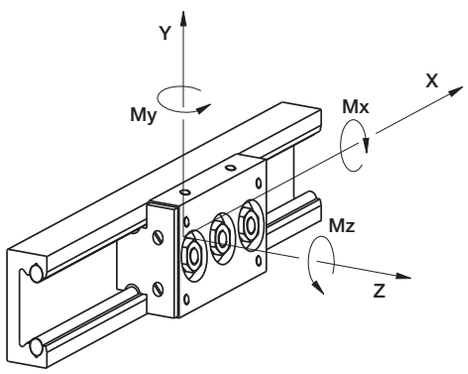
U-Line

LM, LML System

LM system

LM system is based on rail, guide rollers and carriages to provide a complete guiding system.
Guide rails and rollers can be used as single elements. In most cases the application is based on standard carriages and cursors.
Referring to the axis system below, the load capacities are tabulated as follows:



MAX LOAD ON SINGLE CARRIAGE
The following table shows the maximum load that can be applied on a single carriage.

Guide	Carriage	Fy N	Fz N	Mx Nm	My Nm	Mz Nm
LM 30	C3 RCL 17 06 065	1000*	330	3,5	5,8	10
	C4 RCL 17 06 085	1000	660	7	11	20
LM 40	C3 RCL 24 06 085	1810*	520	7,6	15	26
	C4 RCL 24 06 114	1810	1040	15	25	52
LM 65	C3 RCL 35 10 115	4160*	1200	26	45	78
	C4 RCL 35 10 152	4160	2400	50	75	155
LM 90	C4 RCL 35 10 180	4160	2400	75	95	200
LM 120	T4 RCL 35 10 150	4160	2400	110	120	200
	T4 RCL 35 10 220	4160	2400	110	200	350
	T4 RCP 42 10 150	5250	3030	140	150	260
	T4 RCP 42 10 220	5250	3030	140	250	440
LM 180	T4 PFV 43 22 180	6300	3120	185	200	400
	T4 PFV 43 22 280	6300	3120	185	350	715

** Fy directed to load the two concentric guide rollers*

The maximum load is based on the guide roller data (stud and bearing strength) and on maximum contact pressure between rail and roller of 1250 N/mm^2. Loading is considered to be acting in a single plane or axis only.

BASIC DYNAMIC LOAD OF SINGLE CARRIAGE
The following table shows the nominal load that corresponds to a nominal life of the bearing at 100 km.

The nominal carriage life can be estimated from the standard bearing formula.

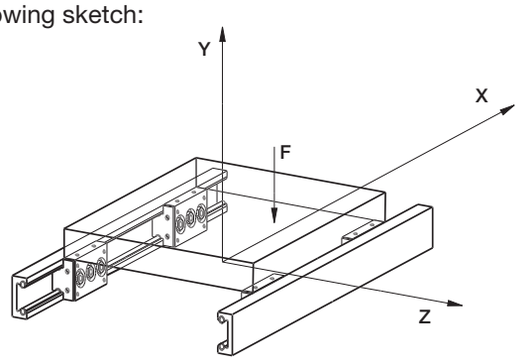
$$L_{10} = (Ci/Pi)^3 \times 100 \text{ km}$$

Ci and Pi are the basic capacity and load applied for a specific direction.

Guide	Carriage	Cy N	Cz N	CMx Nm	CMy Nm	CMz Nm
LM 30	C3 RCL 17 06 065	3000*	830	9	16	30
	C4 RCL 17 06 085	3000	1670	18	26	60
LM 40	C3 RCL 24 06 085	8400*	2340	34	67	122
	C4 RCL 24 06 114	8400	4670	68	110	244
LM 65	C3 RCL 35 10 115	15800*	4050	86	152	296
	C4 RCL 35 10 152	15800	8110	172	250	593
LM 90	C4 RCL 35 10 180	15800	8110	263	325	770
LM 120	T4 RCL 35 10 150	15800	8110	370	400	780
	T4 RCL 35 10 220	15800	8110	370	685	1335
	T4 RCP 42 10 150	24000	14130	650	700	1190
	T4 RCP 42 10 220	24000	14130	650	1195	2030
LM 180	T4 PFV 43 22 180	15190	5300	320	335	965
	T4 PFV 43 22 280	15190	5300	320	600	1725

** Fy directed to load the two concentric guide rollers*

Calculation example: four carriages C3RCL 35 10 115 platform
The common configuration is shown in the here following sketch:



The platform moves along the two guide rails and has a load of “F” acting at 100 mm and 50 mm from the carriage centre.
Data: guide LM 65 and carriages C3RCL3510115

I_x = 400 mm I_z = 300 mm
F = 6.000 N X_F = 100 mm Z_F = 50 mm

In this configuration the load on the most heavily loaded carriage is Py and can be calculated using the following formula:

$$P = \frac{F}{4} + \frac{F \bullet X_F}{2 \bullet I_x} + \frac{F \bullet Z_F}{2 \bullet I_z} = 2750 \text{ N}$$

The load Fy shown in the “max loads” table is 4.160N (carriages mounted with eccentric roller on top), so the system is validated against breakage.

