

Gauges

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Gauges

Conventional measuring methods and instruments are not always suitable for checking tapered seats or measuring the inside or outside envelope diameter of the roller set of a cylindrical roller bearing in precision applications. Therefore, SKF has developed an assortment of gauges specially designed to take the accurate measurements necessary when mounting cylindrical roller bearings with a tapered bore. These gauges are also useful for other than precision applications.

Ring gauges in the GRA 30 series and DMB taper gauges (→ **page 392**) can be used to check the most common tapered seats. A GRA ring gauge can only be used to check a tapered seat for a particular bearing size. DMB taper gauges, however, can be used for a range of diameters, as well as for tapers other than 1:12.

To precisely adjust the radial internal clearance or preload when mounting a cylindrical roller bearing with a tapered bore, it is necessary to accurately measure the inside or outside envelope diameter of the roller set(s). SKF internal clearance gauges in the GB 30 and GB 10 series (→ **page 392**), and in the GB 49 series (→ **page 392**) enable simple and accurate measuring.

For information about other SKF measuring devices, contact the SKF application engineering service.

GRA 30 ring gauges

SKF ring gauges in the GRA 30 series (→ **fig. 1**) are typically used to check tapered shaft seats for cylindrical roller bearings in the NN 30 K series. Shaft seats for bearings in the NNU 49 BK and the N 10 K series can also be checked with a GRA 30 series gauge.

GRA 30 ring gauges are available for tapered seats with $d \leq 200$ mm. For seats with $d > 200$ mm, SKF recommends using a taper gauge (→ *DMB taper gauges*, **page 393**). Ring gauges for $d > 200$ mm would be difficult to handle because of their weight.

Measuring options

GRA 30 ring gauges are used primarily to determine the position of the tapered seat relative to a reference surface on the shaft. The reference face of a GRA 30 ring gauge is on the side of its large bore diameter. The reference surface on the shaft may be either in front of, or behind the gauging face of the ring gauge. GRA 30 ring gauges can also be used to check whether the centreline of the tapered seat is at right angles to a reference surface on the shaft. This is achieved by measuring the distance between the reference face on the ring gauge and the reference surface on the shaft at several positions around the circumference.

Taper form errors can be detected using blue dye.

Tapered seat dimensions

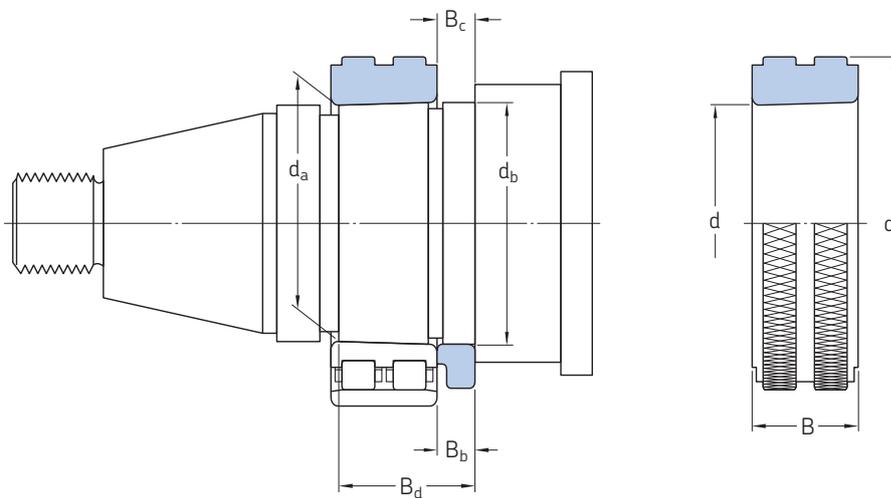
SKF recommends using the tapered seat dimensions for bearings in the NN 30 K series listed in the product tables (→ **page 393**). If other dimensions or bearing series are used, the reference length B_c should always be longer than B_b , the width of the intermediate spacer ring (→ **product table**, **page 393**). This is necessary because the bearing will be driven up further on the seat than the ring gauge, depending on the bearing internal clearance or preload that should be achieved. Therefore, always make the reference length longer than the width of the intermediate ring at least by a value corresponding to the difference $B_c - B_b$ (→ **product table**).



