Triple row axial angular contact ball bearings

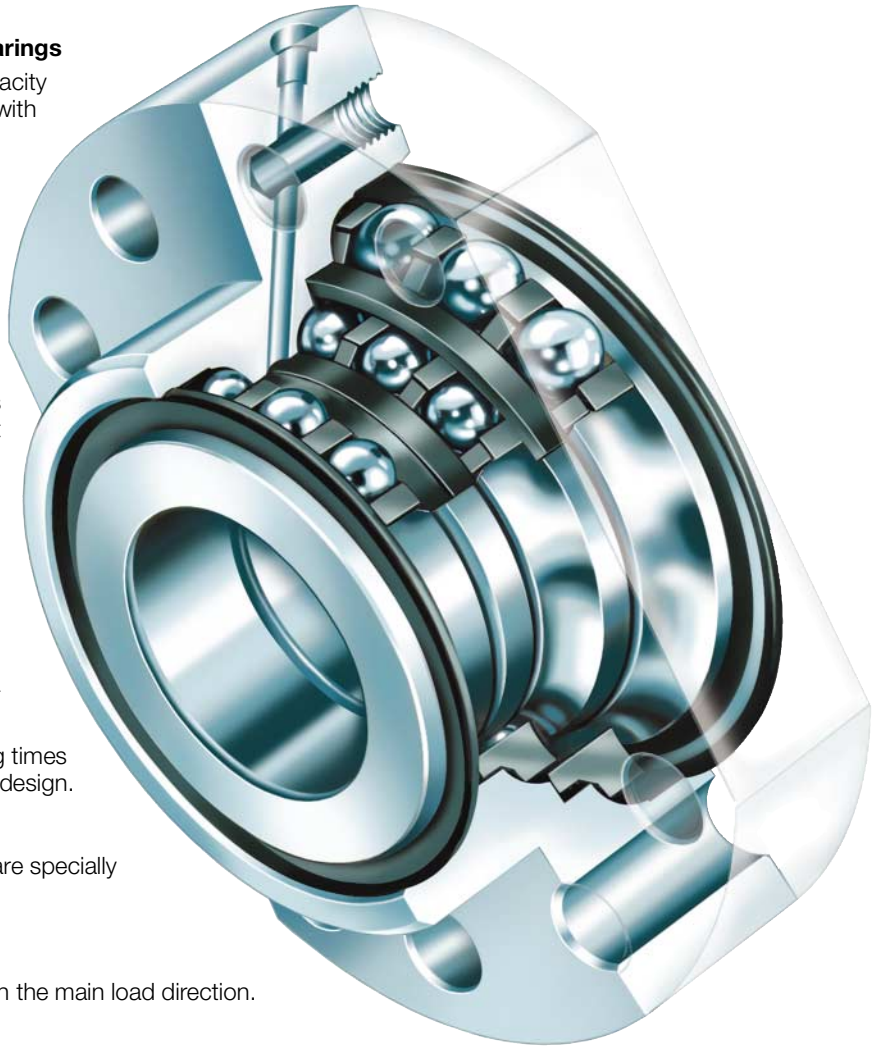
Series DKLFA

Heavy Series

Features

Bearings of series DKLFA with a bore diameter of 30 mm and 40 mm are available in a *Heavy series*.

This allows the user to achieve significant increases in screw drive performance while retaining the same nominal diameter of the threaded spindle.



Advantages of the ready-to-fit bearings

- Almost twice the load carrying capacity compared to the standard design with the same bore diameter
- Higher rigidity than conventional bearing arrangement designs.

DKLFA bearings of the *Heavy series* permit:

- support of significantly higher acceleration and machining forces with the same threaded spindle nominal diameter
- support of even higher inertia forces in vertical linear axes without weight counterbalance
- a significant increase in operational reliability in tensioned screw drives
- higher quality, more precise machining due to increased axis rigidity.