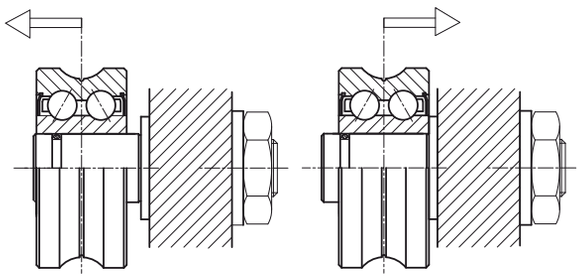
To estimate the system life we proceed as follows:
from the nominal life table Cy = 15.800 N

$$L_{10} = (15.800/2.750)^3 \times 100 = 18.900 \text{ km}$$

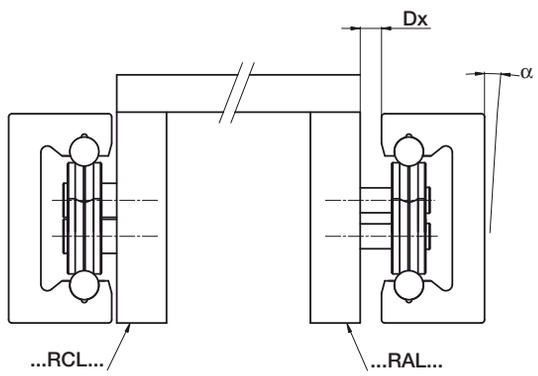
Important note: to reach this value it is important to lubricate the rail, otherwise fretting corrosion between rail and roller can reduce the expected life.

Auto-aligning system

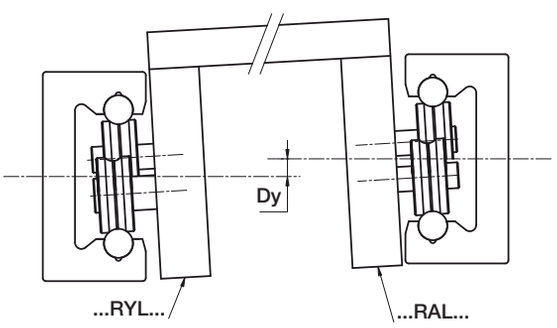
Systems
Auto-aligning systems are assembled with guide rollers RAL type on LM system carriages tables.
The guide rollers RAL type allows axial displacement of the roller on the pin. An “O” ring retains the roller in position during the mounting.
Auto-aligning systems compensate for opposite rail misalignment errors. They are useful for mounting inaccurately aligned structures or those structures subject to flexure.



C3RAL C4RAL T4RAL
Is used to compensate for Dx misalignment between opposite rails. The table or carriage with all guide rollers RAL/RALR type can move towards or away from the rail. Type RAL provides radial support only. Axial load, transverse to the direction of travel, is reacted by carriage type RCL on the opposite rail.

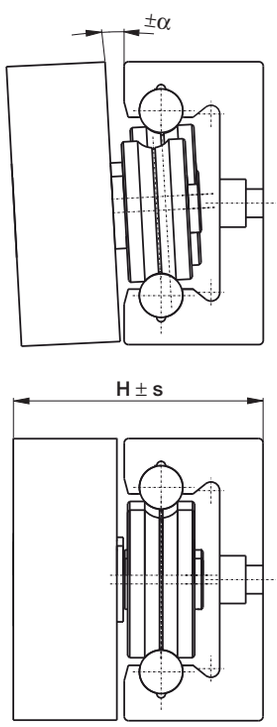


C3RYL C4RYL T4RYL
Rail misalignment Dy requires the ability for both carriages to rotate. The table or carriage RYL type, with guide rollers RCL/RCP in contact with a steel shaft of the LM rail and guide rollers RALR type in contact with the opposite shaft, allows carriage rotation ensuring at the same time the transverse direction control.
The maximum Dy value is dependent on the distance between the rails and the tabulated maximum angle ‘α’ for that carriage.
Note: RYL carriage axial load capability is lower than the same size RCL/RCP carriage.



Max transverse moving allowed by auto-aligning tables and carriages

Carriage code (1)		α max (°)	S **max** (mm)	**H** nominal (mm)	Rail
C3RAL 17 06 065	**C4RAL 17 06 085**	1	0.8	27.5	**LM 30**
C3RYL 17 06 065	**C4RYL 17 06 085**	1	–		
C3RAL 24 06 085	**C4RAL 24 06 114**	1	1	35.7	**LM 40**
C3RYL 24 06 085	**C4RYL 24 06 114**	1	–		
C3RAL 35 10 115	**C4RAL 35 10 152**	1	1	58	**LM 65**
C3RYL 35 10 115	**C4RYL 35 10 152**	1	–		
–	**C4RAL 35 10 180**	1	1	60.5	**LM 90**
–	**C4RYL 35 10 180**	1	–		
T4RAL 35 10 150	**T4RAL 35 10 220**	0.3	1	58.5	**LM 120**
T4RYL 35 10 150	**T4RYL 35 10 220**	0.3	–		
T4RAL 42 10 150	**T4RAL 42 10 220**	0.75	1.5	65.5	
T4RYL 42 10 150	**T4RYL 42 10 220**	0.75	–		

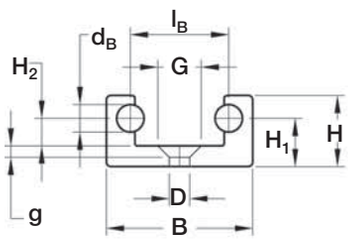


1) See light load systems Nadella catalogue for table and carriage dimensions.
2) Variations of dimension **H** exceeding ± **s** can compromise bearing axial moving and decrease the roller limit load, Fr.

