

Curved guidance systems

with guideways and carriages



Well rounded

Curved guidance systems are compact, ready-to-fit guidance systems for unlimited stroke.

They comprise:

- curved and straight guideways and
- bogie carriages capable of supporting loads.

The curved and straight guideways can be combined with each other. As a result, it is possible to achieve particularly economical curved guidance systems as well as oval and circular guidance systems.

Curved guidance systems:

- can support forces from all directions and moments about all axes
- are suitable for high traverse speeds
- run clearance-free
- the carriages are adjusted against the raceways of the guideways by means of eccentric bolts (..B)
- the carriages can also be supplied preloaded and clearance-free (.. SF)
- are robust and resistant to wear

- are maintenance-free and give reliable operation even under challenging environmental conditions.

Applications

Curved guidance systems are highly suitable for applications:

- that require an economical modular principle
- in handling equipment
- as guidance systems in machinery
- in the automation sector.



Curved guidance systems

with guideways and carriages



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Features

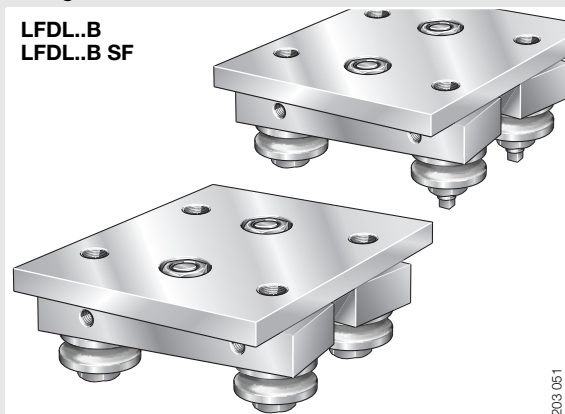
Curved guidance systems

- are compact units comprising:
 - bogie carriages LFDL..B or SF
 - curved guideways LFS..R
 - straight composite guideways LFS
- place only low demands on the adjacent construction
- can be fitted with a lubrication and wiper unit AB (special accessories) to protect the raceways
- with adjustable or preloaded carriages
 - the concentric bolts are tightened to the required tightening torque
 - the two eccentric bolts of the adjustable variant (.B) are screw mounted finger tight
- are particularly easy to install
 - the carriage is screw mounted on the adjacent construction.

Bogie carriage



LFDL..B
LFDL..B SF



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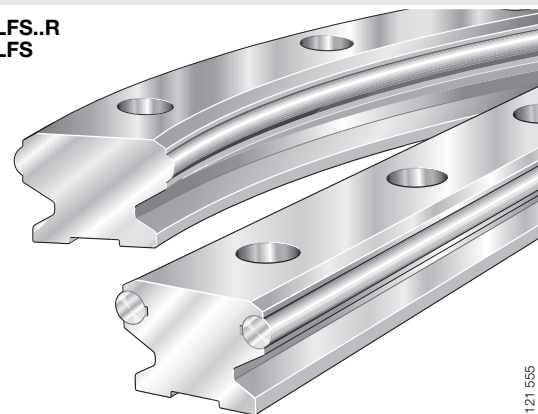
- for curved and straight guideways
- steel saddle plate, two swivelling carriers made from anodised aluminium, two concentric and two eccentric bolts (.B) or four concentric bolts (. SF), four profiled track rollers sealed on both sides and greased
- suitable for operating temperatures from $-20\text{ }^{\circ}\text{C}$ to $+80\text{ }^{\circ}\text{C}$



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Guideways

LFS..R
LFS



121 555

- LFS..R
curved guideway made from hardened steel; surface black oxide coated, raceways ground; location from above
- LFS
straight composite guideway, anodised aluminium support rail, hardened and ground steel shafts rolled into support rail, location from above



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For information on track rollers, see *INA Technical Product Information "TPI 99"*.



Design and safety guidelines

Guideways LFS

The hole pattern of the straight guideways is shown in Figure 1.

Guideways are supplied with a symmetrical hole pattern ①. For a symmetrical hole pattern, $C_5 = C_6$. C_5 and C_6 are dependent on the guideway length.

For an asymmetrical hole pattern ②, please consult INA.

Joined guideways

Straight and curved guideways of the same width can be joined with or without the guideway connector VBS.

In the case of joined guideways, the individual sections are supplied matched to each other and consecutively numbered (Figure 2).

If C_5 exceeds a certain value, an additional hole C_7 is necessary. In the case of oval systems, this also applies to C_6 .

Guideway Designation	$C_5 >$ mm	C_7 mm
LFS 32	30	11
LFS 52	50	17

The deviation at the joints of two combined guideways must not exceed (Figure 3):

- dimension $a \pm 0,01$ mm
- dimension $h_4 \pm 0,1$ mm.

For dimensions a and h_4 , see *dimension table*, page 10/11.

A deviation in h_4 must if necessary be compensated by means of sheet metal. The sheet metal is not included in the delivery.



Combinations of curved guideways and combinations of curved and straight guideways must be treated as multi-piece guideways. Combinations must be ordered together.

Radii and angles of curved guideways

The available radii and angles of the curved guideways are shown in Table 1. Other radii and angles are available by agreement.

Table 1 · Radii and angles of curved guideways

Guideway Designation	Radius mm			Angle °		
	100	300	500	90	180	360
LFS 32 R	100	300	500	90	180	360
LFS 52 R	150	300	500	90	180	360
LFS 32 OV	100	300	500	90	180	–
LFS 52 OV	150	300	500	90	180	–