This gives the user competitive advantages arising from:

- quicker and more productive linear axes in machines
- reduced costs due to shorter fitting times and simpler adjacent construction design.

Preferred areas of application

Bearings of the DKLFA *Heavy series* are specially designed for:

- tensioned screw drives
- vertically arranged screw drives
- applications with continuous load in the main load direction.

Triple row axial angular contact ball bearings

Series DKLFA

Double direction, triple row axial angular contact ball bearings of series DKLFA consist of two rows of balls with a 60° contact angle in an “O” arrangement as well as an extra row of balls. This allows higher axial loads to be supported in one direction only.

Due to the stepped outer ring, the bearing can be easily flange mounted on the adjacent construction. The flanged part of the ring has two flattened areas, which reduces the radial section height required.

The bearings have contact seals on both sides and are grease lubricated for life in the majority of applications. Additional sealing in the adjacent construction is not required.

In most applications, the initial grease lubrication is sufficient for the whole operating life. If relubrication is necessary, however, this can be carried out via a threaded connector on the flange side for a central lubrication system or a lubrication groove and lubrication hole through the adjacent construction.

The runout tolerance is within P5 according to DIN 620.

Heavy series

The increased basic load ratings in comparison with the standard series (Figure 1) allow improved operational reliability in tensioned screw drives. Normally, the maximum operating life of tensioned screw drives is achieved only if the operating temperature corresponds to the values taken as assumptions in the design of the screw drive. Even relatively small changes in temperature have an effect on the bearing life.

This is illustrated by the diagram in Figure 2. It shows, using an example calculation, the bearing life curve as a function of design parameters such as tensioning and the anticipated operating temperature.

The lower curve (DKLFA standard series) shows that the maximum achievable life of approx. 19 000 h for a screw drive can be reduced to 5 000 h if, due to the operating conditions, it does not undergo heating. In such cases, the *Heavy series* offers significantly greater reserves. In the example calculation (upper curve), an operating life of 15 000 h would be achieved even for the most unfavourable case.

Bearings of the *Heavy series* thus permit higher operational reliability in screw drives with a locating/locating bearing arrangement.

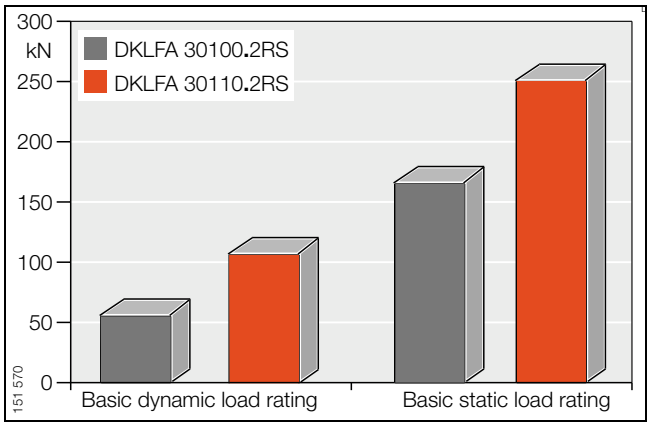


Figure 1 · Load carrying capacity in main load direction – comparison of standard design/*Heavy series*

