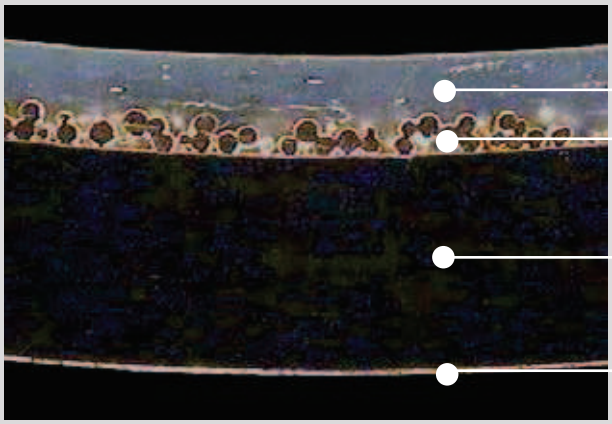
METAL BUSHINGS ITALIA

BUSHINGS

Relubricable bushings
Technical catalogue



1. Polyacetal Resin
0,30 - 0,50 mm.
2. Porous bronze without lead
0,20 - 0,30 mm.
3. Steel strip
0,40 - 2,20 mm.
4. External protection treatment
0,008 mm.

FEATURES

The sliding bushing RL requires little maintenance and is composed by three layers: steel, porous bronze and polyacetal resin. The cavities of the polyacetal resin are real grease reserves and this is why RL, within given limits, is not affected by alignment defects and edge overloads and, at the same time, guarantees the loss of heat from the working surface of the bearing.
Relubricable RL bushings are suitable:

- -In case of heavy, oscillating and rotating loads
- -In case of intermittent working
- -If low coefficient of friction and reduced wear are requested
- -If it is necessary to reduce the number of maintenance interventions.

WEAR

The life time of some sliding bushing is illustrated in comparative chart 1. During the tests bushings of 16mm and static loads at room temperature are used. The lubricated bushings with lithium-grease are fixed and run to rotation with factor
PV = 0,7 N/mm² - m/sec. for 500 hours and for a max. wear of 0,25 mm.

Chart 1 (material comparative)

MATERIAL	TEST DURATION (hours)	WEAR µm/100 (hours)
RL	500	0,8
22% on sheet steel	330	4
Bronze	500	12
BZ AL PB graphite on steel surface	42	800
WHITE METAL on surface	15	900
PHOSPHOR BRONZE	2	SEIZED UP

PHYSICAL AND MECHANICAL FEATURES

Chart 2

FEATURES		DETAILS
LOAD CAPACITY		140 N/mm²
SPEED LIMIT	V max (dry) V max (oil)	2.5 m/sec. 5.0 m/sec.
HEAT LIMIT	continuous intermittent	– 40 ~ + 90°C – 40 ~ + 130°C
DURATION FACTOR K		$3x10^{-11}$ mm²/N
COEFFICIENT OF FRICTION M 200	(dry cond) (grease cond)	0.15 ~ 0.25 0.05 ~ 0.15
HEAT EXPANSION		$3x10^{-5}$ / °C
HEAT CONDUCTION		40 W/mK

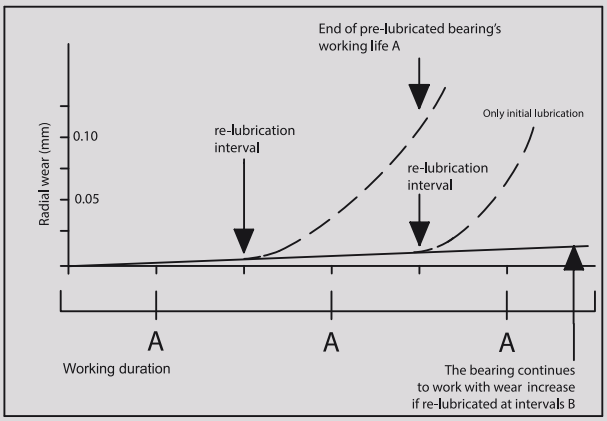
PHYSICAL AND MECHANICAL FEATURES

The max. acceptable specific load depends on the lubrication conditions as illustrated in Chart 3.

