8. IBC Super Precision Locknuts + Labyrinth Seals

Applications

IBC precise locknuts are used in cases where precise machine elements, mostly bearings, have to be preloaded or clamped together.
The IBC locknuts replace customer and individually made locknuts as a standardized super precision locknut providing high accuracy by reduced axial amount. The locknuts can be loosened and reused if adjustments have to be made during assembling.
Retaining grooves for lockwashers would reduce the cross section of a shaft and would also cause a stress factor within the shaft.
This is of special interest for hollow spindles with a small cross section.

Accuracy

A high accuracy of 0,002 mm or even less for smaller locknuts will be achieved by operating thread and face in one machining operation. The especially developed CeraPow method and the SupSurf method in the same setup provide a higher accuracy and surface quality as the conventional grinding methods. The tread tolerance is according to 4H, DIN 13.

The accuracy of the counter thread should be „medium" 6 g for general applications and „fine" for higher standards.

Design

For compact applications and lower force the series MMR is generally recommended. Their radial locking devices can easily be secured with 2 or more set screws.

For higher loads IBC has developed the MMRB series which has the same dimensions as the MMR series only with larger width which is similar to the MMA series. This locknut is recommended for heavy loaded bearing sets in ball screw applications.

The type MMRBS incorporates additional to the MMRB a set of laminar rings made out of spring steel held in an outside groove. The laminar rings are creating a labyrinth seal when mounted, guided via a cone, into the counterpart of matched size. The nut groove should be filled witd the same grease as used for lubricating the bearings.
MMRBS has proved to be very handy in narrow applications, where space for labyrinth seals is limited.

The nuts of the series MMRS (see next page) are adjusted in their cross sectional dimensions as well to the IBC ball screw bearings of same bore size as to the MD-sealnuts stated on page 53.

These series has a similar groove and a set of laminar rings made of spring steel. These lis prelubricated with BearlLub GH62 grease similar to the prelubricated ball screw support bearings.
The MMA series has the same dimensions as the MMRB series but only with axial locking device.

Mounting

All locking devices must not be loosened before mounting. The locknuts can be mounted with different kind of spanners or with specially supplied IBC spanners. Those adapters can also be used for torque spanners fixing the nut with controlled torque.
Double the nominal torque should be applied to avoid setting of clamped parts, the nut then has to be loosened and retightened again with the nominal torque.
The necessary torque for the nut depends also on the required preload F_v (see bearing data tables). To calculate this in a simple formula is not possible, as many factors have to be considered:
a) max. axial load of nut
b) max. allowed specific load for the parts to be clamped
> bearings with a thin cross section like the 719.. series should be tightened less than others
c) material strength of the shaft thread
d) fits of bearings or other parts to be clamped
To state a general clamping torque for thread diameters is not possible as the preload of bearings of the same bore can vary for example from 45 N for the spindle bearing 71904C....UL up to 3500 N for the ballscrew bearing BS 20 M 47. P4A.UH.
For bearings with relatively high preload the following formula has been proved satisfactorily:

$$M_D = 3 \cdot d_{Gewinde} \cdot F_v \cdot K_{Fv} \cdot 10^{-4} \ \text{[Nm]} \qquad [14.1]$$

K_{Fv}: for Duplex sets:
for Triplex sets:
for Quad sets:

For slim section bearings with low preloads the calculated results are to small. Here it is necessary to enhance the torque without passing the maximum allowable specific load of the small contact area of 60 N/mm^2.

Securing against loosening

Tighten the first set screw until the first resistance is noticeable, then tighten the other(s) to the clamping torque stated in the tables.

socket screws	key size S [mm]	max. tightening torque max. M_A [Nm]
M4	2	2
M5	2,5	4
M6	3	7
M8	4	18
M10	5	34
M12	6	60

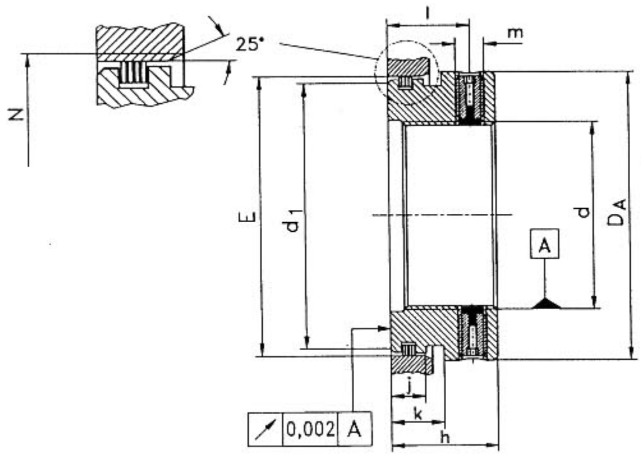
Table 14.1: max. tightening torque of securing devices