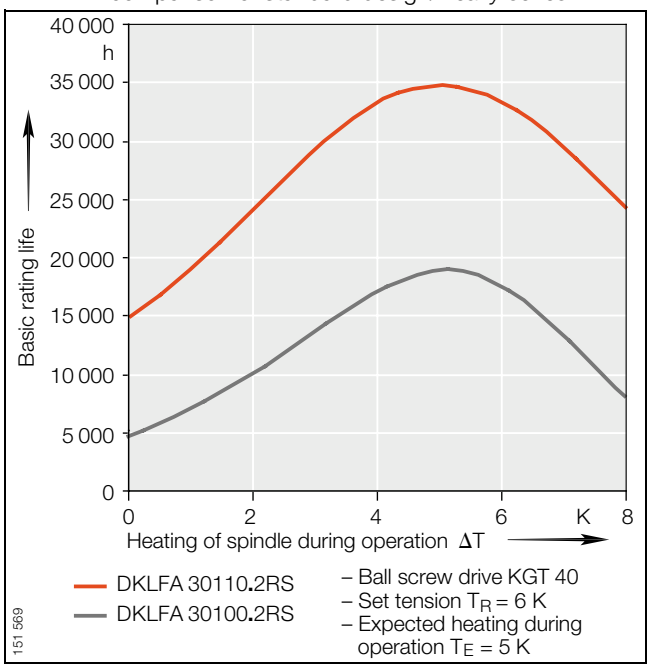


Figure 2 · Influence of actual operating temperature on basic rating life

Further information on bearings of series DKLFA is given in *INA publication “ZAE”* and *INA Technical Product Information “TPI 100”*!

Application example

HSC machining centre

Screw drive bearing arrangement of vertical axis

In order to increase the efficiency of machining processes based on cutting, non-productive operating times must be reduced further. This places high demands on the screw drive bearing arrangements in the vertical linear axes. Due to the continuously increasing acceleration capacity of the linear axes, the bearing arrangement must support not only the machining forces and the weight of the machine table but also extremely high mass inertia forces. These requirements can only be fulfilled by a bearing arrangement that has extremely high rigidity and load carrying capacity.

INA design solution

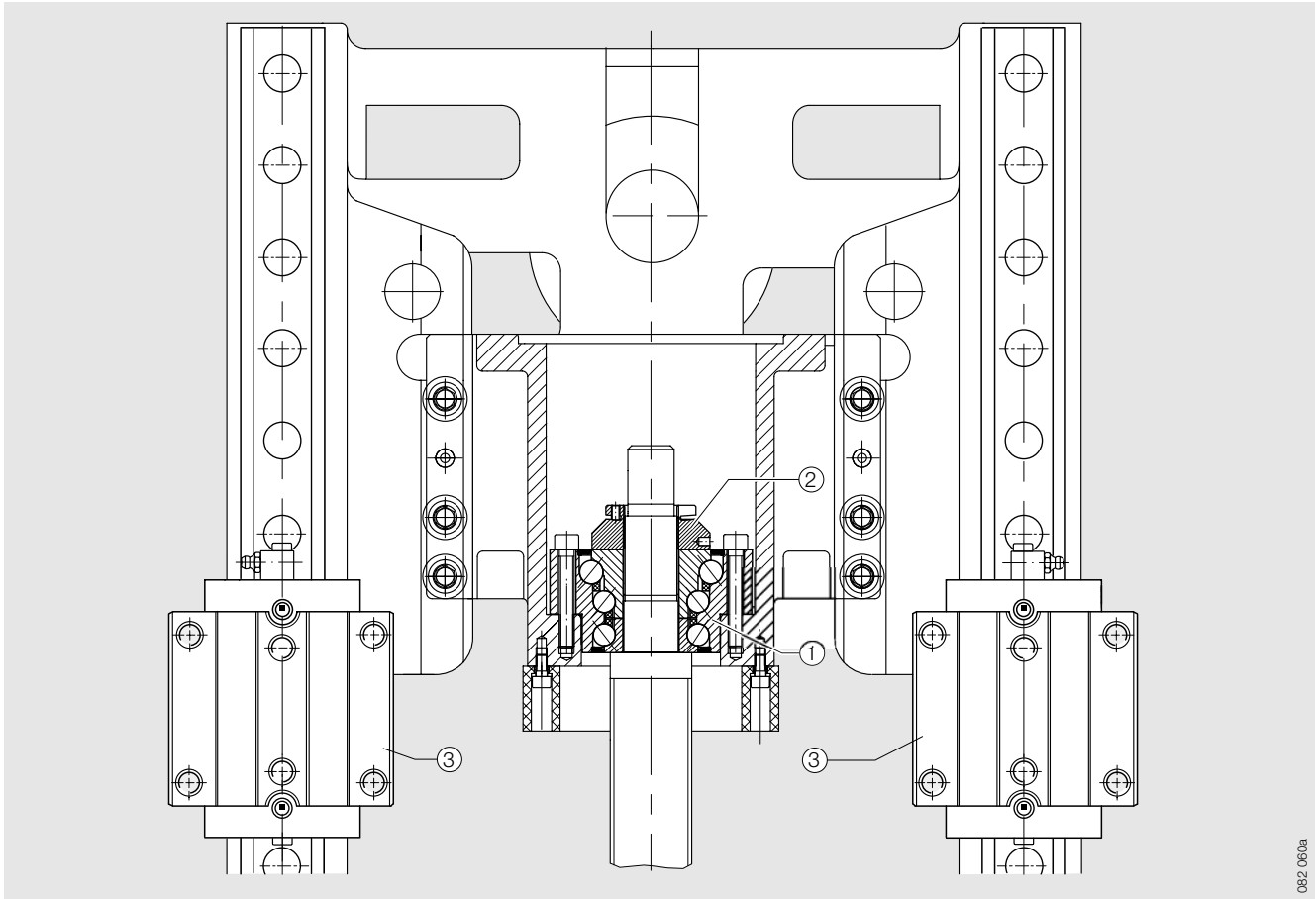
The triple row axial angular contact ball bearing of the *Heavy series* reliably supports the forces acting predominantly in the main load direction. There is therefore no need for a larger nominal diameter of screw drive.

