simplify measurements of internal and external gear gauges *) and will cover in total a measuring range of Mi from 11.5-300 mm and Ma from 0-275 mm. Due to its sturdy construction, the measuring tables DIA-COME are suited perfectly for use in workshops. These instruments stand out by their ease of use and flexibility. Conversion for measurement of different sizes (Mi) and to change from internal to external diameters is very fast and easy. The instrument has one fixed and one mobile measuring contact. The fixed measuring contact can be adjusted to adapt to measurements Mi or Ma. The mobile measuring contact has a measuring range of 20 mm. Travel is transferred directly 1:1 to indicator unit. Virtually all types of indicators with clamping of 8h7 may be used. You will need an indicator for external measurements to display the values correctly ! Accuracy is ± 0.002 mm.

*) The same basic gauge combined with other measuring pins is also suitable for measurement of internal and external diameters, recesses (internal and external) and conical parts.



QUALITÄTSPRODUKTE – WELTWEIT
QUALITY PRODUCTS – WORLDWIDE



**WILLRICH PRECISION
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THINK MEASUREMENT... THINK WILLRICH
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