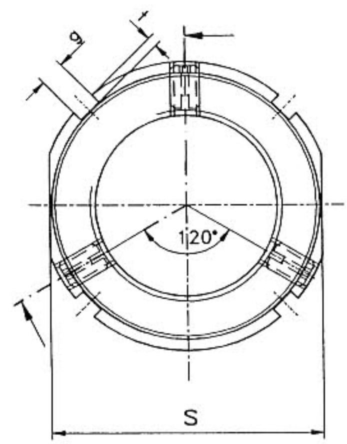
By this high loosening torque is achieved even for spindles running intermittent clockwise and counterclockwise.

Disassembling

First loosen socket set screws slightly, then the nut. The nut can be used several times in the way stated.

8.1 Super Precision Labyrinth Locknuts MMRS





Thread	Designation	Dimensions												Tightening torque set screws	Allowed axial load
		E	D_A	h	g	t	d_1	l	m	j	k	n	S	M_S	F_a
		mm												Nm	kN
M 17 x 1	**MMRS 17-36.Q2**	36	38	20	5	2	32	15,5	M 5	9	11	37,5	36	4	100
M 20 x 1	**MMRS 20-36.Q2**														110
M 25 x 1,5	**MMRS 25-50.Q2**	50	58	25	6	2,5	46	19	M 6	10	13	52	55	7	150
M 30 x 1,5	**MMRS 30-50.Q2**														180
M 30 x 1,5	**MMRS 30-60.Q2**	60	70	28			56	21	M 8			63	65	18	180
M 35 x 1,5	**MMRS 35-60.Q2**														190
M 40 x 1,5	**MMRS 40-60.Q2**														210
M 45 x 1,5	**MMRS 45-60.Q2**														260
M 35 x 1,5	**MMRS 35-76.Q2**	76	80	30	7	3	72	23			15	79,5	75		290
M 40 x 1,5	**MMRS 40-76.Q2**														340
M 45 x 1,5	**MMRS 45-76.Q2**														400
M 50 x 1,5	**MMRS 50-76.Q2**														420
M 55 x 2	**MMRS 55-76.Q2**														450
M 55 x 2	**MMRS 55-99.Q2**	99	105		8	3,5	95				19	103	95		450
M 60 x 2	**MMRS 60-99.Q2**														480
M 75 x 2	**MMRS 75-99.Q2**														510
M 100 x 2	**MMRS 100-132.Q2**	132	140	35	12	5	128	27	M 10	12		137,3	135	34	710
M 125 x 2	**MMRS 125-162.Q2**	162	175				158					166	165		800

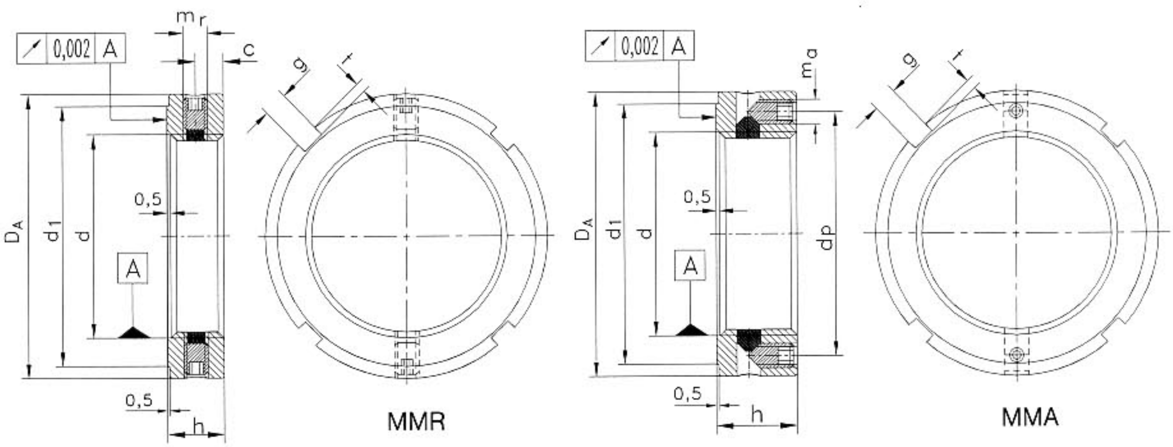
Function

Labyrinth locknuts MMRS are creating with their laminar rings and with a hereto in diameter matched housing or with the seal-nut of series MD a labyrinth sealing.
While the nut is turning with the shaft, supposing a driven shaft, the laminar rings are standing still in the counterpart hold radially by the spring tension of the spring steel. Axially is some free space, which has to be filled with grease used in the bearings. The sealing area is already filled with the grease BearLub 62, which has proven its excellent quality in the lubrication of ball-screw supporting bearings.
Beside using the grooves with hook spanners the mounting also can take place using the flats for engineer's wrenches.