Fig. 1

8.1 GRA 30 ring gauges

d 25 – 200 mm



Bearing Designation	Bearing seat Dimensions				B _d	Ring gauge Dimensions			Mass	Designation	
	d _a	d _b	B _b	B _c Nom- inal		Toler- ance	d	d ₁			B
–	mm				–	mm			kg	–	
NN 3005 K	25,1	27	4	4,2	±0,1	19	25	46	16	0,13	GRA 3005
NN 3006 KTN	30,1	32	6	6,2	±0,1	24	30	52	19	0,18	GRA 3006
NN 3007 K	35,1	37	6	6,2	±0,1	25	35	57	20	0,21	GRA 3007
NN 3008 KTN	40,1	42	8	8,2	±0,1	28	40	62	21	0,26	GRA 3008
NN 3009 KTN	45,1	47	8	8,2	±0,1	30	45	67	23	0,31	GRA 3009
NN 3010 KTN	50,1	52	8	8,2	±0,1	30	50	72	23	0,34	GRA 3010
NN 3011 KTN	55,15	57	8	8,3	±0,12	32,5	55	77	26	0,42	GRA 3011
NN 3012 KTN	60,15	62	10	10,3	±0,12	34,5	60	82	26	0,45	GRA 3012
NN 3013 KTN	65,15	67	10	10,3	±0,12	34,5	65	88	26	0,51	GRA 3013
NN 3014 KTN	70,15	73	10	10,3	±0,12	38,5	70	95	30	0,69	GRA 3014
NN 3015 KTN	75,15	78	10	10,3	±0,12	38,5	75	100	30	0,73	GRA 3015
NN 3016 KTN	80,15	83	12	12,3	±0,12	44,5	80	105	34	0,88	GRA 3016
NN 3017 KTN9	85,2	88	12	12,4	±0,15	44	85	112	34	1	GRA 3017
NN 3018 KTN9	90,2	93	12	12,4	±0,15	47	90	120	37	1,3	GRA 3018
NN 3019 KTN9	95,2	98	12	12,4	±0,15	47	95	128	37	1,55	GRA 3019
NN 3020 KTN9	100,2	103	12	12,4	±0,15	47	100	135	37	1,7	GRA 3020
NN 3021 KTN9	105,2	109	12	12,4	±0,15	51	105	142	41	2,1	GRA 3021
NN 3022 KTN9	110,25	114	12	12,5	±0,15	54,5	110	150	45	2,6	GRA 3022
NN 3024 KTN9	120,25	124	15	15,5	±0,15	58,5	120	162	46	3,05	GRA 3024
NN 3026 KTN9	130,25	135	15	15,5	±0,15	64,5	130	175	52	3,95	GRA 3026

Bearing Designation	Bearing seat Dimensions					B _d	Ring gauge Dimensions			Mass	Designation
	d _a	d _b	B _b	B _c Nom- inal	Toler- ance		d	d ₁	B		
-	mm						mm			kg	-
NN 3028 K	140,3	145	15	15,6	±0,15	65	140	188	53	4,75	GRA 3028
NN 3030 K	150,3	155	15	15,6	±0,15	68	150	200	56	5,6	GRA 3030
NN 3032 K	160,3	165	15	15,6	±0,15	72	160	215	60	6,8	GRA 3032
NN 3034 K	170,3	176	15	15,6	±0,15	79	170	230	67	8,8	GRA 3034
NN 3036 K	180,35	187	20	20,7	±0,15	90,5	180	245	74	11,5	GRA 3036
NN 3038 K	190,35	197	20	20,7	±0,18	91,5	190	260	75	13	GRA 3038
NN 3040 K	200,35	207	20	20,7	±0,18	98,5	200	270	82	15	GRA 3040

Gauges

DMB taper gauges

SKF taper gauges in the DMB series enable a quick and accurate check of the diameter and the angle of external tapers. They are suitable for final checks as well as for intermediate checks during machining. DMB taper gauges are available for tapered seats from $d = 40$ to 360 mm.