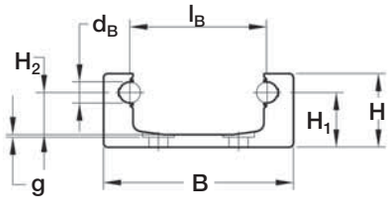
U-Line

Guide rails LM

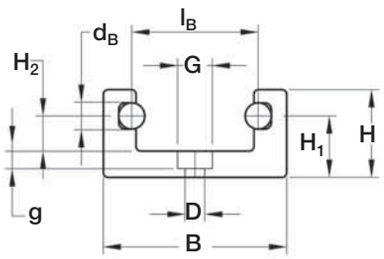
LM 30



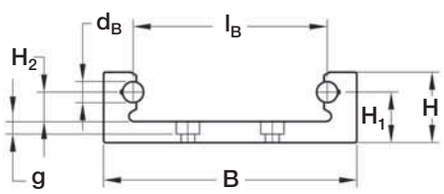
LM 90



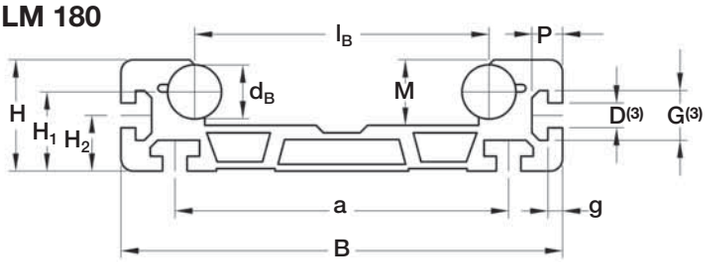
LM 40
LM 65

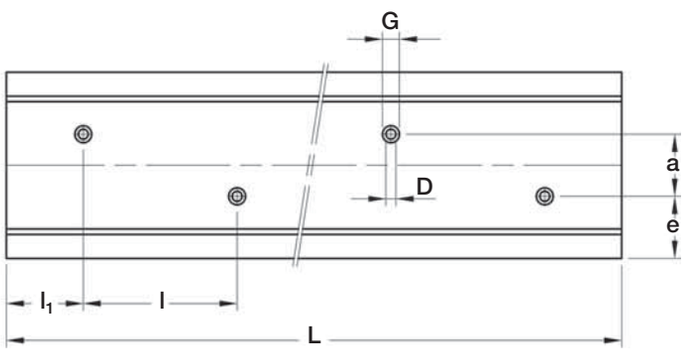


LM 120



LM 180





Type	Dimensions (mm)															Moments of inertia[2] (cm^4)		Weight (kg/m)	$L^{(1)}$ max (mm)
	d_B	l_B	B	H	H_1	H_2	M	D	G	g	a	e	P	l	l_1	J_x	J_y		
LM 30[4]	6	21.5	32	15.5	10.5	6	11	4.5	9.5	2.5	–	16	–	80	40	0.5	3	1.1	6 000
LM 40[4]	6	29	42	20	14	8	14	4.5	8	4	–	21	–	100	50	1.2	8.8	1.5	6 000
LM 65[4]	10	42.5	65	32	23.5	13.5	22	6.5	11	6	–	32.5	–	100	50	8.8	54.9	4.1	6 000
LM 90[4]	10	65	90	35	26	20	29	9	15	0.5	38	26	–	100	50	16.4	160.2	4.7	6 000
LM 120[4]	10	92	120	33.5	24	14	23.5	6.5	11	6	40	40	–	100	50	14.8	311.6	6	6 000
LM 180	22	120	180	45	32	22.5	26.5	10[3]	20.1[3]	6	136	–	12.5	–	–	53.3	1 096.6	13.1	6 000

1) Longer rails are supplied in sections with ground butt joints and, on request, with pin connection
2) Inertia value based on equivalent aluminium yield 70000 N/mm²
3) Slot for nut DIN 508
4) available with stainless steel shafts (suffix **NX**)

Hole layout
- holes according to catalogue (**SB**)
- finishes to drawing (**NZ**)
- without holes (**NF**)

Optional features
- ground one end (**R**)
- ground both ends (**RR**)
- chromium plated shafts (**CH**)
- stainless steel shafts (**NX**)

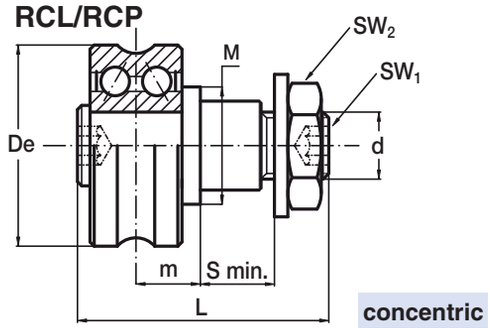
Example of standard designation : **LM 40/1720 NF**