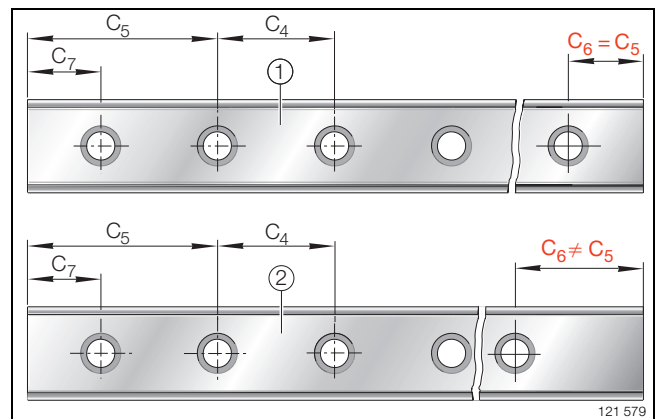


Figure 1 · Hole pattern of guideways

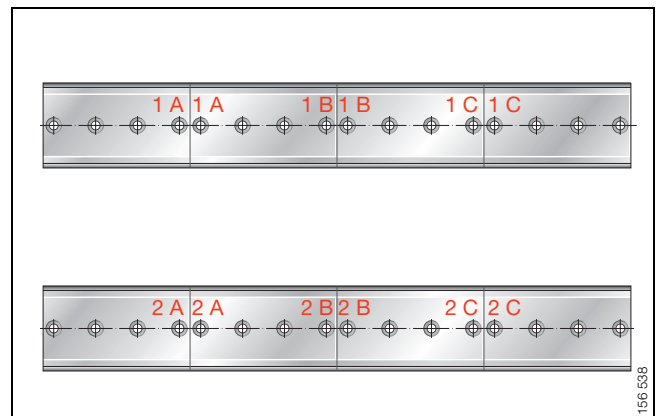


Figure 2 · Joined guideways LFS

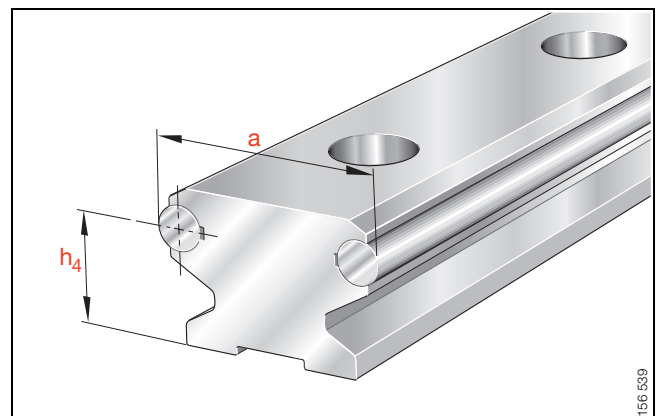


Figure 3 · Dimension a and dimension h_4

Curved guidance systems

with guideways and carriages

Fitting of track roller guidance system with guideways LFS without guideway connectors VBS

Fitting the guideway

- Place the guideway ① on the adjacent construction ② and screw mount finger tight (Figure 4)
- Align the guideway – if necessary clamping it against a locating edge – and screw firmly into place (Figure 4)

⚠ Observe the tightening torque M_A in Table 2.

Table 2 · Tightening torque for guideway fixing screws

Fixing screw DIN ISO 4 762-8.8, DIN 7 984-8.8 Thread	Tightening torque M_A Nm
M 6	9,9
M10	48

Fitting and setting the carriage clearance-free using eccentric bolts

- Push the carriage LFDL..B ③ onto the guideway (Figure 5).

⚠ If lateral load is present, the main load should be supported by the concentric bolts.
Adjust the carriage LFDL..B without load.

- Turn the eccentric bolts using an open-end wrench or ring wrench so that the track rollers are set against the raceway (Figure 5). Note the direction or rotation.

⚠ The bogie must be easily movable and clearance-free.
If excessive adjustment is used, preload will occur that reduces the life of the guidance system.

- Tighten the hexagonal nut to the tightening torque M_A (Figure 5, Table 3).

Check the setting.

The guidance system is correctly set if:

- all the track rollers turn when the carriage is moved
- the carriage can be moved smoothly.

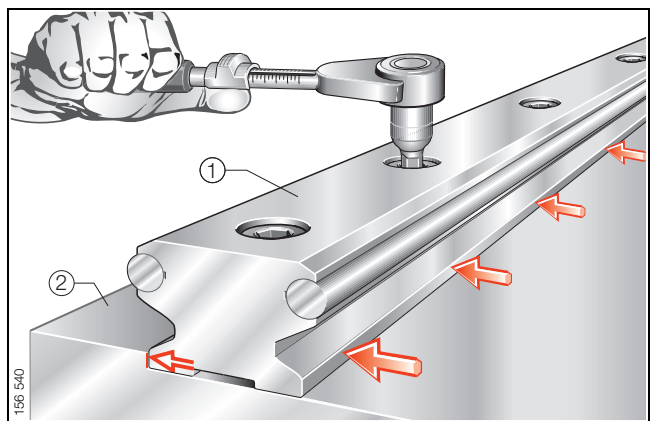


Figure 4 · Fitting the guideway

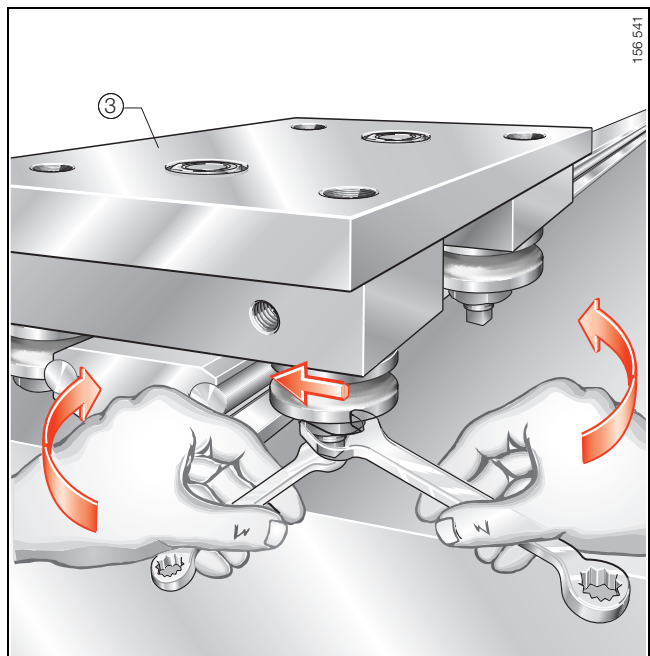


Figure 5 · Fitting the carriage and setting the profiled track rollers clearance-free



Joined guideways can also be ordered with guideway connectors. For further information on guideway connectors VBS, see INA publication "MAI 83".

Tabelle 3 · Tightening torque for eccentric bolts

Profiled track roller	Bolt thread	Tightening torque M_A
Designation	K	N
LFR 50/8 KDD	M 8	15
LFR 5201 KDD	M10	40

Mounting on the adjacent construction

■ Screw the carriage to the adjacent construction (Figure 6).

⚠ Observe the tightening torque M_A in Table 4.

Tabelle 4 · Tightening torque for fixing screws

Fixing screw DIN ISO 4 762-8.8 Thread	Tightening torque M_A
M 8	24
M10	48



Accuracy

Length tolerances of guideways LFS

The length tolerances are shown in Table 5.

Tabelle 5 · Length tolerances

Guideway	Length L mm	Tolerance
Single-piece	$L < 1000$	± 1 mm
	$1000 \leq L < 2000$	± 2 mm
	$2000 \leq L < 4000$	± 2 mm
	$4000 \leq L$	± 5 mm
Multi-piece	Total length L	$\pm 1\%$

Parallelism and positional tolerances of guideways

The parallelism and positional tolerances are shown in Figure 7.

⚠ In applications with two parallel guideways or oval systems where, due to the design, one locating and one non-locating side is necessary, see also INA publication "MAI 103".