DMB taper gauges (\rightarrow **fig. 2**) consist of:

- two saddles (**a**), firmly joined together at a fixed distance
- a gauge pin (**b**), positioned in each of the saddles
- two adjustable radial stops (**c** and **d**), in each saddle at 90° intervals from the gauge pin
- an axial stop (**e**) to locate the gauge axially on the taper

The gauge pins and the radial stops can be set to measure any taper angle between 0° and 6° and any diameter within the range of the gauge. Markings on the scales show the settings for 1:12 and 1:30 tapers.

As standard, DMB taper gauges are supplied together with two dial indicators. Tailored reference tapers can be supplied on request.

Measuring

Set the radial stops and straight edges of the gauge pins to the desired diameter and taper angle, using the scales. Then, adjust the axial stop on the taper to be measured. Put the gauge on a reference taper and set the dials to zero. The gauge is now ready to take measurements.

To take a measurement, put the DMB taper gauge on the taper to be measured, making sure that it is up against the axial stop. Then take a reading. The readings on the dials are the diameter deviations. A difference in the readings between the two dials indicates a deviation in the taper angle.

While measuring, the gauge should be inclined at about 10° from the horizontal plane (\rightarrow **fig. 3**). In this position, the gauge is located on the taper by the radial and axial stops.

Accuracy

The measuring accuracy of DMB taper gauges is within $1 \mu\text{m}$ for $d < 280$ mm and within $1,5 \mu\text{m}$ for $d \geq 280$ mm.