Applications

The labyrinth locknuts MMRS is especially used in combination with ball screw supporting bearings and units. It seals very good against dust and little splashing water but not against standing fluids.
Its long fine thread can support high loads and thus it can also be used for other clamping or preloading applications as well as for stretching spindles.

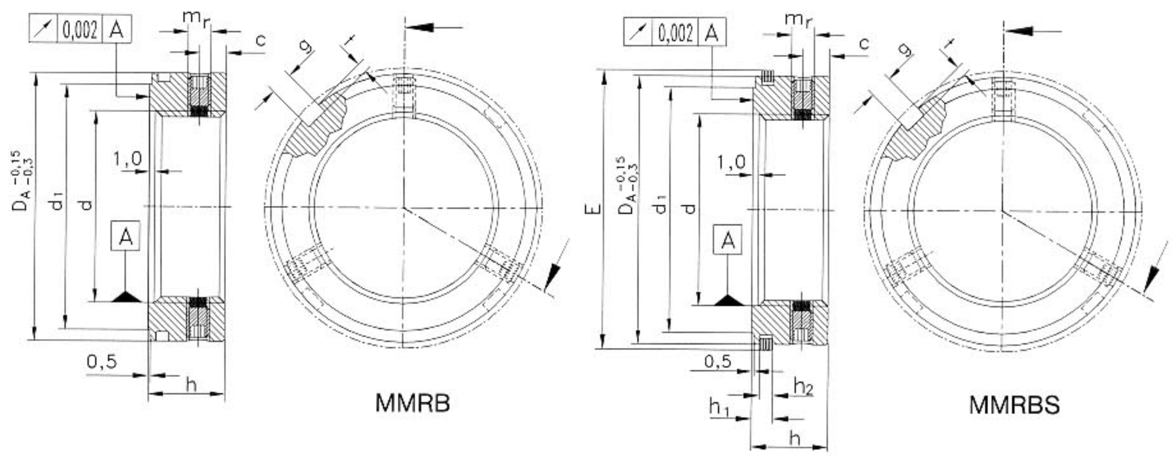
8.2 Super Precision Locknuts MMA, MMR, MMRB, MMRBS



Thread	Designation		Dimensions												Max. Tightening torque set screws		Allowed axial load
	Radial securing	Axial securing	D_A	h	g	t	d_1	c	m_r	m_a	d_p	h_1	h_2	E*	M_S rad.	M_S ax.	F_a
			mm												Nm		kN
M 6 x 0,5	MMR 6		16	8	3	2	12	4	M 4						2		16
M 8 x 0,75	MMR 8																17
M 10 x 0,75	MMR 10		18				14										22
M 12 x 1	MMR 12		22				18										26
M 15 x 1	MMR 15		25				21										33
M 17 x 1	MMR 17		28	10	4		23	5	M 5						4		49
		MMA 17		16						M 4	23					2	70
M 20 x 1	MMR 20		32	10			27										55
	MMRB 20	MMA 20		16							26	4,4	2,9	32			110
M 20 x 1,5	MMR 20 x 1,5			10													70
	MMRB 20 x 1,5	MMA 20 x 1,5		16						M 5	26			32		4	110
M 25 x 1,5	MMR 25		38	12	5		33	6	M6						7		87
	MMRB 25	MMA 25		18							31,5			38			130
M 30 x 1,5	MMR 30		45	12			40					5,2	3,2				110
	MMRB 30	MMA 30		18							37,5			45			150
M 35 x 1,5	MMR 35		52	12			47										120
	MMRB 35	MMA 35		18						M 6	43,5			52		7	170
M 40 x 1,5	MMR 40		58	14	6	2,5	52	7									150
	MMRB 40	MMA 40		20							49			58			210
M 45 x 1,5	MMR 45		65	14			59					6	3,6				170
	MMRB 45	MMA 45		20							55			65			240
M 50 x 1,5	MMR 50		70	14			64										180
	MMRB 50	MMA 50		20							60			70			260
M 55 x 2	MMR 55		75	16	7	3	68	8	M 8	M 8					18	18	250
	MMRB 55	MMA 55		22							65			75			340
M 60 x 2	MMR 60		80	16			73										270
	MMRB 60	MMA 60		22							70			80			360
M 65 x 2	MMR 65		85	16			78										290
	MMRB 65	MMA 65		22							75			85			400
M 70 x 2	MMR 70		92	18	8	3,5	85	9									350
	MMRB 70	MMA 70		24							81			92			470
M 75 x 2	MMR 75		98	18			90										370
	MMRB 75	MMA 75		24							87			98			500
M 80 x 2	MMR 80		105	18			95					7,3	4,3				390
	MMRB 80	MMA 80		24							93			105			520
M 85 x 2	MMR 85		110	18			102		M 10						34	34	400
	MMRB 85	MMA 85		24							98			110			540