See page 17 for standard codification

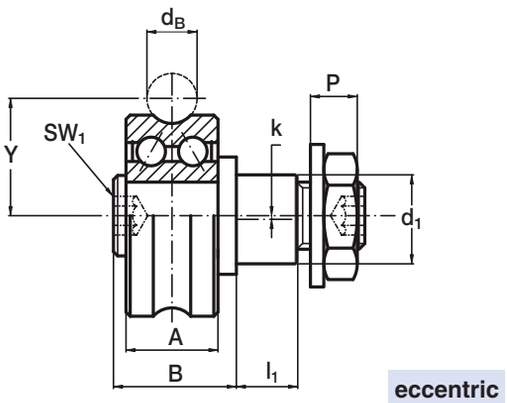
U-Line

Guide rollers RCL, RCP, PFV

RCL/RCP

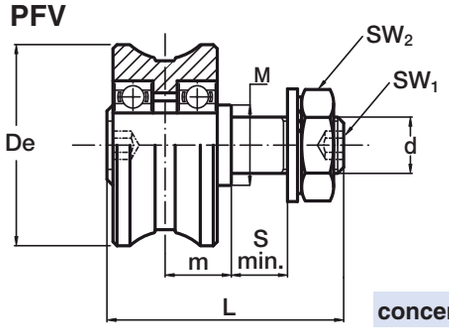


concentric

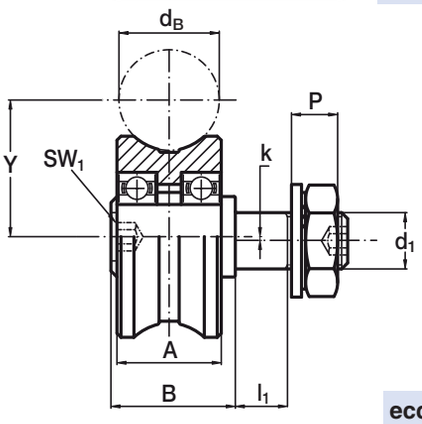


eccentric

PFV



concentric



eccentric

Type		Dimensions (mm)																Suggested combination
concentric	eccentric	De	d_B	d_1 (1) conc.	d_1 (1) ecc.	d	Y	m	S min.	P	L	A	B	l_1	M	SW_1	SW_2	k	
RCL 17.06(3)	**RCLR 17.06**(3)	17	6	5	6.5	M 5x0.8	10.5	6	6	3.7	21	7	11	5.2	9	2.5	8	0.25	**LM 30**
RCL 24.06(3)	**RCLR 24.06**(3)	24	6	8	11	M 8x1.25	14	7.7	7	5.6	28.2	11	14.7	6.5	14	4	13	0.5	**LM 40**
RCL 35.10(3)	**RCLR 35.10**(3)	35	10	10	10	M10x1.25	20.65	10.5	14	7	43	15.9	20.5	13	18	5	17	0.75	**LM 65**
RCP 42.10	**RCPR 42.10**(3)	42	10	17	17	M12x1.25	24	12.5	12	9.5	50	19	24.5	11	25	6	19	0.75	**LM 120**
PFV 43.22(3)	**PFVR 43.22**(3)	43	22	12	12	M12x1.5	29	14	13	12.5	52	23	27	12	18	5	19	1	**LM 180**

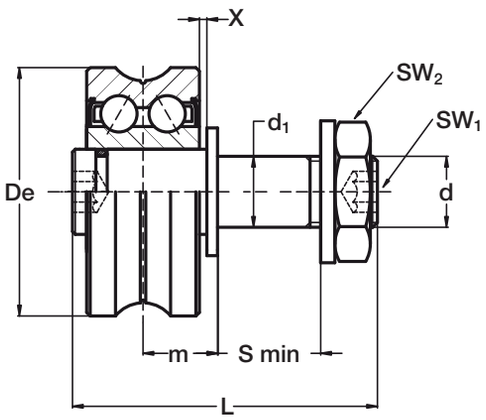
Type		Dynamic load (N)	Limit loads (N)		Life coefficients				Torque wrench (2) settings (Nm)	Weight (g)
					Pa/Pr ≤ 0.37		Pa/Pr > 0.37			
		C_w(4)	radial Fr	axial F_a	X	Y	X	Y		
RCL 17.06	**RCLR 17.06**	1 500	530	260	1	1.37	0.5	2.73	1.8	20
RCL 24.06	**RCLR 24.06**	4 200	1 600	830	1	1.37	0.5	2.73	8	40
RCL 35.10	**RCLR 35.10**	7 900	2 400	1 100	1	1.67	0.5	3.03	20	130
RCP 42.10	**RCPR 42.10**	12 000	4 300	1 160	1	1.17	0.5	2.53	24	185
PFV 43.22	**PFVR 43.22**	7 600	3 150	780	1	4	1	4	26	205

1) Housing bore tolerance: H7
2) The torque wrench settings are given for non-lubricated threads; for lubricated threads, multiply figure by 0.8
3) Available in stainless steel (suffix **NX**) with RS seals type
4) Cw basic load for 100 km
5) The guide rollers are complete with self-locking washers and hexagonal nut (DIN 439B) for fitting
6) Pressure angle α for load calculation: 60°
7) Standard shields ZZ type for RCL and RCP; NBR seals type RS for PFV