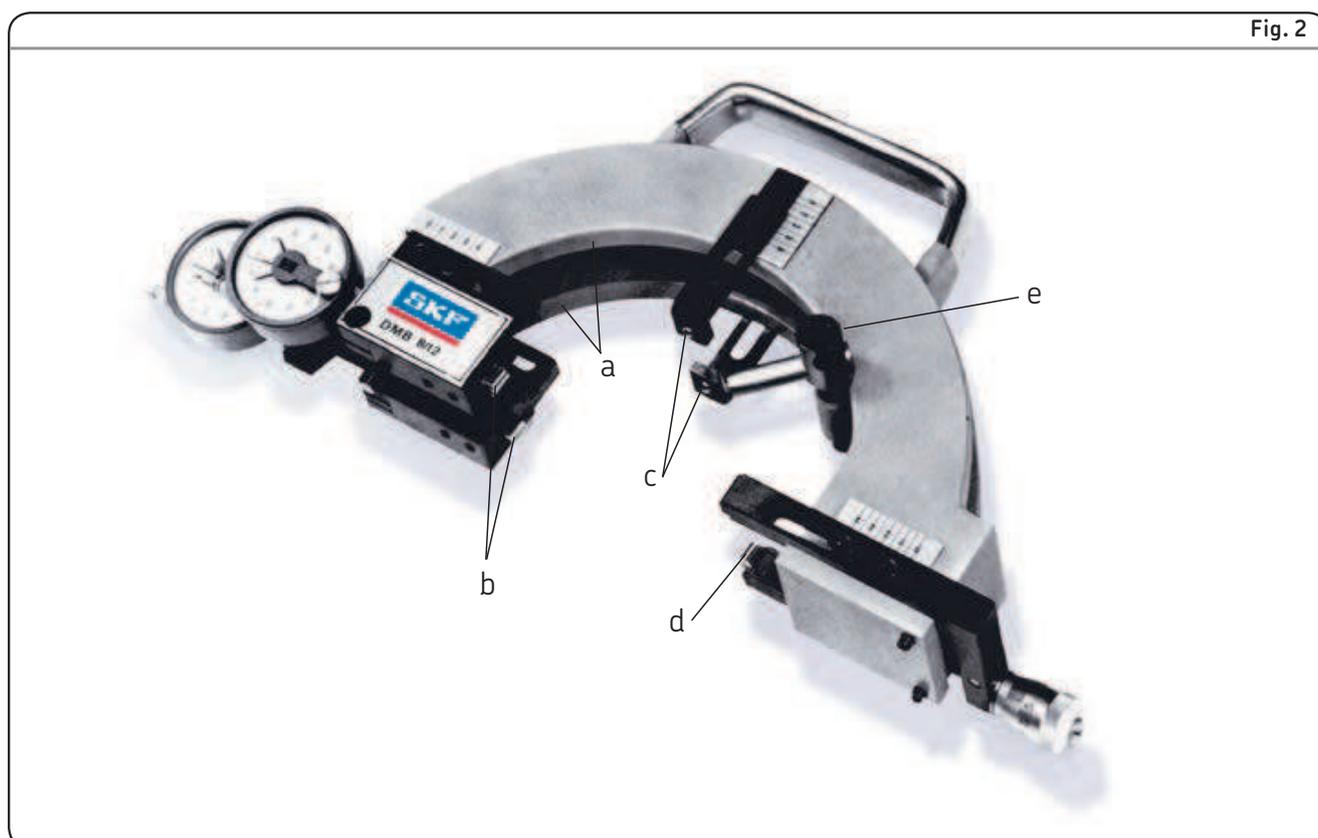
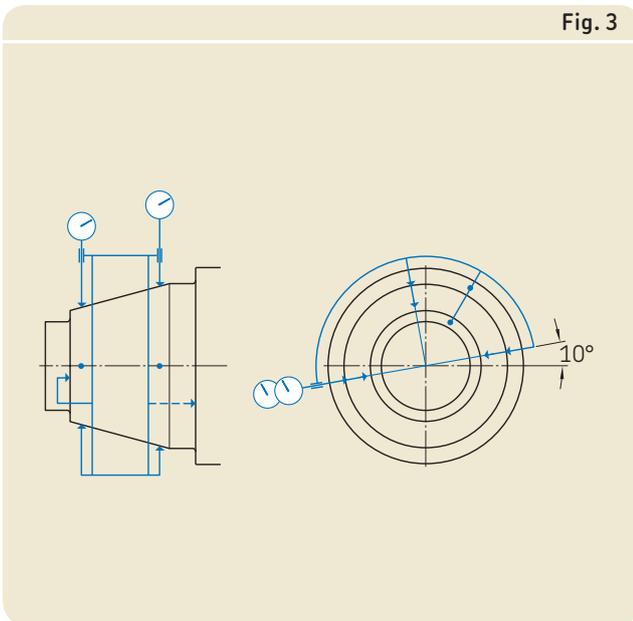
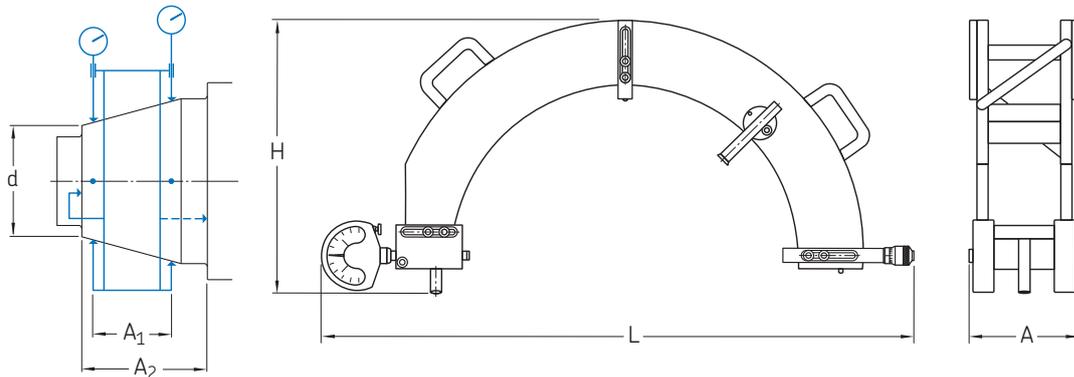


Fig. 2

Fig. 3



8.2 DMB taper gauges
d 40 – 360 mm



Taper Diameter		Taper gauge Dimensions					Mass	Designation
d from	to	A	A ₁	A ₂	H	L		
mm		mm					kg	-
40	55	36	18	28	140	320	2,5	DMB 4/5,5
50	85	38	20	30	160	350	2,5	DMB 5/8,5
80	120	48	30	40	190	380	3	DMB 8/12
120	160	58	40	50	190	425	3,5	DMB 12/16
160	200	74	50	64	190	465	4,5	DMB 16/20
200	240	84	60	74	215	505	5,5	DMB 20/24
240	280	99	75	89	240	540	7	DMB 24/28
280	320	114	90	104	265	590	8,5	DMB 28/30
320	360	114	90	104	290	640	10	DMB 32/36