Chart 3

LOAD	TEST CONDITIONS	LUBRICATION	Q N/mm²
COSTANT	VERY SLOW ROTATIONS (0.01 m/sec)	GREASE OR OIL	140
COSTANT	CONTINUOUS ROTATIONS	GREASE OR OIL (continuous)	70
COSTANT OR DYNAMIC	CONTINUOUS ROTATIONS	OIL (hydro-dynamic lubrication)	45
COSTANT	FLUCTUATIONS	GREASE OR OIL	*
DYNAMIC	CONTINUOUS ROTATIONS	GREASE OR OIL	*
* THIS VALUE CAN CHANGE ON VARYING OF NUMBER OF CYCLES q		< 10^5 cicli = 10^7 cicli > 10^8 cicli	140 20 5

(1 N/mm² = 1MN/m² = 10^6 N/m²)

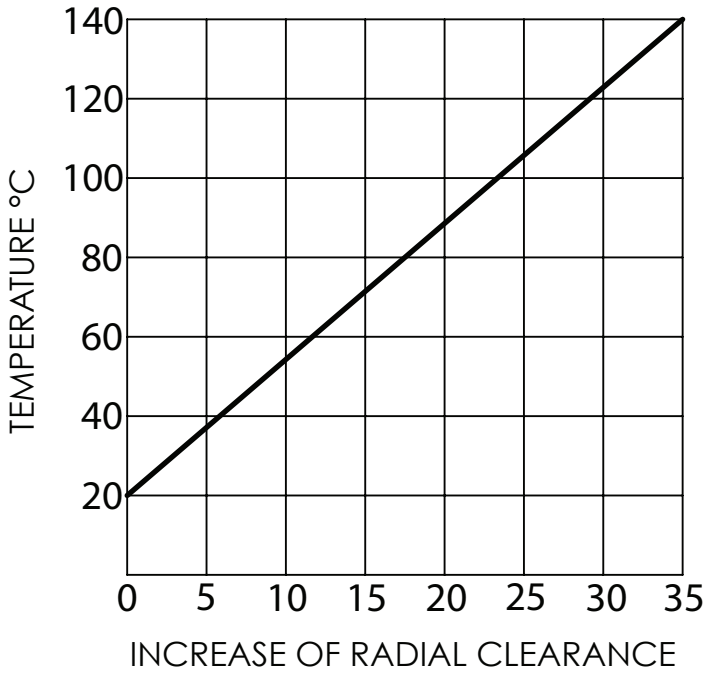


A periodic re-lubrication guarantees a long working life to the bushing with reduced wear;
0,025 mm. with specific load < 100 N/mm2
As the lubricant properties end (A area), restore the lubricant in order to allow the bushing to work with small wear increase.

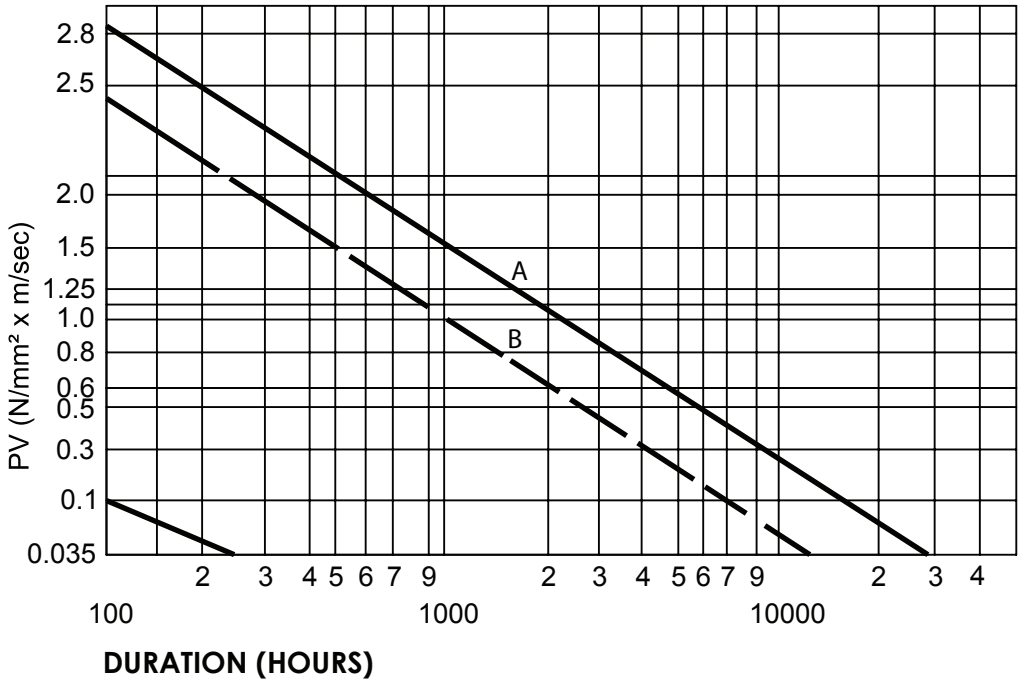
SPEED FV FACTOR FV

Chart 4

SPEED m/sec	fv
< 0,5	1.0
0,5 ~ 1.0	1.3
1.0 ~ 1.5	1.5
1.5 ~ 2.0	1.7
2.0 ~ 2.5	1.8
> 2,5	–



Pict. 2



LIFE TIME

Line B of Pict.2 shows the duration in the relubrication interval. Line A indicates the bushing working life which changes according to the following application factors:

T=temperature
S=type of housing bore and Shaft finishing surface.