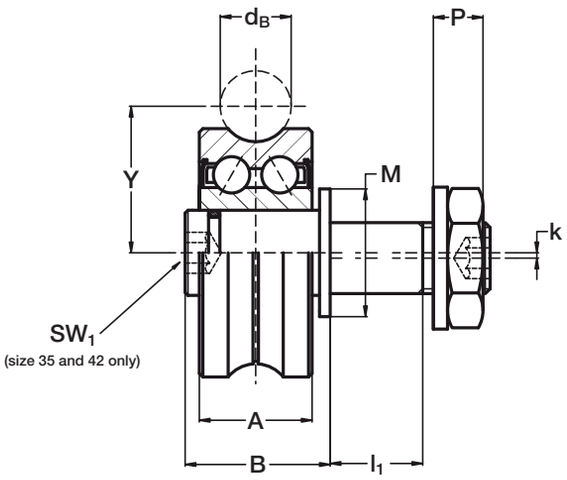
U-Line

Guide rollers RAL

concentric



eccentric



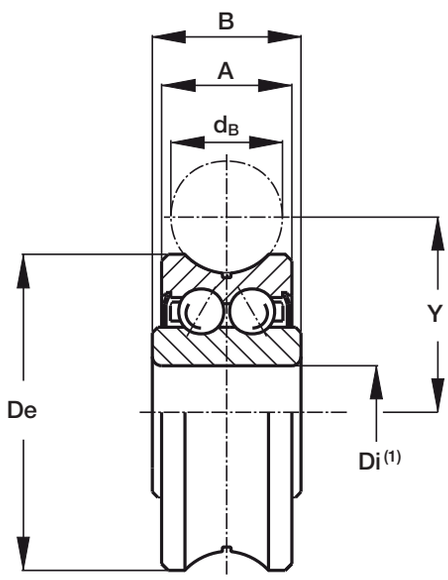
Type		Dimensions (mm)																		Suggested combination
concentric	eccentric	De	d_B	d_1 (1) conc.	d_1 (1) ecc.	d	Y	m	S min.	P	L	A	B	X (5)	l_1	M	SW_1	SW_2	k	
RAL 17.06(6)	**RALR 17.06**(6)	17	6	5	6.5	M 5x0.8	10.5	6	6	3.7	20.5	7	10.5	0.8	5.2	9	2.5	8	0.25	**LM 30**
RAL 24.06(6)	**RALR 24.06**(6)	24	6	8	11	M 8x1.25	14	7.7	7	5.6	27.5	11	14	1	6.5	14	4	13	0.5	**LM 40**
RAL 35.10(6)	**RALR 35.10**(6)	35	10	10	10	M10x1.25	20.65	10.5	14	7	43	15.9	20.5	1	13	18	5	17	0.75	**LM 65**
RAL 42.10	**RALR 42.10**	42	10	17	17	M12x1.25	24	12.5	12	9.5	49	19	23.5	1.5	11	25	6	19	0.75	**LM 120**

Type		Dynamic load (N)	Limit loads (N) (5)	Torque wrench (2) settings (Nm)	Weight (g)
		C_w (3)	radial F_r		
RAL 17.06	**RALR 17.06**	1 500	450	1.8	20
RAL 24.06	**RALR 24.06**	4 200	1 400	8	40
RAL 3510	**RALR 35.10**	7 900	2 100	20	130
RAL 42.10	**RALR 42.10**	12 000	3 400	24	185

1) Housing bore tolerance: H7
2) The torque wrench settings are given for non-lubricated threads; for lubricated threads, multiply figure by 0.8
3) Cw basic load for 100 km
4)The guide rollers are complete with self-locking washers and hexagonal nut for fitting
5) Dimension ± X is the max displacement from dimension m to ensure proper guide roller function and safety
6) Available in stainless steel (suffix **NX**) with **RS** seals type
7) Standard shields ZZ type

U-Line

Guide wheels GLA

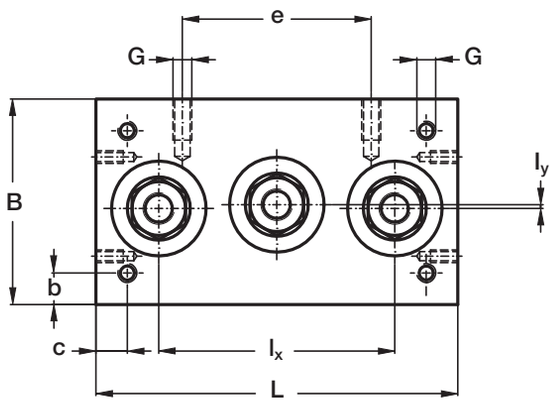


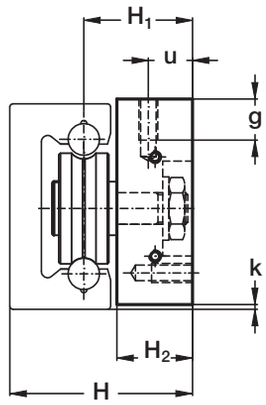
Type	Dimensions (mm)					
	De	d_B	Di (1)	Y	A	B
GLA 17.06 (4)	17	6	5	10.5	7	8
GLA 24.06 (4)	24	6	8	14	11.9	11.9
GLA 35.10 (4)	35	10	12	20.65	15.9	15.9
GLA 35.12	35	12	12	21.75	15.9	15.9
GLA 42.10	42	10	12	24	19	19
GLA 47.10	47	10	15	26.65	19.9	19.9
GLA 52.16	52	16	20	31.5	20.6	22.6