Gauges

GB 30 and GB 10 internal clearance gauges

SKF internal clearance gauges in the GB 30 and GB 10 series are designed for use with double row cylindrical roller bearings ranging from NN 3006 K to NN 3068 K (GB 30 gauges) and for use with single row cylindrical roller bearings ranging from N 1010 K to NN 1020 K (GB 10 gauges). In general, gauges in the GB 30 series can also be used for single row bearings in the N 10 K series. GB 30 and GB 10 internal clearance gauges are able to accurately measure the outside envelope diameter of the roller set when the rollers are in contact with the inner ring raceway.

Depending on their size, GB 30 and GB 10 internal clearance gauges consist of either a two piece or a slotted gauge body that holds two diametrically opposed ground gauging zones (→ **fig. 4**). The gauge body can be expanded by means of an adjustment screw. This enables the gauge to be pushed over the

inner ring with roller and cage assembly, without damaging the rollers or the gauging zones. The gauging zone that is connected to one half of the gauge body transmits the diameter measured by both gauging zones to a dial indicator.

Fig. 4GB 3006 ... GB 3020
GB 1010 ... GB 1020

GB 3021 ... GB 3068

GB 30 and GB 10 internal clearance gauges

Gauging

The typical gauging procedure:

- 1 Set a bore gauge to the raceway diameter of the mounted outer ring and zero the dial indicator.
- 2 Place the bore gauge in the centre of the gauging zone of the GB 30 or GB 10 gauge. Adjust the GB 30 or GB 10 gauge until the bore gauge indicates zero minus the correction value listed in the GB 30 or GB 10 user instructions.
- 3 Further adjust the GB 30 or GB 10 gauge by increasing the gauge dimension by the value of the desired preload or reduce it by the desired clearance. Zero the dial indicator on the GB 30 or GB 10.
- 4 Place the bearing inner ring and roller set assembly onto the tapered shaft seat. Place the GB 30 or GB 10 gauge over the rollers and drive the inner ring up on the tapered seat until the dial indicator on the GB 30 or GB 10 reads zero.

For additional information, refer to *Mounting* on **page 401**.

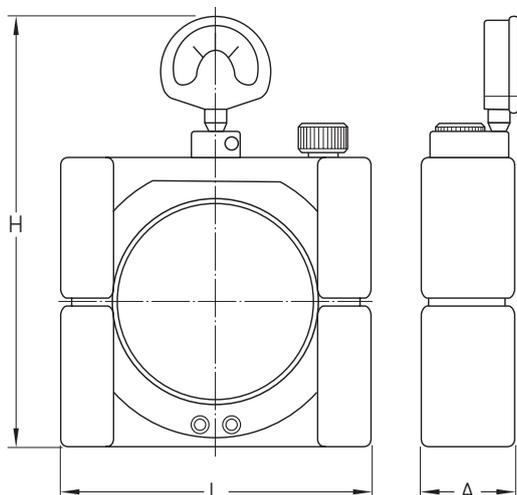
Accuracy

The accuracy of GB 30 and GB 10 gauges is within 1 μm for sizes ≤ 20 (GB 3006 to GB 3020 and GB 1010 to GB 1020) and within 2 μm for sizes ≥ 21 (GB 3021 to GB 3068).