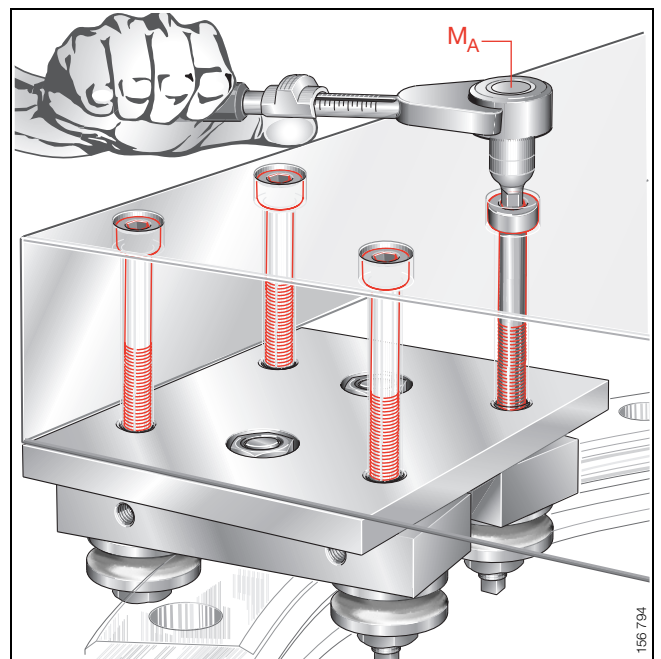


Figure 6 · Screw mounting the carriage on the adjacent construction

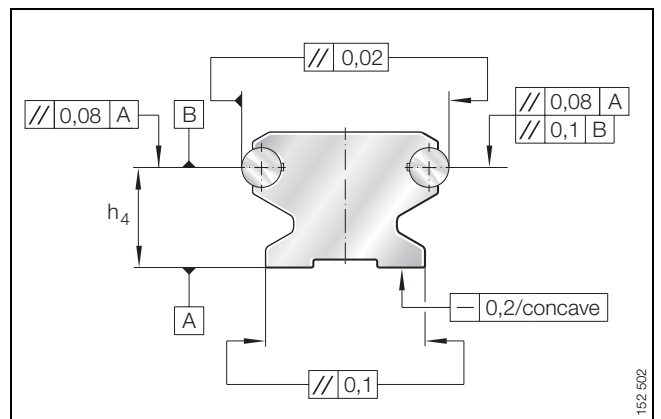


Figure 7 · Parallelism and positional tolerances

Curved guidance systems with guideways and carriages



Ordering example and ordering designation

Adjustable bogie carriage

Bogie carriage LFDL...B
Size a 32 B

Ordering designation:
1 × LFDL 32 B (Figure 8).

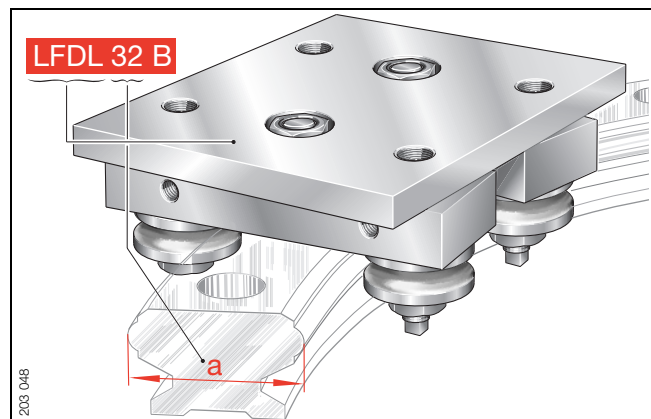


Figure 8 · Bogie carriage LFDL 52 B

Curved guideway

Guideway LFS..R
Guideway width a 32 mm
Radius of curve 300 mm
Arc 180°
Steel version St

Ordering designation:
1 × LFS 32 R-300/180 St (Figure 9).

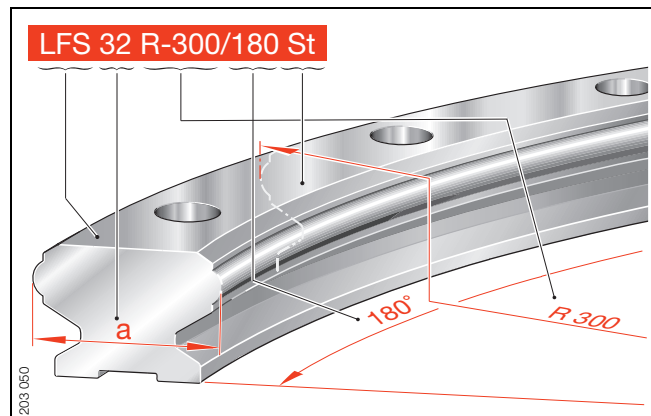


Figure 9 · Guideway LFS 52 R-300/180 St

Closed oval system with 2×180° arcs

Guideways	LFS
Guideway width a	52 mm
Closed oval system	OV
Radius of curve	300 mm
Arc	180°
Length of straight guideways	2 000 mm
Ordering designation:	
	1×LFS 52 OV 300/180-2000 (Figure 10).

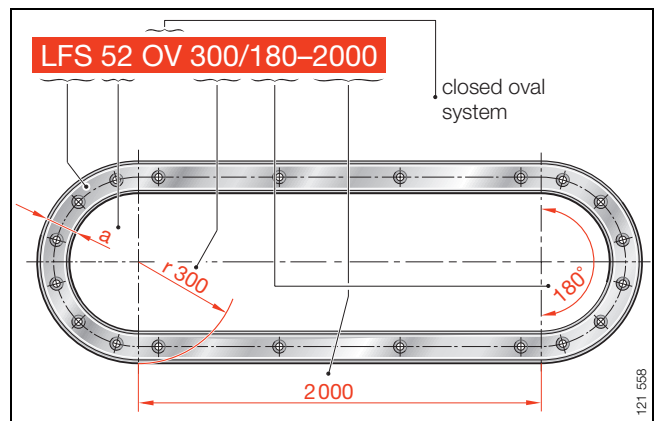


Figure 10 · Closed oval system with 180° arcs
LFS 52 OV 300/180-2000

Closed oval system with 4×90° arcs

Guideways	LFS
Guideway width a	52 mm
Closed oval system	OV
Radius of curve	300 mm
Arc	90°
Length of	
1 st straight guideway pair	2 000 mm
2 nd straight guideway pair	3 000 mm
Ordering designation:	
	1×LFS 52 OV 300/90-2000/3000 (Figure 11).