APPLICATION FACTOR f

Chart 5

HOUSING TYPE	LUBRICANT GREASE / OIL	WORKING TEMPERATURE °C			
		20 ~ 40	50	75	100
QUALITY AVERAGE OF HEAT DISSIPATION	LITHIUM BASE SILICONE OIL	0.8	0.6	0.4	0.2
	LITHIUM BASE MINERAL OIL	1.0	0.7	0.4	0.15
HOUSING WITH LIMITED HEAT DISSIPATION	LITHIUM BASE SILICONE OIL	0.4	0.3	0.2	0.1
	LITHIUM BASE MINERAL OIL	0.5	0.35	0.2	
NON-METALLIC HOUSING WITH BAD HEAT DISSIPATIONS	LITHIUM BASE SILICONE OIL	0.2	0.1	NOT RECOMMENDED	
	LITHIUM BASE MINERAL OIL	0.3	0.2		

Chart 5 shows the application factor (f) in relation with the dissipation possibilities of the BUSHING HOUSING BORE.
The lubrication can considerably improve the performances.

RL TOLERANCE AND MACHINING

The supplied bearing is ready to be assembled. Its hole can be bored or broached if necessary.

RL SUGGESTED MATCHES

Housing H7
Shaft h8
Roughness mm Rz < 6 - Ra < 0,8

Min. radial clearance of **RL** bushing considering temperature T>20°C and sliding speed 0,5 m/sec.

Chart 6

SHAFT DIAMETER (mm)	PV VALUE (N/mm² x m/sec.)				
	0.1	0.25	0.5	1.0	2.8
10	0.020	0.028	0.036	0.044	0.060
20	0.027	0.040	0.051	0.063	0.082
30	0.035	0.048	0.063	0.079	0.110
40	0.040	0.056	0.071	0.090	0.120
50	0.043	0.062	0.081	0.100	0.130
60	0.048	0.069	0.090	0.110	0.145
80	0.056	0.080	0.110	0.128	0.170
100	0.064	0.089	0.120	0.140	0.185

SLIDING SPEED, CORRECTIVE FACTOR α

Chart 7

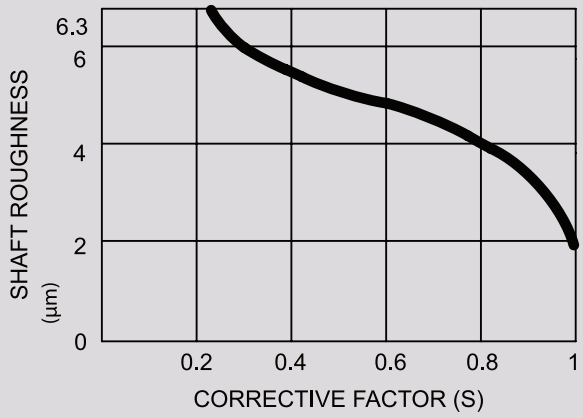
SLIDING SPEED	m/sec.	< 0.5	0.5 ~ 1.0	1.0 ~ 1.5	1.5 ~ 2.0	2.0 ~ 2.5	> 2.5
Max PV (grease)	N/mm² m/sec.	2.8	2.8	2.8	1.4	1.05	0.7
Static load downwards	not machined bearing	2.0	1.8	1.6	1.2	0.8	–
Static load upwards	not machined bearing	1.1	1.0	0.9	0.7	0.11	–
Rotary load	not machined bearing	3	2.25	2.5	1.5	1.2	–
Thrust block	not machined	1.0	0.5	0.1	–	–	–
Thrust block	machined	1.0	0.6	0.2	–	–	–

When the speed is over 2,5m/sec. oil lubrication is recommended.

ROUGHNESS INFLUENCE

If a duration of almost 2000 hours is required, the shaft hardness should be at least HRC35 and the roughness Rz less than 2 µm. If not possible, pict. 3 shows the corrective life factor (S).