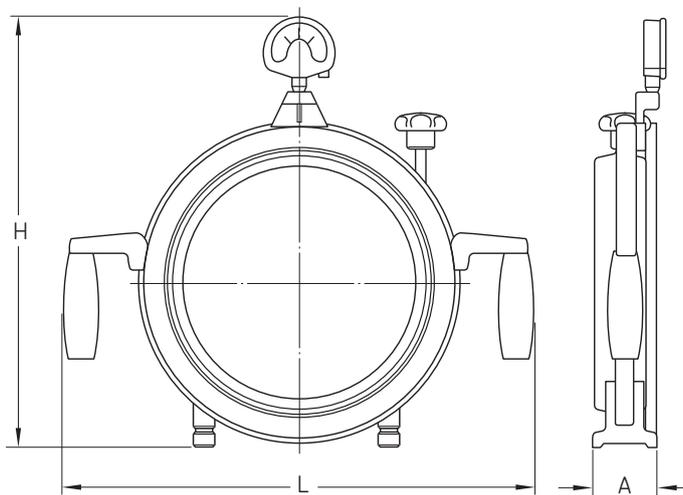
8.3 GB 30 and GB 10 internal clearance gauges for cylindrical roller bearings

NN 3006 KTN – NN 3068 K

N 1010 K – N 1020 K



GB 3006 ... GB 3020
GB 1010 ... GB 1020



GB 3021 ... GB 3068

Bearing Designation	Internal clearance gauge Dimensions			Mass	Designation
	L	H	A		
–	mm			kg	–
NN 3006 KTN	107	175	36	2	GB 3006
NN 3007 K	112	180	37	2	GB 3007
NN 3008 KTN	117	185	39	2	GB 3008
NN 3009 KTN	129	197	40	2,5	GB 3009
NN 3010 KTN N 1010 K	134 134	202 207	40 33	2,5 2	GB 3010 GB 1010
NN 3011 KTN N 1011 K	144 144	212 217	43 35	3,5 2,3	GB 3011 GB 1011
NN 3012 KTN N 1012 K	152 152	222 225	44 36	4 2,7	GB 3012 GB 1012
NN 3013 KTN N 1013 K	157 157	225 230	44 36	4 3	GB 3013 GB 1013
NN 3014 KTN N 1014 K	164 164	232 237	48 38	5 3,2	GB 3014 GB 1014
NN 3015 KTN N 1015 K	168 168	236 241	48 38	5 3,4	GB 3015 GB 1015
NN 3016 KTN N 1016 K	176 176	244 249	52 40	6 4	GB 3016 GB 1016
NN 3017 KTN9 N 1017 K	185 185	253 258	53 41	6,5 4,5	GB 3017 GB 1017
NN 3018 KTN9 N 1018 K	198 198	266 271	56 43	8 5,5	GB 3018 GB 1018
NN 3019 KTN9 N 1019 K	203 203	271 276	56 43	9 5,8	GB 3019 GB 1019
NN 3020 KTN9 N 1020 K	212 212	280 285	56 43	9 6,5	GB 3020 GB 1020

Bearing Designation	Internal clearance gauge Dimensions			Mass	Designation
	L	H	A		
-	mm			kg	-
NN 3021 KTN9	322	350	46	10,5	GB 3021
NN 3022 KTN9	332	362	46	11	GB 3022
NN 3024 KTN9	342	376	48	12	GB 3024
NN 3026 KTN9	364	396	54	13	GB 3026
NN 3028 K	378	410	54	14,5	GB 3028
NN 3030 K	391	426	58	15	GB 3030
NN 3032 K	414	446	60	16	GB 3032
NN 3034 K	430	464	62	17	GB 3034
NN 3036 K	454	490	70	17,5	GB 3036
NN 3038 K	468	504	70	18	GB 3038
NN 3040 K	488	520	74	19	GB 3040
NN 3044 K	575	514	85	26	GB 3044
NN 3048 K	605	534	87	28	GB 3048
NN 3052 K	654	580	104	41	GB 3052
NN 3056 K	680	607	106	45	GB 3056
NN 3064 K	725	640	122	60	GB 3064
NN 3068 K	738	665	122	64	GB 3068

Gauges

GB 49 internal clearance gauges

SKF internal clearance gauges in the GB 49 series are designed for use with double row cylindrical roller bearings ranging from NNU 4920 BK to NNU 4960 BK. GB 49 series internal clearance gauges are able to accurately measure the internal envelope diameter of the roller set when the rollers are in contact with the outer ring raceway.