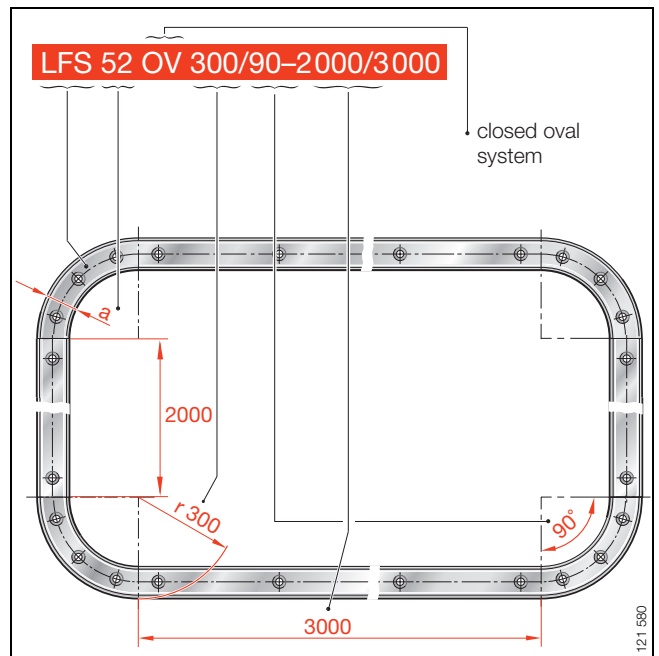


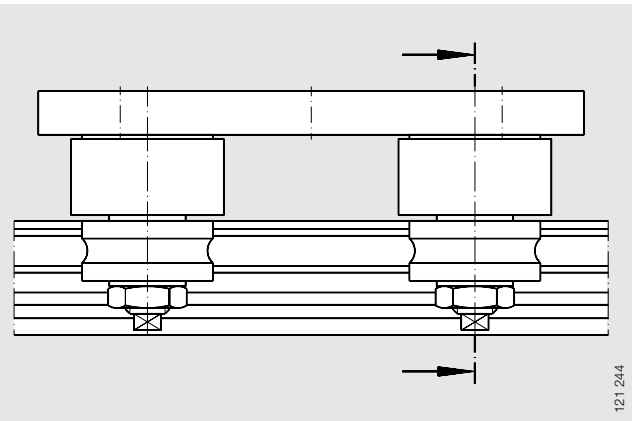
Figure 11 · Closed oval system with 90° arcs
LFS 52 OV 300/90-2000/3000

Bogie carriages

Serie LFDL..B (SF)

Guideways

Serie LFS..R



LFDL..B with LFS..R

Dimension table • Dimensions in mm

Bogie carriage			Curved guideways ⁵⁾		Dimensions					
Designation	Mass ≈kg	With profiled track rollers	Designation ¹⁾	Mass ≈kg	Carriage			Guideway		
					H	A	C	h	a	β ⁵⁾ °
LFDL 32 B (SF)⁶⁾	1	LFR 50/8 KDD	LFS 32 R-100/ 90 St	0,5	44,2	80	100	20	32	90
			LFS 32 R-100/180 St	1						180
			LFS 32 R-100/360 St	2						360
			LFS 32 R-300/ 90 St	1,7						90
			LFS 32 R-300/180 St	3,4						180
			LFS 32 R-300/360 St	6,8						360
			LFS 32 R-500/ 90 St	2,9						90
			LFS 32 R-500/180 St	5,8						180
			LFS 32 R-500/360 St	11,6						360
LFDL 52 B (SF)⁶⁾	2,5	LFR 5201 KDD	LFS 52 R-150/ 90 St	2	66,1	120	150	34	52	90
			LFS 52 R-150/180 St	4						180
			LFS 52 R-150/360 St	8						360
			LFS 52 R-300/ 90 St	4,5						90
			LFS 52 R-300/180 St	9						180
			LFS 52 R-300/360 St	18						360
			LFS 52 R-500/ 90 St	7,8						90
			LFS 52 R-500/180 St	15,6						180
			LFS 52 R-500/360 St	31,2						360

1) Corrosion-resistant design available by agreement.

2) For fixing screw to DIN ISO 4762-8.8.

3) Number of holes on pitch circle r_1 .

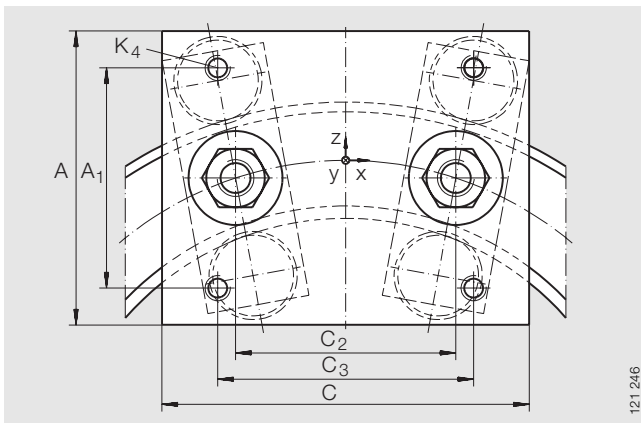
4) Tightening torque for bolts LFZ and LFE, bolts LFZ are supplied tightened to M_A .

5) Other radii and segment sections are available by agreement.

6) The carriages can also be fitted with the lubrication and wiper unit AB (special accessories) to protect the guideways.
Please consult INA in this case.

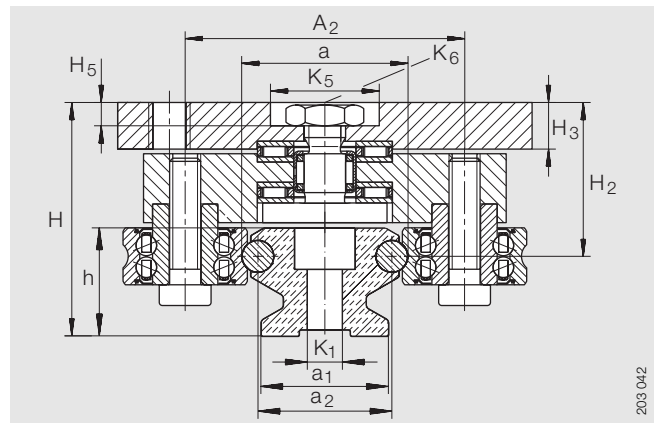
Load carrying capacity table

Bogie carriage with guideway Designation	Forces				Moment ratings					
	$F_{y\max}$ N	$F_{0y\max}$ N	$F_{z\max}$ N	$F_{0z\max}$ N	$M_{x\max}$ Nm	$M_{0x\max}$ Nm	$M_{y\max}$ Nm	$M_{0y\max}$ Nm	$M_{z\max}$ Nm	$M_{0z\max}$ Nm
LFDL 32 B (SF) with LFS 32 R	850	1400	1000	1000	11	18	13	13	11	18
LFDL 52 B (SF) with LFS 52 R	1500	2500	2500	2500	31	31	41	41	25	25



LFDL..B with LFS..R (view rotated 90°)