As has been shown by the existing and proven series DKLFA, the stepped outer ring suitable for flange mounting allows defect-free and rapid fitting of the bearing. Furthermore, the bearing is mounted directly on the machine structure with a solid fitting face, giving an extremely rigid system – a reliable basis for high precision machining performance.

The bearing is preloaded by means of a locknut of series AM.

INA products used

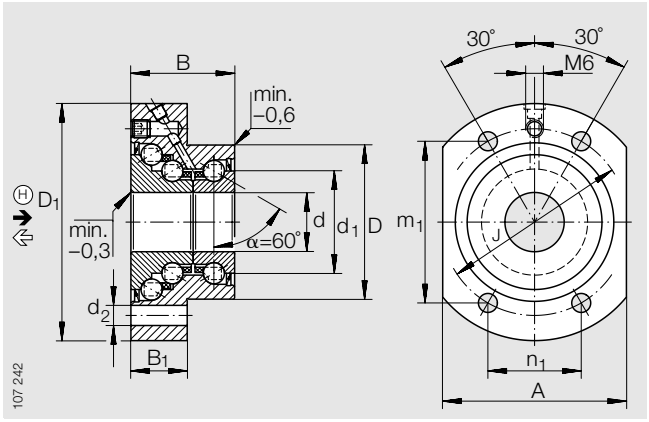
① Axial angular contact ball bearing, *Heavy series* DKLFA...2RS
② Precision locknut AM
③ Linear recirculating roller bearing and guideway assembly RUE



Triple row axial angular contact ball bearing

Series DKLFA...2RS

⚠ Due to the specific design features, these bearings must be subjected to continuous load in the main load direction Ⓗ.