Type	Dynamic load (N)	Limit loads (N)		Life coefficients				Weight (g)
				Pa/Pr ≤ 0.37		Pa/Pr > 0.37		
	C_w (2)	radial C_{or}	axial C_{oa}	X	Y	X	Y	
GLA 17.06	1 500	840	350	1	1.37	0.5	2.73	10
GLA 24.06	4 200	2 300	1 000	1	1.37	0.5	2.73	20
GLA 35.10	7 900	5 100	1 500	1	1.67	0.5	3.03	80
GLA 35.12	7 800	5 000	1 400	1	2.47	0.5	3.83	80
GLA 42.10	12 000	7 100	2 100	1	1.17	0.5	2.53	100
GLA 47.10	15 400	9 200	3 300	1	0.97	0.5	2.33	170
GLA 52.16	19 300	10 500	4 000	1	2.17	0.5	3.53	230

1) Tolerance of Diameter Di: +0 / -0.008 mm
2) Cw basic load for 100 km
3) Pressure angle α for load calculation: 60°
4) Available in stainless steel (suffix **NX**) with RS seals type
5) Standard shields ZZ type (GLA 52.16 with RS seals type)

Carriage C3RCL, C3RAL, C3RYL

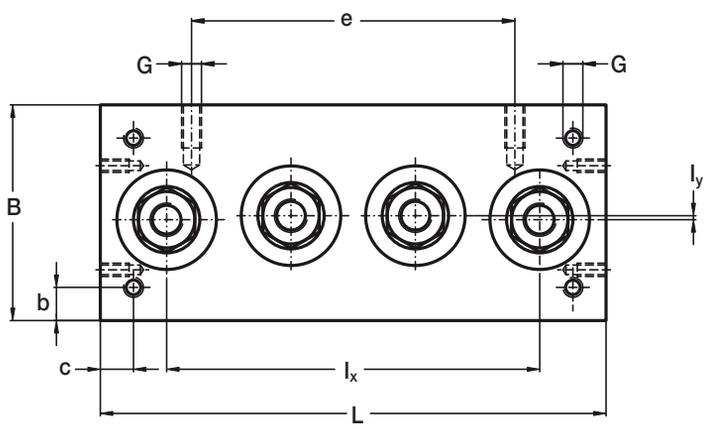


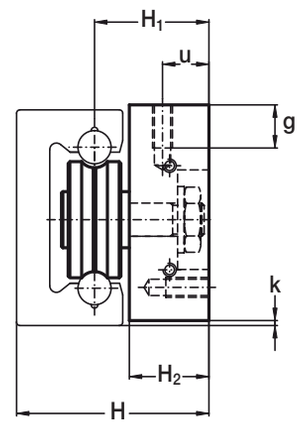


Type	Dimensions (mm)														Weight (kg)	Suggested combinations
	L	B	l_x	l_y	H	H_1	H_2	G	g	b	c	u	e	k		
C3RCL 17 06 065	65	32	40	0.5	27.5	17	11	M4	6	4	6	5.5	24	0.5	0.1	**LM 30**
C3RCL 24 06 085	85	42	58	1	35.7	21.7	14	M5	8	6	6	7	35	1	0.2	**LM 40**
C3RCL 35 10 115	115	65	75	1.2	58	34.5	24	M6	10	10	10	14	60	1.5	0.8	**LM 65**

1) Dimensions in the table are correct also for carriages C3 RAL, C3 RYL
2) Available with stainless steel guide rollers (suffix **NX**)

Carriage C4RCL, C4RAL, C4RYL



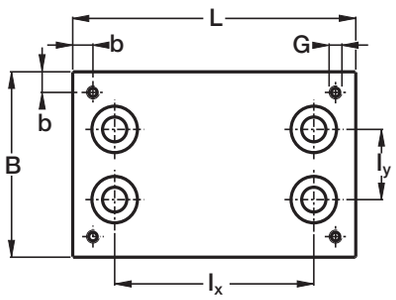


Type	Dimensions (mm)														Weight (kg)	Suggested combinations
	L	B	l_x	l_y	H	H_1	H_2	G	g	b	c	u	e	k		
C4RCL 17 06 085	85	32	60	0.5	27.5	17	11	M4	6	4	6	5.5	44	0.5	0.15	**LM 30**
C4RCL 24 06 114	114	42	87	1	35.7	21.7	14	M5	8	6	6	7	60	1	0.25	**LM 40**
C4RCL 35 10 152	152	65	112.5	1.2	58	34.5	24	M6	10	10	10	14	90	1.5	1	**LM 65**
C4RCL 35 10 180	180	90	135	23.7	60.5	34.5	24	M6	10	10	10	14	120	2	1.5	**LM 90**