121 246

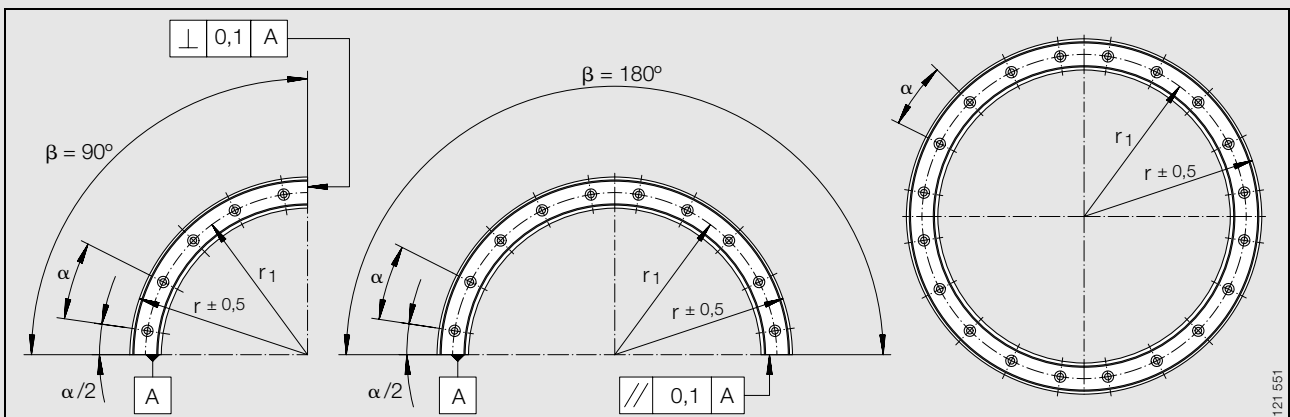


LFDL..B SF

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Mounting dimensions

A ₁	A ₂	a ₁	a ₂	C ₂	C ₃	H ₁ max.	H ₂	H ₃	H ₅	K ₁ ⁽²⁾	K ₄	K ₅	K ₆	x ⁽³⁾	r °	r ₁	α	M _A ⁽⁴⁾ Standard Nm
60	54	24	26	60	70	43	29,2	9	4	M 6	M 8	21	M 8	3	100	84	30	15
														6				
														12				
														4	300	284	22,5	
														8				
														16				
5	500	484	18															
10																		
20																		
90	83	40	42	76	90	65,1	41	11	6	M10	M10	26	M10	3	150	124	30	40
														6				
														12				
														4	300	274	22,5	
														8				
														16				
5	500	474	18															
10																		
20																		



Curved guideway – available arc values

121 551

Closed oval systems without guideway connectors VBS

Arc values 90° and 180°

Series LFS..OV

Dimension table · Dimensions in mm

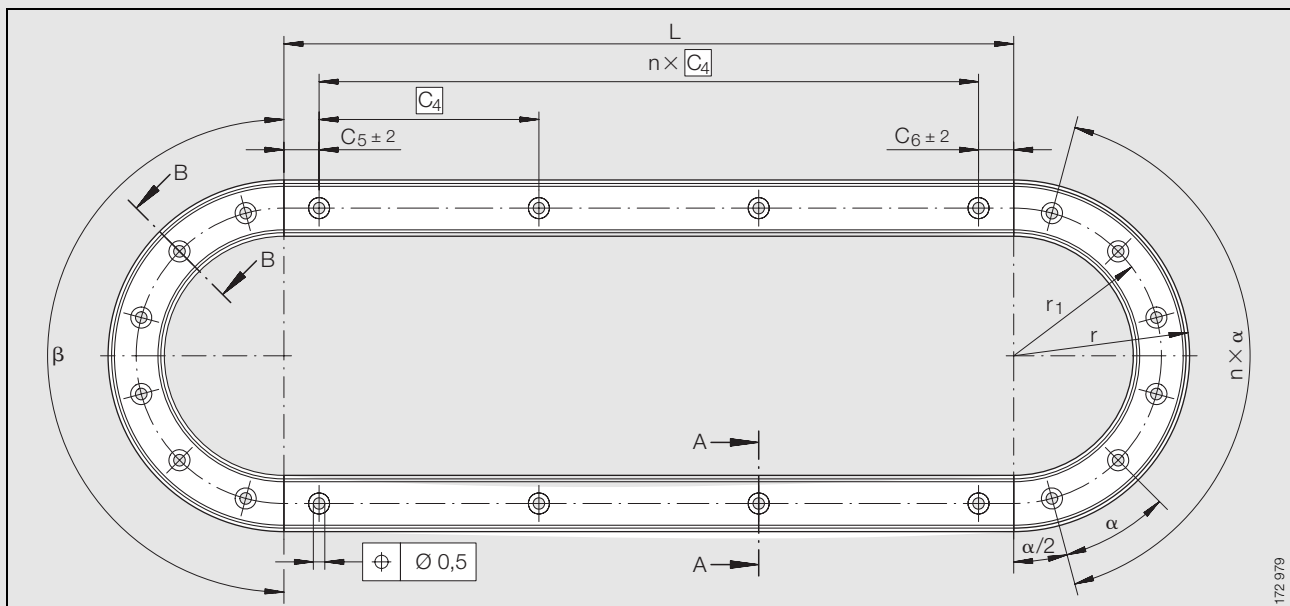
Closed oval Designation		Dimensions				Mounting dimensions					
		a	h	β	$L_{\max}^{1)}$	a_1	a_2	C_4	C_5/C_6		d_{Lw}
									min.	max.	
LFS 32 OV 100/180	–	32	20	180	6 000	24	26	125	11	116	6
–	LFS 32 OV 100/90			90							
LFS 32 OV 300/180	–			180							
–	LFS 32 OV 300/90			90							
LFS 32 OV 500/180	–			180							
–	LFS 32 OV 500/90			90							
LFS 52 OV 150/180	–	52	34	180	8 000	40	42	250	17	235	10
–	LFS 52 OV 150/90			90							
LFS 52 OV 300/180	–			180							
–	LFS 52 OV 300/90			90							
LFS 52 OV 500/180	–			180							
–	LFS 52 OV 500/90			90							

⚠ Closed oval systems can only be ordered as a single unit.
Each unit consists of two curved guideways LFS..R with an arc value 180° and two straight guideways LFS (Figure below) or each unit consists of four curved guideways LFS..R with an arc value 90° and four straight guideways LFS (figure, page 11).

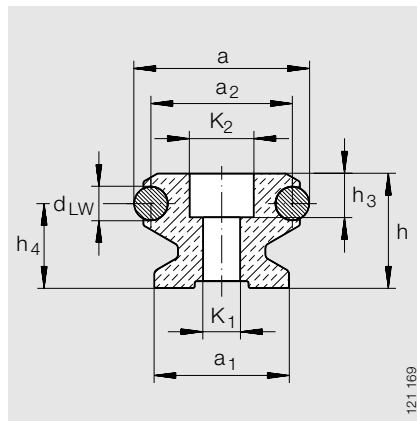
1) Maximum length of single-piece guideways.

2) For fixing screw to DIN ISO 4762-8.8.

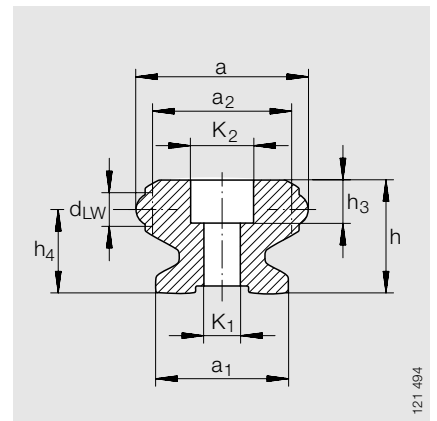
3) Number of holes on pitch circle r_1 .