DKLFA...2RS (d ≦20 mm)
Standard design

Dimension table · Dimensions in mm

Shaft diameter d	Designation	Mass ≈kg	Dimensions d –0,010	D h5	B –0,25	d_1	D_1	B_1	J	d_2	m_1	m_2	n_1	n_2	A	Mounting dimension d_a [5]
15	DKLFA 1575.2RS	0,53	15	45	32	28	75	18	58	6,8	50,2	–	29	–	55	20
20	DKLFA 2080.2RS	0,7	20	52	35	34,5	80	19	63	6,8	54,6	–	31,5	–	62	25
25	DKLFA 2590.2RS	0,9	25	57	38	40,5	90	22	75	8,8	53	–	53	–	70	32
30	DKLFA 30100.2RS	1	30	62	38	45,5	100	22	80	8,8	56,6	–	56,6	–	72	40
	DKLFA 30110.2RS [1]	2,5	30	75	56	51	110	35	95	8,8	91,8	67,2	24,6	67,2	85	47
40	DKLFA 40115.2RS	1,5	40	72	42	58	115	23	94	8,8	66,5	–	66,5	–	90	50
	DKLFA 40140.2RS [1]	4,2	40	90	60	65	140	35	118	11	114	83,4	30,5	83,4	110	56

The ball cages are made of plastic and have a permissible operating temperature of: +120 °C (continuous operation).

1) Bearings of *Heavy series*.

2) Tightening torques for the fixing screws according to manufacturer's recommendations. Screws to DIN 912 are not included in the delivery.

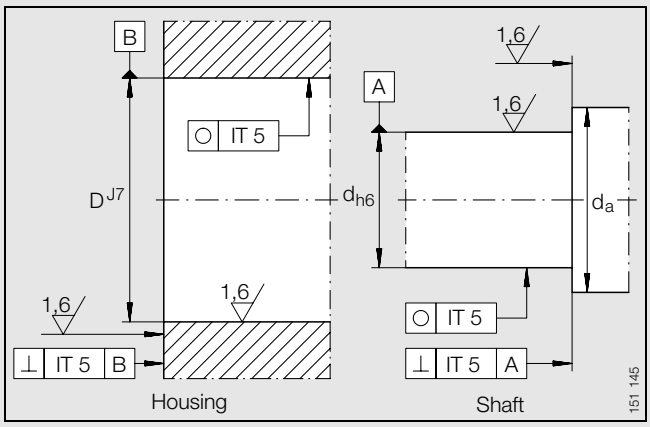
3) Moment of inertia for the rotating inner ring.

4) Dimension table: see page 6 and 7. Locknuts are not included and must be ordered separately! Tightening torques must be defined specially for applications with locating bearing arrangements on both sides. Data sheet for design: see *INA publication "ZAE"*.

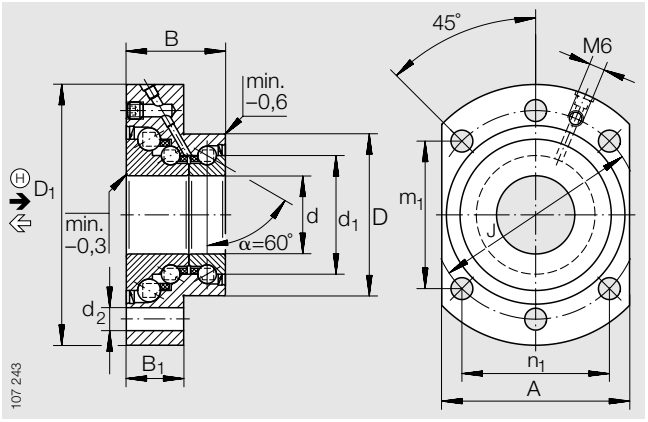
5) ⚠ Recommended minimum abutment diameter. If these values are not used, the actual bearing shoulder dimension d_1 must be observed.

6) ⚠ When dimensioning the drive, the starting torque and the frictional torque at high speeds, which can be 2 to 3×M_{RL}, must be taken into consideration.