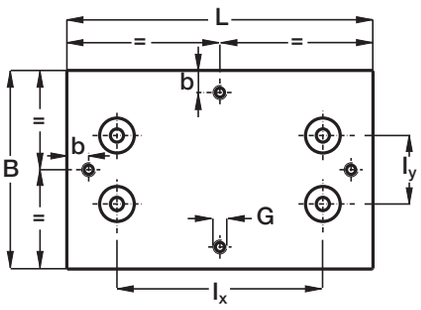
1) Dimensions in the table are correct also for carriages C4 RAL and C4 RYL
2) Available with stainless steel guide rollers (suffix **NX**)

Carriage T4RCL, T4RCP, T4PFV, T4RAL, T4RYL

T4RCL
T4RCP



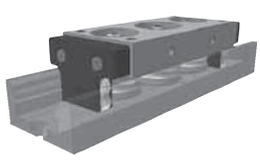
T4PFV

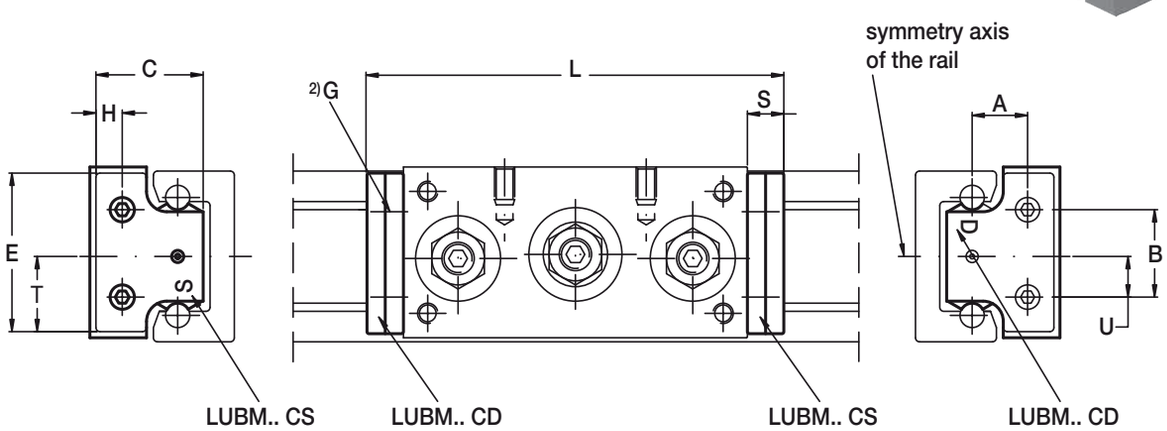


Type	Dimensions (mm)									Weight (kg)	Recommended pairing
	L	B	l_x	l_y	H	H_1	H_2	G	b		
T4RCL 35 10 150	150	120	99	50.7	58.5	34.5	24	M8	10	1.6	**LM 120**
T4RCL 35 10 220	220	120	169	50.7	58.5	34.5	24	M8	10	2.2	**LM 120**
T4RCP 42 10 150	150	120	99	44	65.5	41.5	29	M8	15	2	**LM 120**
T4RCP 42 10 220	220	120	169	44	65.5	41.5	29	M8	15	2.7	**LM 120**
T4PFV 43 22 180	180	180	127	62	74	42	28	M10	20	3.1	**LM 180**
T4PFV 43 22 280	280	180	227	62	74	42	28	M10	20	4.5	**LM 180**

1) Dimensions valid also for T4RAL and T4RYL

Lubricator LUBM





Type	Dimensions (mm)											Suggested combinations with the rails
	A	B	U	E	T	H	C	G	S	L C3 RCL	L C4 RCL	
LUBM 030	9.5	16	8	30	15	6.5	20.5	M2.5	9	83	103	**LM 30**
LUBM 040 CD/CS	13.7	21.5	10	40	19	7	27	M3	9	103	132	**LM 40**
LUBM 065 CD/CS	20.5	30	15	63	30	13	44.5	M4	9	133	170	**LM 65**

1) The lubricator is supplied with the felt already lubricated. The lubricant has a mineral oil base - 2) One lubricator for packaging. Countersunk head screws for the mounting are already in the packaging - 3)The lubricator can be mounted on carriages RCL, RAL and RYL - (4) Optional felt without lubricant (D)

U-Line

System LML

Application

Aluminium guide rails LML as well as RCL guide rollers with a plastic-coated outer ring are the components of this line.
LML can be used whenever extremely compact dimensions, simple linear motion and an economic solution are required.
LML system is suitable for manual and low precision movements, for safety doors, for the adjustment of cameras and sensors and many other products.
Applications can be found amongst others in mechanical engineering, medical and food engineering or object monitoring.

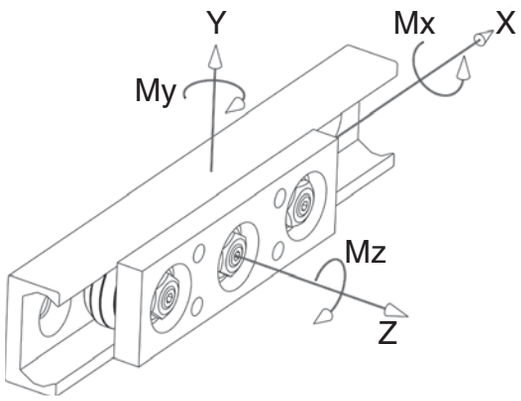
Materials, surfaces, running characteristics

The guide rail, made of extruded aluminium, has a hard anodised surface. This grey-coloured protective coating ensures a significant protection against wear and corrosion. In addition, it has good tribological characteristics.
The guide rollers are made of corrosion-resistant bearing steel and their outer rings are coated with a special polyamide material.
This material combination contributes to a further improvement of the already known good running characteristics of Nadella roller guides and makes possible an absolutely low-noise linear motion without any stick-slip. In contrast to steel to steel combinations, the plastic coating of the guide rollers is slightly flexible and allows higher production tolerances and thus a cost-efficient production.