Depending on their size, GB 49 internal clearance gauges are available in two different designs (→ **fig. 5**). They have a slotted gauge body, so that both gauging ring halves can be brought to bear on the roller set with the appropriate pressure, as a result of the inherent resilience of the material. The outside cylindrical surface of the gauging ring has two diametrically opposed ground gauging zones. The gauge body can be compressed by means of an adjustment screw. This enables the gauge to be positioned inside the roller set

without damaging the rollers or the gauging zones.

Fig. 5



GB 4920 ... GB 4938

GB 4940 ... GB 4960

GB 49 internal clearance gauges

Gauging

The typical gauging procedure:

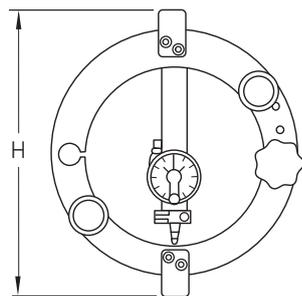
- 1 Insert the GB 49 gauge in the outer ring and roller assembly and loosen the adjustment screw until the two gauging ring halves are in contact with the roller set.
- 2 Set the dial indicator on the GB 49 gauge to zero.
- 3 Compress GB 49 using adjustment screw and remove from outer ring assembly.
- 4 Reset GB 49 so that dial indicator reads zero again using adjustment screw.
- 5 Set a stirrup gauge to GB 49 gauge diameter setting the stirrup gauge dial indicator to zero.
- 6 Drive the inner ring up onto its tapered seat monitoring the diameter expansion with the stirrup gauge until the dial indicator reads zero plus the desired preload or zero minus the desired clearance.

For additional information, refer to *Mounting* on **page 405**.

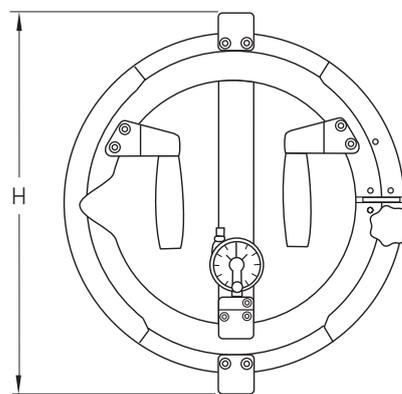
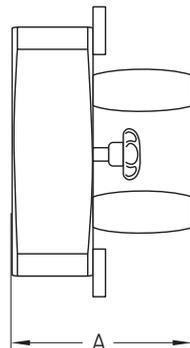
Accuracy

The accuracy of GB 49 gauges is within 1 μm for sizes ≤ 38 (GB 4920 to GB 4938) and within 2 μm for sizes ≥ 40 (GB 4940 to GB 4960).

8.4 GB 49 internal clearance gauges for cylindrical roller bearings
NNU 4920 BK/SPW33 – NNU 4960 BK/SPW33



GB 4920 ... GB 4938



GB 4940 ... GB 4960

Bearing Designation	Internal clearance gauge Dimensions		Mass	Designation
	A	H		
–	mm		kg	–
NNU 4920 BK/SPW33	128	138	2,5	GB 4920
NNU 4921 BK/SPW33	128	143	3	GB 4921
NNU 4922 BK/SPW33	128	148	3	GB 4922
NNU 4924 BK/SPW33	133	162	3,5	GB 4924
NNU 4926 BK/SPW33	138	176	4	GB 4926
NNU 4928 BK/SPW33	138	186	4,5	GB 4928
NNU 4930 BK/SPW33	148	204	6	GB 4930
NNU 4932 BK/SPW33	148	212	6,5	GB 4932
NNU 4934 BK/SPW33	148	224	8	GB 4934
NNU 4936 BK/SPW33	157	237	9,5	GB 4936
NNU 4938 BK/SPW33	157	248	10,5	GB 4938
NNU 4940 BK/SPW33	105	263	12	GB 4940
NNU 4944 BK/SPW33	105	283	13	GB 4944
NNU 4948 BK/SPW33	105	303	14	GB 4948
NNU 4952 BK/SPW33	120	340	15	GB 4952
NNU 4956 BK/SPW33	120	360	17	GB 4956
NNU 4960 BK/SPW33	135	387	19	GB 4960