Picture 3



CALCULATION

Rotation

$V = 5.2 \times 10^{-5} \times d \times n$

$P = \frac{F}{D \times L}$

$EP = P \times \left(\frac{Q}{Q - P} \right)$

If EP is 10,000 or P is bigger than Q, the bearing is undersized: increase its width and diameter.

$PV = EP \times V$

$L = A \times \alpha \times f \times s$

$E = B \times \alpha \times f \times s$

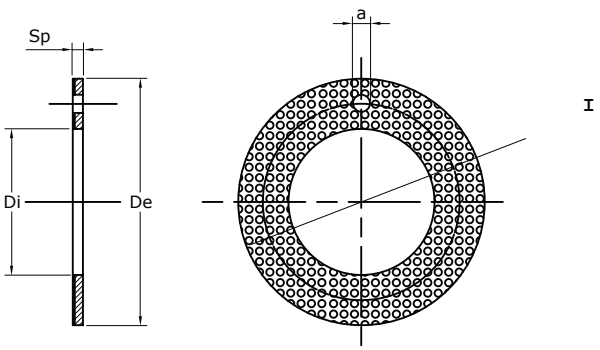
OSCILLATION

$Z = L \times C \times 60$

$ZR = E \times (R + 2)$

d = bearing diameter mm.
L = bearing width mm.
F = load on bearing N
n = rotation speed rpm.

Suggested housing:
from **Di 12** to **Di 42** mm 1
from **Di 48** to **Di 52** mm 1,5



I

FOR OSCILLATING

µ = oscillating width

$P = \frac{4 \mu C}{360}$

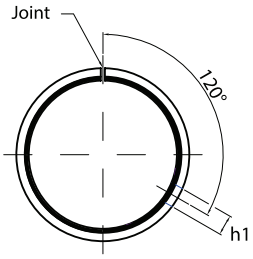
C = cycles/min.

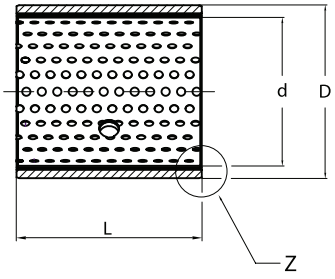
a = corrective speed factor (chart 7)
f = heat application factor (chart 5)
s = corrective factor (shaft finishing) (pict.3)
Q = specific load limit (chart 3)
V = speed m/sec
P = specific load
EP = equivalent specific load
L = bushing life time (hours)
A = pict.2
B = pict.2
E = lubrication interval (hours)

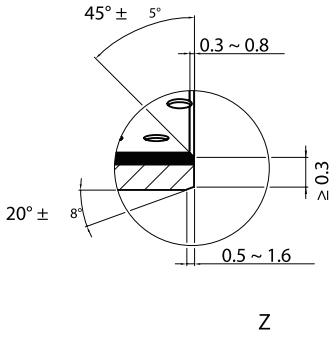
RL RELUBRICABLE THRUST WASHER SIZES

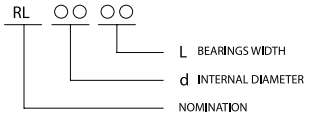
TYPE	Di + 0,25	De – 0,25	Sp – 0,05	a + 0,2	I ± 0,12
TW10RL	12	24	1,5	1,5	18
TW12RL	14	26	1,5	2	20
TW14RL	16	30	1,5	2	23
TW16RL	18	32	1,5	2	25
TW18RL	20	36	1,5	3	28
TW20RL	22	38	1,5	3	30
TW22RL	24	42	1,5	3	33
TW24RL	26	44	1,5	3	35
TW25RL	28	48	1,5	4	38
TW30RL	32	54	1,5	4	43
TW35RL	38	62	1,5	4	50
TW40RL	42	66	1,5	4	54
TW45RL	48	74	2	4	61
TW50RL	52	78	2	4	65