Oval system with two curved and two straight guideways – arc value 180°

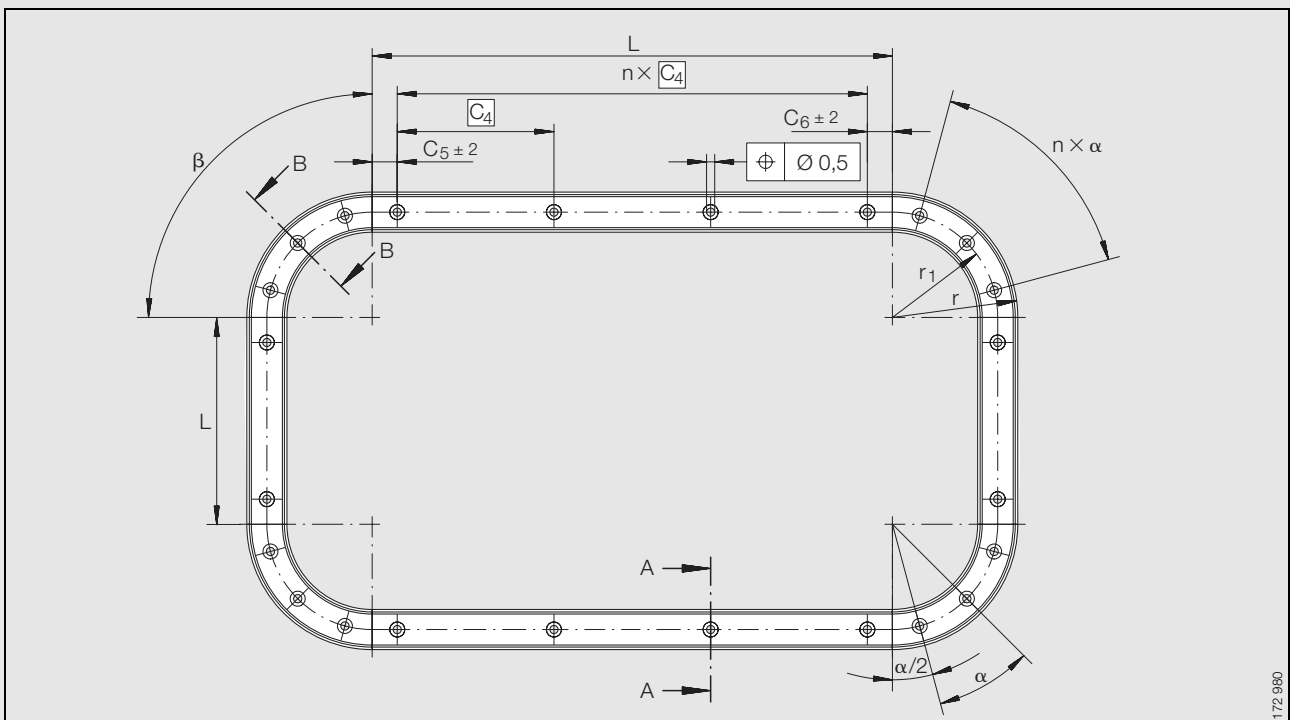


LFS (section A-A)



LFS..R (section B-B)

h_3	h_4	$K_1^{(2)}$	K_2	$x^{(3)}$	r	r_1	α	Closed oval Designation	
8	15	6,5	12	6	100	84	30	LFS 32 OV 100/180	-
				3	100	84	30	-	LFS 32 OV 100/90
				8	300	284	22,5	LFS 32 OV 300/180	-
				4	300	284	22,5	-	LFS 32 OV 300/90
				10	500	484	18	LFS 32 OV 500/180	-
				5	500	484	18	-	LFS 32 OV 500/90
13	25	11	19	6	150	124	30	LFS 52 OV 150/180	-
				3	150	124	30	-	LFS 52 OV 150/90
				8	300	274	22,5	LFS 52 OV 300/180	-
				4	300	274	22,5	-	LFS 52 OV 300/90
				10	500	474	18	LFS 52 OV 500/180	-
				5	500	474	18	-	LFS 52 OV 500/90



Oval system with four curved and four straight guideways – arc value 90°

Closed oval systems with guideway connectors VBS

Arc values 90° and 180°

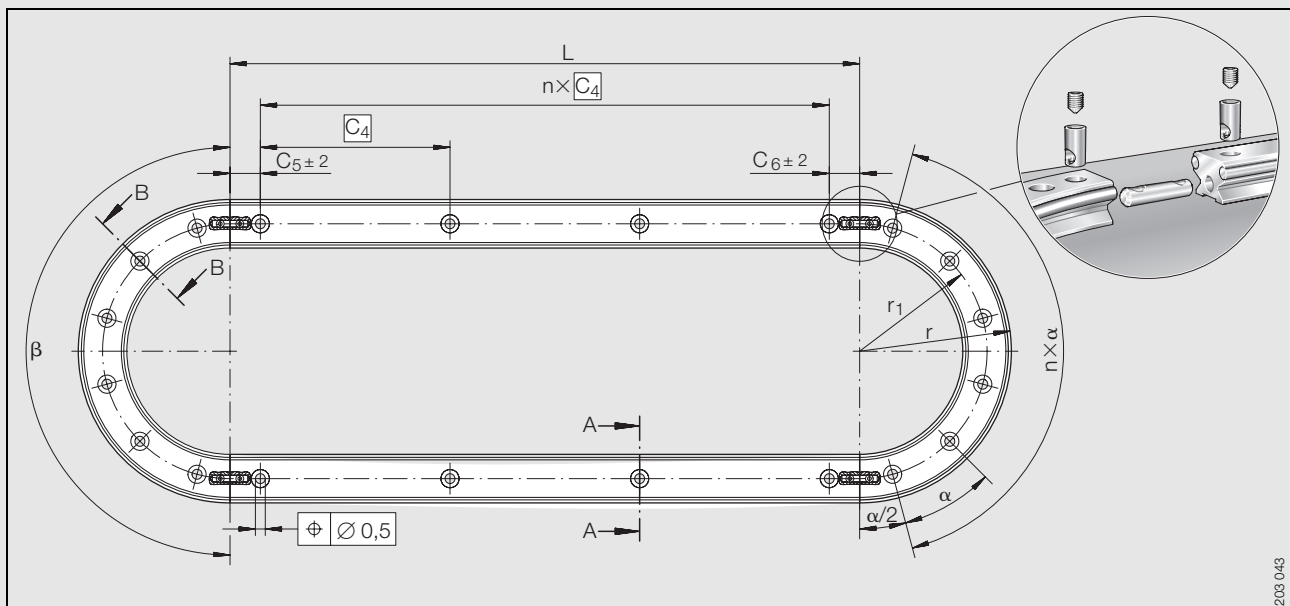
Series LFS..OV..VBS

Dimension table · Dimensions in mm

Closed oval Designation		Dimensions				Mounting dimensions					
		a	h	β	$L_{max}^{1)}$	a_1	a_2	C_4	C_5/C_6		d_{Lw}
									min.	max.	
LFS 32 OV 100/180 VBS	-	32	20	180	6 000	24	26	125	36	116	6
-	LFS 32 OV 100/90 VBS			90							
LFS 32 OV 300/180 VBS	-			180							
-	LFS 32 OV 300/90 VBS			90							
LFS 32 OV 500/180 VBS	-			180							
-	LFS 32 OV 500/90 VBS			90							
LFS 52 OV 150/180 VBS	-	52	34	180	8 000	40	42	250	49	235	10
-	LFS 52 OV 150/90 VBS			90							
LFS 52 OV 300/180 VBS	-			180							
-	LFS 52 OV 300/90 VBS			90							
LFS 52 OV 500/180 VBS	-			180							
-	LFS 52 OV 500/90 VBS			90							