Load rating and working life

The carrying capacity of the system is determined by the surface pressure between the plastic coating and the aluminium guide rail.

The working life is not calculated.
The following graph applies to the loads indicated in the tables:



MAXIMUM LOAD ON INDIVIDUAL CARRIAGES

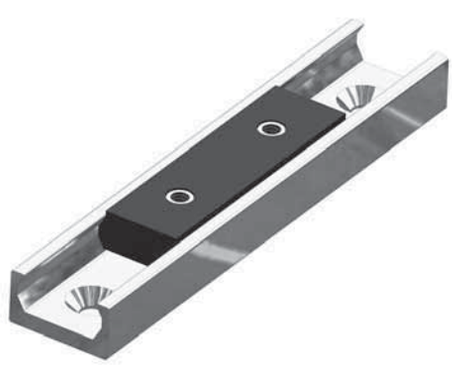
The table below shows the maximum static load that can be applied to an individual carriage for up to 100 hours without leading to permanent deformation of the outer rings. For short stress (<2s) and under dynamic load the values can be doubled.

Carriage	Fy (N)	Fz (N)	Mx (Ncm)	My (Ncm)	Mz (Ncm)
C3RCL 16 NX	150*	30	12.5	60	150
C4RCL 16 NX	150	60	25	95	300

* Fy with effect on the two concentric rollers.

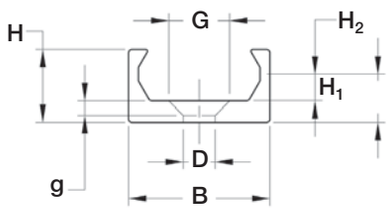
Option sliding guide

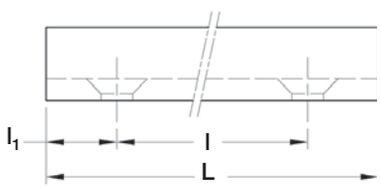
For mostly static applications such as adjusting devices or for non-critical linear movements a suitable polyamide slide with incorporated lubricant is available. Please contact our application engineers.



U-Line

Guide Rails LML



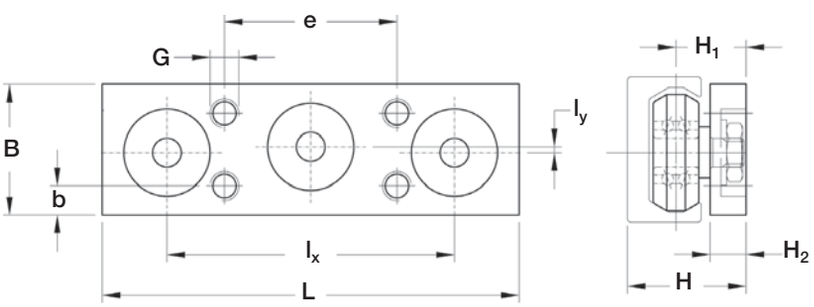


Hole layout
- holes according to catalogue (**SB**)
- holes according to drawing (**NZ**)
- without holes (**NF**)

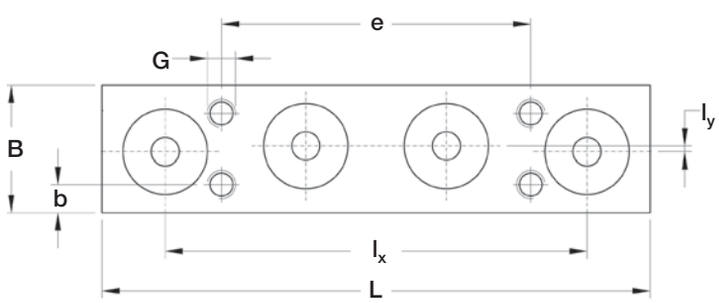
Type	Dimensions (mm)									Moments of inertia (1) (cm⁴)		Weight (kg/m)	L_{max} (mm)
	B	H	H1	H2	D	G	g	l	l1	Jx	Jy		
LML 20	20	10.3	6.8	3.8	4.5	9.5	2.5	80	40	0.068	0.427	0.235	2800

1) Inertia value based on E module for aluminium 70 000 N/mm². Surface hard anodised

Carriage C3RCL 16 NX



Carriage C4RCL 16 NX



Type	Dimensions (mm)										Weight (g)
	L	B	lx	ly	H	H1	H2	G	b	e	
C3RCL 16 NX	58	18	40	0.8	16.5	9.75	5	M4	4	24	33
C4RCL 16 NX	78	18	60	0.8	16.5	9.75	5	M4	4	44	44

Corrosion-resistant design

Example: standard rail **LML20/1200SB**
standard carriage **C3RCL16NX**

U-Line

Mounting example

Protective doors on machine tool
U-Line