E* see page 51

IBC

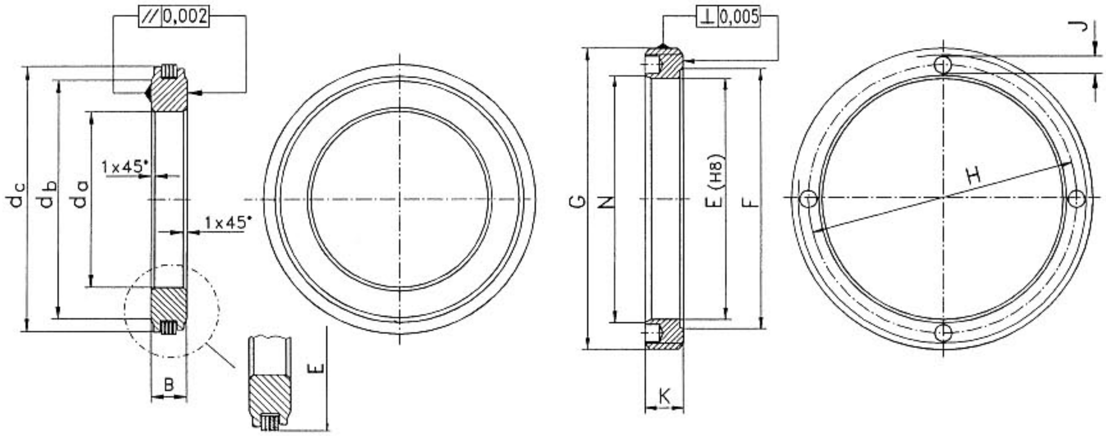


Thread	Designation		Dimensions												Max. Tightening torque set screw	Allowed axial load
	Radial securing	Axial securing	D_A	h	g	t	d_1	c	m_r	m_a	d_p	h_1	h_2	E*	M_S	F_a
			mm												Nm	kN
M 90 x 2	**MMR 90**		120	20	10	4	108	9	M 10	M 10		7,3	4,3		34	470
	MMRB 90	**MMA 90**		26							105			120		610
M 95 x 2	**MMR 95**		125	20			113									490
	MMRB 95	**MMA 95**		26							110			125		640
M 100 x 2	**MMR 100**		130	20			120									510
	MMRB 100	**MMA 100**		26							115			130		660
M 105 x 2	**MMR 105**		140	22	12	5	126									560
	MMRB 105	**MMA 105**		28							123			140		700
M 110 x 2	**MMR 110**		145	22			133									600
	MMRB 110	**MMA 110**		28							128			145		770
M 115 x 2	**MMR 115**		150	22			137					7,5	4,4			660
	MMRB 115	**MMA 115**		28							133			150		820
M 120 x 2	**MMR 120**		155	24			138									710
	MMRB 120	**MMA 120**		30							138			155		890
M 125 x 2	**MMR 125**		160	24			148									740
	MMRB 125	**MMA 125**		30							143			160		920
M 130 x 2	**MMR 130**		165	24			149									760
	MMRB 130	**MMA 130**		30							148			165		950
M 140 x 2	**MMR 140**		180	26	14	6	160	10	M 12	M 12					60	880
	MMRB 140	**MMA 140**		32							160			180		1080
M 150 x 2	**MMR 150**		190	26			171									930
	MMRB 150	**MMA 150**		32							170			190		1040
M 160 x 3	**MMRB 160**	**MMA 160**	205	34	16	7	182					8,3	5,3	205		1360
M 170 x 3	**MMRB 170**	**MMA 170**	215				193				183			215		1430
M 180 x 3	**MMRB 180**	**MMA 180**	230	36	18	8	203							230		1600
M 190 x 3	**MMRB 190**	**MMA 190**	240				214				193			240		1670
M 200 x 3	**MMRB 200**	**MMA 200**	245	38			226							245		1850
M 210 x 4	**MMRB 210**		270	40	20	10	238	14	M 14	M 14	205	10	6,4	270	85	2000
M 220 x 4	**MMRB 220**		280				250							280		2250
M 240 x 4	**MMRB 240**		300	44			270				215			300		2300
M 260 x 4	**MMRB 260**		310				290							310		2500
M 280 x 4	**MMRB 280**		330	50	24		310				223	11	6,6	330		2850
M 300 x 5	**MMRB 300**		360				336							360		3100