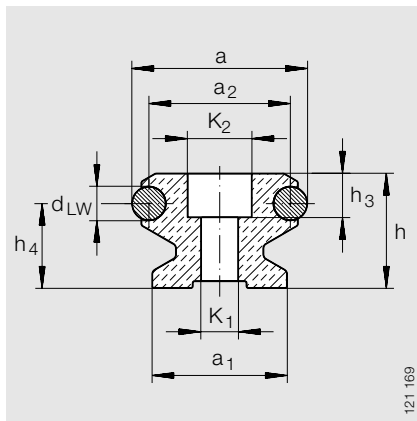
! Closed oval systems can only be ordered as a single unit.
 Each unit consists of two curved guideways LFS..R VBS with an arc value 180° and two straight guideways LFS..VBS (figure below) or each unit consists of four curved guideways LFS..R VBS with an arc value 90° and four straight guideways LFS..VBS (figure, page 13).
 For information on guideway connectors VBS, see *INA publication "MAI 83"*.

- 1) Maximum length of single-piece guideways.
- 2) For fixing screw to DIN ISO 4762-8.8.
- 3) Number of holes on pitch circle r_1 .

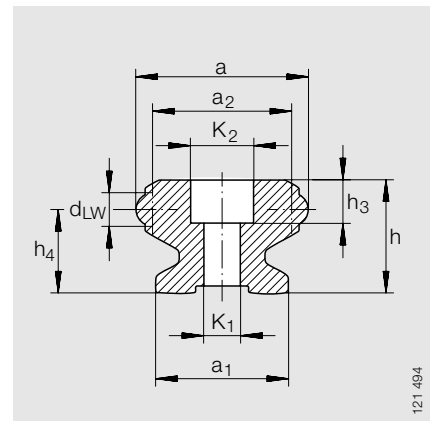


Oval system with two curved and two straight guideways – arc value 180°

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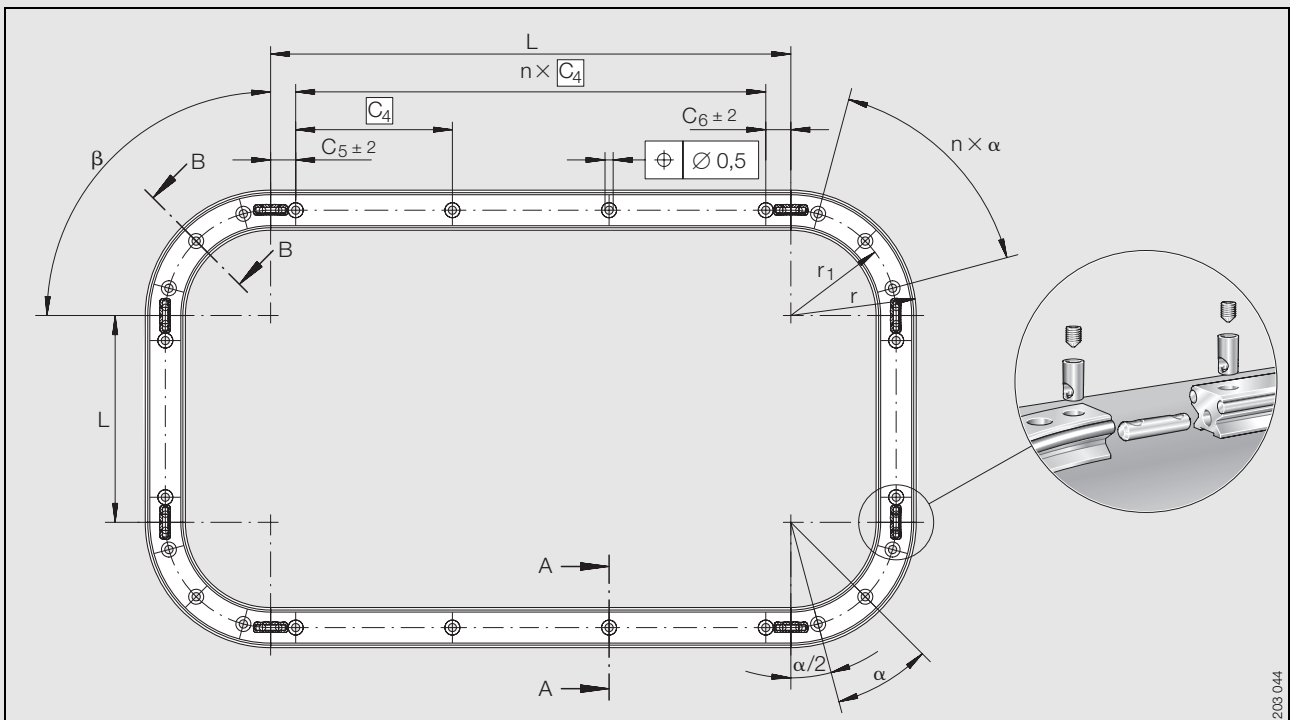


LFS (section A-A)