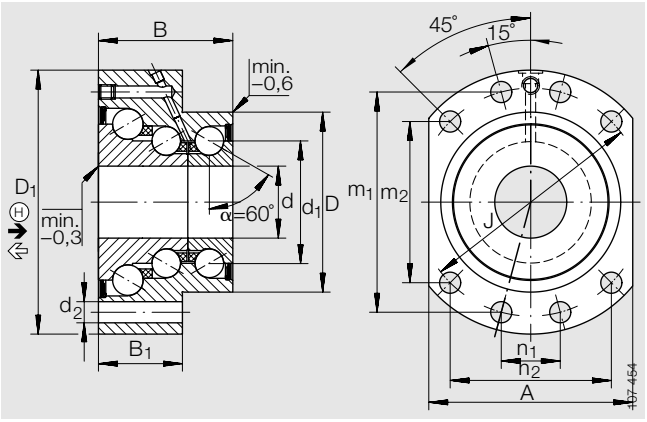
7) Guide value at 5 min^{-1}.



Tolerance grades for shaft and housing

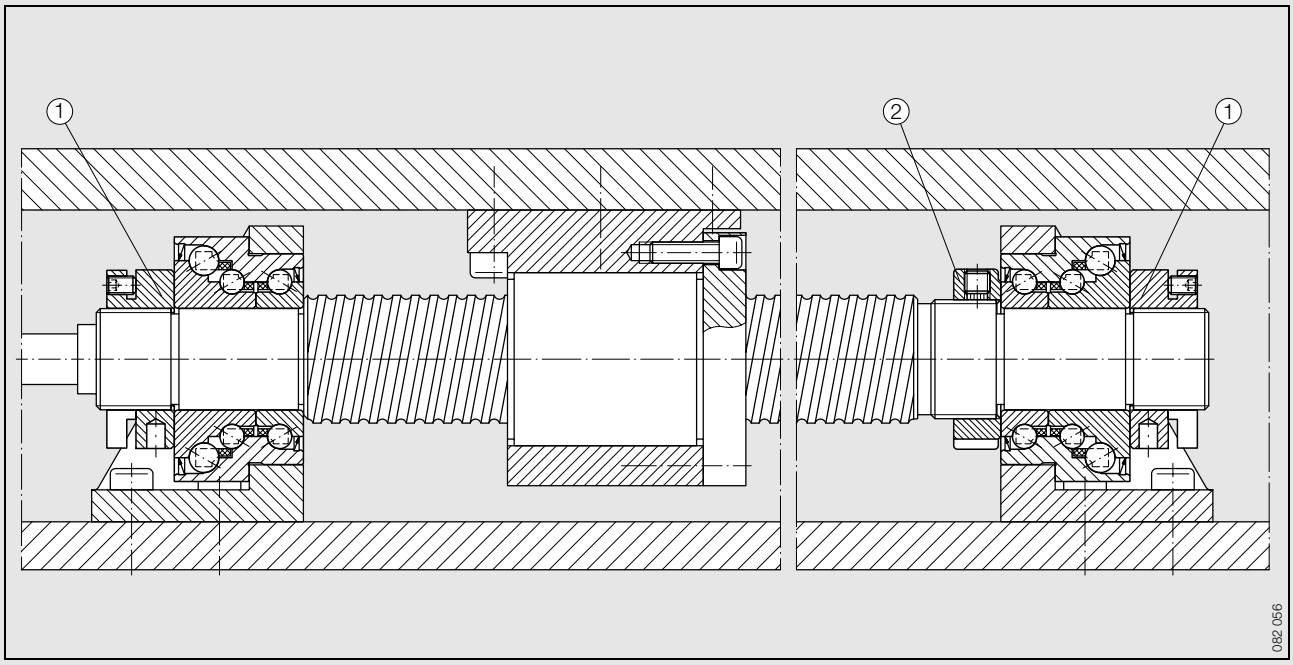


DKLFA...**.**2RS (d ≧25 mm)
Standard design



DKLFA...**.**2RS
Heavy series

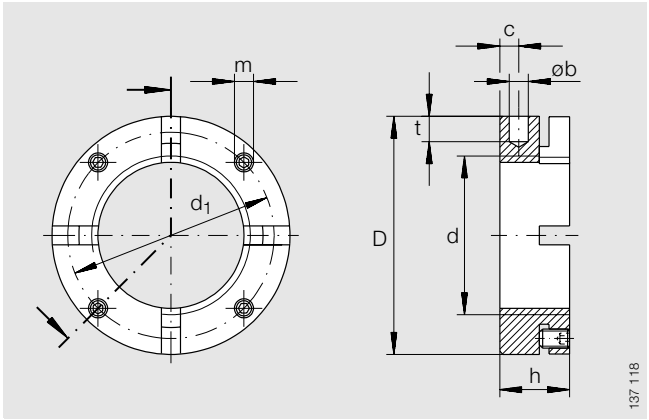
Fixing screws DIN 912-10.9[2]		Basic load ratings axial ⇐		Basic load ratings axial Ⓗ →		Limiting speed[7]	Frictional torque[6][7]	Rigidity axial ⇐	Rigidity axial →	Tilting rigidity	Mass moment of inertia[3]	Recommended INA locknut[4]			Shaft diameter
		dyn. C	stat. C_0	dyn. C	stat. C_0	n_G grease	M_{RL}	C_{AL}	C_{AL}	C_{KL}	M_M	Designation			
	Quantity	kN	kN	kN	kN	min^{-1}	Nm	N/µm	N/µm	Nm/mrad	kg · cm^2	①		②	d
M 6	4	17,9	28	37	83	2600	0,35	500	950	140	0,278	**ZMA 15/33**	**AM 15**	**ZM 17**	***15***
M 6	4	26	47	44,5	110	2200	0,45	750	1100	260	0,553	**ZMA 20/38**	**AM 20**	**ZM 25**	***20***
M 8	6	27,5	55	52	144	2000	0,6	850	1200	370	1,12	**ZMA 25/45**	**AM 25**	**ZM 30**	***25***
M 8	6	29	64	55	165	1800	0,75	900	1400	500	1,7	**ZMA 30/52**	**AM 30**	**ZM 35**	***30***
M 8	8	59	108	106	250	1600	1,5	1300	1600	650	3,23	**–**	**AM 30/65**	**ZM 35**	
M 8	6	43	101	73	227	1500	1	1100	1700	1000	4,23	**ZMA 40/62**	**AM 40**	**ZM 45**	***40***
M10	8	72	149	126	363	1200	2,5	1800	2000	1370	9,32	**–**	**AM 40/85**	**ZM 45**	