MMRBS = MMRB + Laminar springsteel ring (Labyrinth seal)

E* = Bore diameter of counterpart = $D_{A\,0}^{+0,1}$ and a 15° taper for introducing the springsteel ring (see also MMRS)

8.3 Labyrinth-seals S.. — Seal-nuts MD..



Designation	Primary dimensions				Designation	Dimensions							Allowed axial load
	d_a	d_b	d_c	B		E	F	G	H	J	K	N	F_a
	mm					mm							kN
S 12-26.Q2	12	21	25,6	7	**MD 40-26.Q5**	26	28	M 40 x 1,5	31	4,3	9	27	45
S 15-26.Q2	15												
S 17-36.Q2	17	26	35,6		**MD 50-36.Q5**	36	41	M 50 x 1,5	42,5		10	37,5	65
S 20-36.Q2	20												
S 25-40.Q2	25	32	39,7		**MD 55-40.Q5**	40	45	M 55 x 1,5	47			42	77
S 25-50.Q2		41	49,6	10	**MD 70-50.Q5**	50	56	M 70 x 1,5	59,5		12	52	100
S 30-50.Q2	30												
S 30-60.Q2		46	59,6		**MD 80-60.Q5**	60	65	M 80 x 1,5	72			63	130
S 35-60.Q2	35												
S 35-76.Q2		66	75,6	12	**MD 110-76.Q5**	76	92	M 110 x 2	90	6,3	14	79,5	190
S 40-60.Q2	40	50	59,6	10	**MD 80-60.Q5**	60	65	M 80 x 1,5	72	4,3	12	63	130
S 40-76-10.Q2		66	75,6		**MD 95-76.Q5**	76	82	M 95 x 2	84,5	6,3		79,5	150
S 40-76-12.Q2				12	**MD 110-76.Q5**		92	M 110 x 2	90		14		190
S 45-60.Q2	45	55	59,6	10	**MD 80-60.Q5**	60	65	M 80 x 1,5	72	4,3	12	63	130
S 45-66.Q2			65,6		**MD 85-66.Q5**	66	72	M 85 x 1,5	76			69	130
S 45-76.Q2		66	75,6	12	**MD 110-76.Q5**	76	92	M 110 x 2	90	6,3	14	79,5	190
S 50-76-10.Q2	50	68		10	**MD 95-76.Q5**		82	M 95 x 2	84,5		12		150
S 50-76-12.Q2				12	**MD 110-76.Q5**		92	M 110 x 2	90		14		190
S 55-76.Q2	55			10	**MD 95-76.Q5**		82	M 95 x 2	84,5		12		150
S 55-99.Q2		86	98,6	12	**MD 130-99.Q5**	99	110	M 130 x 2	110		14	103	220
S 60-99.Q2	60												
S 75-99.Q2	75			10	**MD 120-99.Q5**		101	M 120 x 2					210
S 100-132.Q2	100	114	131,6	14	**MD 160-132.Q5**	132	134	M 160 x 3	148		18	137,3	340
S 110-132.Q2	110	120	131,7										
S 127-162.Q2	127	144	161,6	14,5	**MD 190-162.Q5**	162	167	M 190 x 3	176			166	440

Function
The non-touching labyrinth seals of series S are designed as a one piece parallel ground steel ring with an outside groove. A set of laminar rings made of spring steel are assembled into the groove and grease packed with IBC BearLub GH62. The seals can be used in combination with the MD locknut.

Applications
The labyrinth seal is especially used in combination with ball screw supporting bearings and units. It seals very good against dust and little splashing water but not against standing fluids. It reduces sliding friction in comparison to touching seals.
It can be used for other applications, where no touching sealing is necessary.

Seal-nut MD
The seal-nut MD with an outside fine thread is used to clamp bearing outer rings or other machine parts.
It needs a securing by glue or by the means of an external socket set screw.