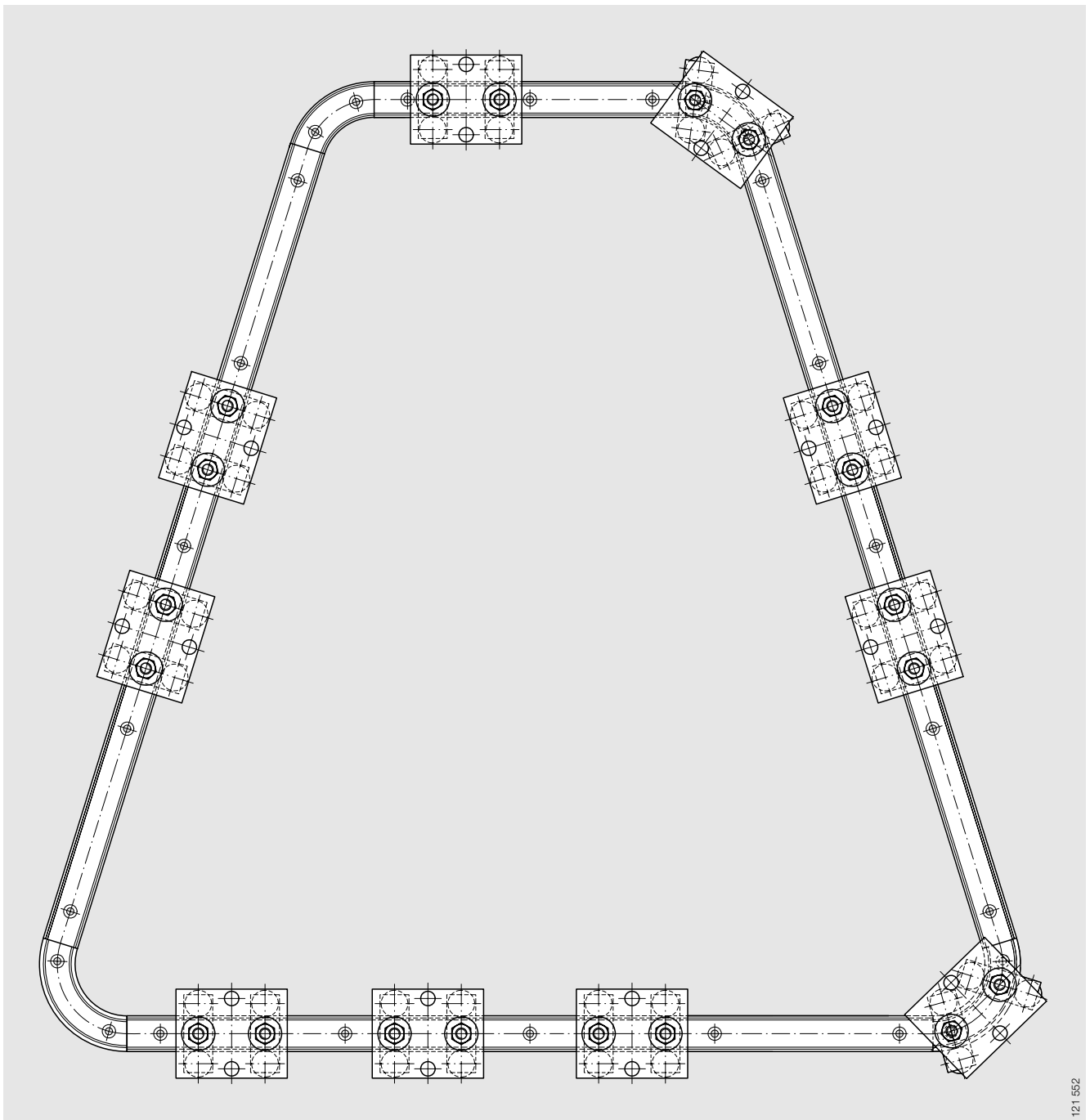
LFS..R (section B-B)

h_3	h_4	$K_1^{(2)}$	K_2	$x^{(3)}$	r	r_1	α	Closed oval Designation	
8	15	6,5	12	6	100	84	30	LFS 32 OV 100/180 VBS	-
				3	100	84	30	-	LFS 32 OV 100/90 VBS
				8	300	284	22,5	LFS 32 OV 300/180 VBS	-
				4	300	284	22,5	-	LFS 32 OV 300/90 VBS
				10	500	484	18	LFS 32 OV 500/180 VBS	-
				5	500	484	18	-	LFS 32 OV 500/90 VBS
13	25	11	19	6	150	124	30	LFS 52 OV 150/180 VBS	-
				3	150	124	30	-	LFS 52 OV 150/90 VBS
				8	300	274	22,5	LFS 52 OV 300/180 VBS	-
				4	300	274	22,5	-	LFS 52 OV 300/90 VBS
				10	500	474	18	LFS 52 OV 500/180 VBS	-
				5	500	474	18	-	LFS 52 OV 500/90 VBS



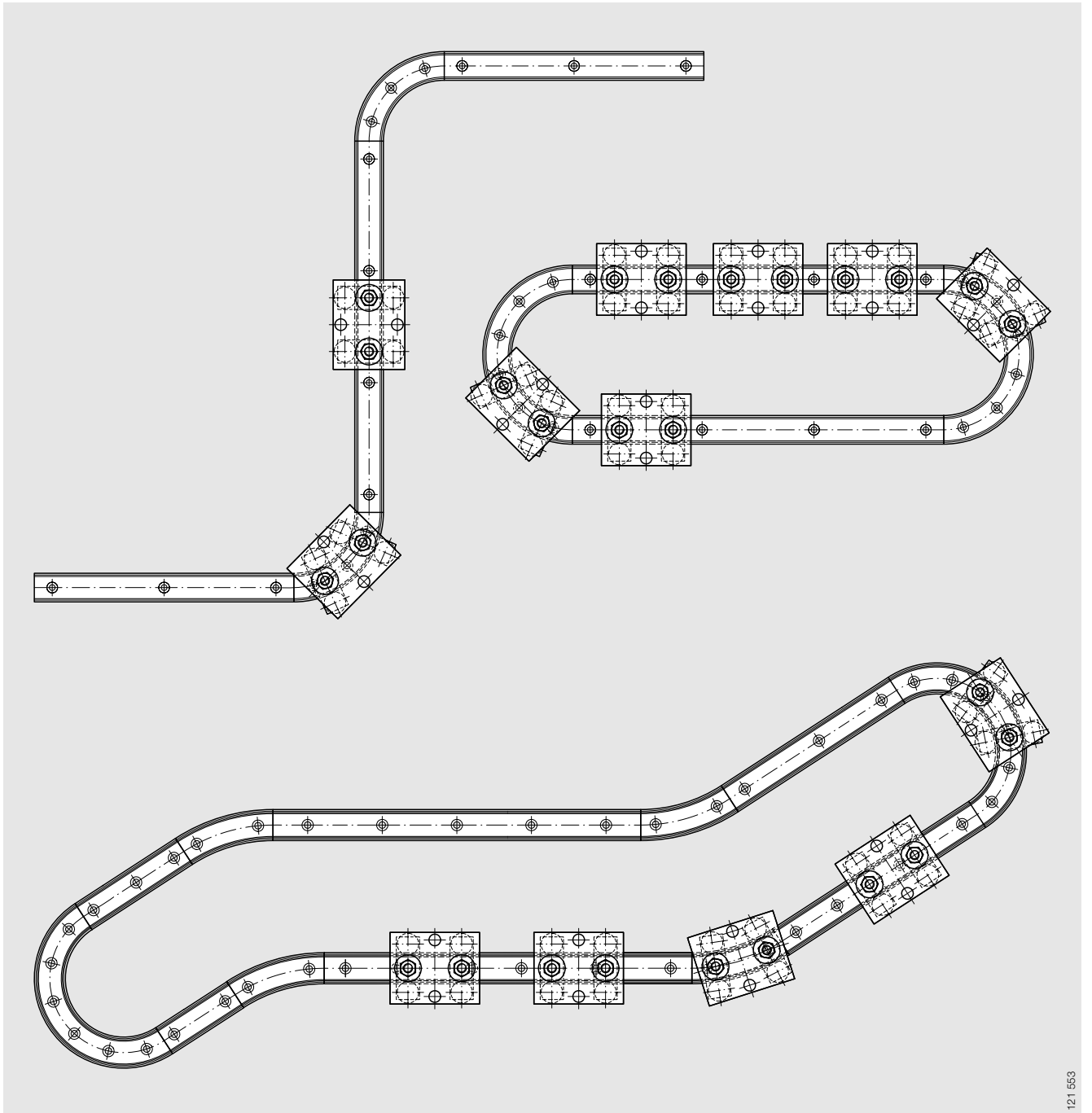
Oval system with four curved and four straight guideways – arc value 90°

Design examples



Example of special arrangement

121 552



Example of special arrangement

121 553



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