Ball screw drive with locating bearing arrangement on both sides

Precision locknuts

Series AM



AM

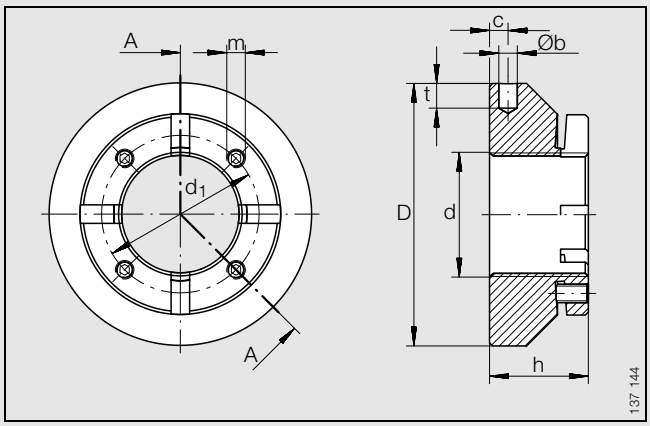
Dimension table · Dimensions in mm

Thread	Designation	Mass	Dimensions							Set screw	Locknut					Designation
										Tightening torque	Tightening torque[2]	Ultimate axial load	Breakaway torque	Reference tightening torque	Mass moment of inertia	Adapter
			D	h	b	t	d_1	c	m	M_m	M_m	F_{aB}	M_L	M_{AL}	M_M	
d		≈kg			H11					Nm	Nm	kN	Nm	Nm	kg · cm²	
M15×1	AM 15	0,06	30	18	4	5	23	5	M4	2	20	102	20	15	0,089	AMS 20
M20×1	AM 20	0,13	38	18	4	6	29,5	5	M6	5	80	145	45	18	0,225	AMS 20
M25×1,5	AM 25	0,16	45	20	5	6	35	6	M6	5	110	205	60	25	0,491	AMS 30
M30×1,5	AM 30	0,2	52	20	5	7	40	6	M6	5	150	246	70	32	0,86	AMS 30
	AM 30/65[1]	0,5	65	30	6	8	40	6	M6	5	150	401	70	32	2,8	AMS 30
M40×1,5	AM 40	0,3	65	22	6	8	51	6	M6	5	240	347	120	55	2,26	AMS 40
	AM 40/85[1]	0,75	85	32	6	8	51	6	M6	5	240	570	120	55	7,6	AMS 40

Further advice, sizes and fitting tools: see *INA publication "ZAE"* and *Fitting and maintenance manual "TPI 100"*.

1) For bearings of *Heavy series*.

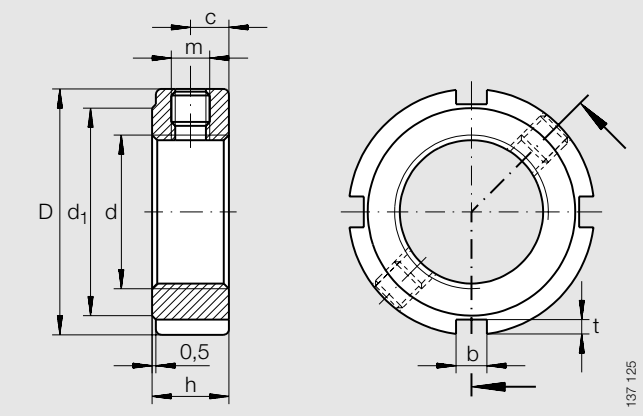
2) ⚠ Max. permissible tightening torque in conjunction with adapter AMS!



AM 30/65, AM 40/85

Precision locknuts

Series ZM
ZMA



ZM, ZMA

Dimension table · Dimensions in mm

Thread	Designation	Mass	Dimensions							Set screw	Locknut			
										Tightening torque	Ultimate axial load	Breakaway torque	Reference tightening torque	Mass moment of inertia
			D	h	b	t	d_1	c	m	M_m	F_{aB}	M_L	M_{AL}	M_M
d		≈kg								Nm	kN	Nm	Nm	kg · cm^2
M15×1	**ZMA 15/33**	0,08	33	16	4	2	28	8	M5	3	106	30	10	0,14
M17×1	**ZM 17**	0,028	28	10	4	2	23	5	M5	3	57	30	15	0,401
M20×1	**ZMA 20/38**	0,12	38	20	5	2	33	10	M5	3	174	40	18	0,297
M25×1,5	**ZM 25**	0,055	38	12	5	2	33	6	M6	5	90	60	25	0,157
	ZMA 25/45	0,16	45	20	5	2	40	10	M6	5	211	60	25	0,572
M30×1,5	**ZM 30**	0,075	45	12	5	2	40	6	M6	5	112	70	32	0,304
	ZMA 30/52	0,22	52	22	5	2	47	11	M6	5	270	70	32	1,1
M35×1,5	**ZM 35**	0,099	52	12	5	2	47	6	M6	5	134	80	40	0,537
M40×1,5	**ZMA 40/62**	0,27	62	22	6	2,5	56	11	M8	15	310	95	55	2,07
M45×1,5	**ZM 45**	0,17	65	14	6	2,5	59	7	M6	5	181	110	65	1,48

Further advice, sizes and fitting tools: see *INA publication "ZAE"* and *Fitting and maintenance manual "TPI 100"*.

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Sach-Nr. 010-663-894/MAI 75 US-D 09011 ○ · Printed in Germany