RTL version (machinable after assembled) available on request









RL Relubricable cylindrical bearing sizes

d	D	d SHAFT (mm)	D HOUSING H7 (mm)	WIDTH L (mm) $+^{0}_{-0,4}$																		HOLE
				4	5	6	8	10	12	15	20	25	30	40	50	60	70	80	90	95	100	115	h 1 mm
10	12	10 – $^{0}_{0,022}$	12+ $^{0}_{0,018}$				1008	1010	1012	1015	1020												
12	14	12 – $^{0}_{0,027}$	14+ $^{0}_{0,018}$				1208	1210	1212	1215	1220	1225											
14	16	14 – $^{0}_{0,027}$	16+ $^{0}_{0,018}$					1410	1412	1415	1420	1425											
15	17	15 – $^{0}_{0,027}$	17+ $^{0}_{0,018}$					1510	1512	1515	1520	1525											
16	18	16 – $^{0}_{0,027}$	18+ $^{0}_{0,018}$					1610	1612	1615	1620	1625											
18	20	18 – $^{0}_{0,027}$	20+ $^{0}_{0,018}$					1810	1812	1815	1820	1825	1830										
20	23	20 – $^{0}_{0,033}$	23+ $^{0}_{0,021}$					2010	2012	2015	2020	2025	2030	2040									
22	25	22 – $^{0}_{0,033}$	25+ $^{0}_{0,021}$					2210	2212	2215	2220	2225	2230										
24	27	24 – $^{0}_{0,033}$	27+ $^{0}_{0,021}$							2415			2430										
25	28	25 – $^{0}_{0,033}$	28+ $^{0}_{0,021}$					2510		2515	2520	2525	2530	2540	2550								
30	34	30 – $^{0}_{0,033}$	34+ $^{0}_{0,025}$							3015	3020	3025	3030	3040	3050								
32	36	32 – $^{0}_{0,039}$	36+ $^{0}_{0,025}$							3215	3220	3025	3230										
35	39	35 – $^{0}_{0,039}$	39+ $^{0}_{0,025}$							3515	3520	3525	3530	3540	3550								
40	44	40 – $^{0}_{0,039}$	44+ $^{0}_{0,025}$								4020	4025	4030	4040	4050								
45	50	45 – $^{0}_{0,039}$	50+ $^{0}_{0,025}$								4520		4530	4540	4550								
50	55	50 – $^{0}_{0,039}$	55+ $^{0}_{0,03}$								5020	5025	5030	5040	5050	5060							
55	60	55 – $^{0}_{0,046}$	60+ $^{0}_{0,03}$										5530	5540	5550	5560							
60	65	60 – $^{0}_{0,046}$	65+ $^{0}_{0,03}$										6030	6040	6050	6060	6070						
65	70	65 – $^{0}_{0,046}$	70+ $^{0}_{0,03}$												6550	6560	6570						
70	75	70 – $^{0}_{0,046}$	75+ $^{0}_{0,035}$											7040	7050	7060	7070	7080					
75	80	75 – $^{0}_{0,046}$	80+ $^{0}_{0,035}$												7550	7560		7580					
80	85	80 – $^{0}_{0,046}$	85+ $^{0}_{0,035}$											8040	8050	8060					80100		
85	90	85 – $^{0}_{0,054}$	90+ $^{0}_{0,035}$											8540		8560		8580			85100		
90	95	90 – $^{0}_{0,054}$	95+ $^{0}_{0,035}$												9050	9060		9080			90100		
95	100	95 – $^{0}_{0,054}$	100+ $^{0}_{0,035}$													9560					95100		
100	105	100 – $^{0}_{0,054}$	105+ $^{0}_{0,035}$													10060						100115	
105	110	105 – $^{0}_{0,054}$	110+ $^{0}_{0,035}$													10560						105115	
110	115	110 – $^{0}_{0,054}$	115+ $^{0}_{0,035}$													11060						110115	
115	120	115 – $^{0}_{0,054}$	120+ $^{0}_{0,035}$													11560					115100		
120	125	120 – $^{0}_{0,054}$	125+ $^{0}_{0,040}$													12060					120100		
125	130	125 – $^{0}_{0,063}$	130+ $^{0}_{0,040}$																		125100		
130	135	130 – $^{0}_{0,063}$	135+ $^{0}_{0,040}$													13060					130100		
135	140	135 – $^{0}_{0,063}$	140+ $^{0}_{0,040}$																		135100		
140	145	140 – $^{0}_{0,063}$	145+ $^{0}_{0,040}$													14060					140100		
150	155	150 – $^{0}_{0,063}$	155+ $^{0}_{0,040}$													15060					150100		
160	165	160 – $^{0}_{0,063}$	165+ $^{0}_{0,040}$																		160100		
180	185	180 – $^{0}_{0,072}$	185+ $^{0}_{0,040}$																		180100		
200	205	200 – $^{0}_{0,072}$	205+ $^{0}_{0,046}$																		200100		
220	225	220 – $^{0}_{0,072}$	225+ $^{0}_{0,046}$																		220100		
250	255	250 – $^{0}_{0,072}$	255+ $^{0}_{0,046}$																		250100		
300	305	300 – $^{0}_{0,081}$	305+ $^{0}_{0,052}$																		300100		
350	356	350 – $^{0}_{0,089}$	356+ $^{0}_{0,057}$																		350100		

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