The Mark of Linear Motion

Engineering and Development Department, THK European Headquarters

Lubrication Manual for THK LM Guides

Booklet-EHQ-002-01

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1. General Information

The main purposes of lubricating stuff are to reduce friction of a system and to protect the system against corrosion. Therefore, a proper and adequate lubrication is essential for a trouble-free operation of the LM Guides. The lubricant and the method of lubrication should be selected according to the LM Guide and the application.

Under normal operating conditions, the general lubrication interval is every 100 km of operation or every six months. This value can vary (increase or decrease) due to special environmental conditions or / and application requirements and as well depends on the kind of lubricant used.

Such influences can for example be:

- high and low temperatures
- influence of condensation and splash water
- operation with radiation influence
- operation at high vibrations
- operation in vacuum or / and clean room
- influence of special material (e.g. steam, fume, acid etc.)
- high acceleration or / and velocity
- sustained short stroke (< two block length)

Another influencing variable is dust or dirt. These can reduce the operation lifetime considerably. In this case it is necessary to protect the LM Guides with THK special sealing options at the carriage or for example with bellows or a cover.

In case of order please inform THK whether the LM Guides will be lubricated with grease or oil. The LM blocks are filled with standard grease and protected with anti-corrosion oil. Furthermore, in case of oil lubrication it is necessary to use special paper seals.

The use of special additives or / and high-grade synthetic lubricants can considerably increase the operation lifetime. Nevertheless, it is not possible to give a meaningful statement about the increase of the operation lifetime because many varying environmental influences are combined with customer specific applications. Thus, main characteristic values can only be determined by own testing under real operating conditions/ influences.

If you have any questions about this topic do not hesitate to contact the Technical Department of THK.

2. Lubricants

2.1 Global Standard

For working under normal operating conditions / influences we recommend the lubricants with the following minimum standard and minimum specification:

Table 2.1 Lubricant standard

Lubricant	DIN indication	DIN number	Notice
Grease	KP 2 – K	51502 or 51825	Lithium soap
Oil	CLP32 – 100	51517 Part 3	ISO VG 32-68

Attention!

Lubricants with solid particle additives like MoS_2, graphite, PTFE etc. are generally not appropriate for THK LM systems. If such greases have to be used please contact THK.

2.2 THK Lubricants

Table 2.2a THK Greases

THK grease types	Consistency enhancer (Soap)	Base oil	Base oil viscosity at 40℃ CST [mm²/S]	Consistency class DIN 51 818	Walking penetration DIN ISO 2137	Service temperature range (℃)	Service environment	Lubricant characteristics
AFA	Urea	Synthetic oil	25	1 ~ 2	280~320 1/10mm	-45° ~ +160℃	For high-speed and low noise applications	➔Low inner frictional resistance ➔High oxidation resistance ➔Long service life ➔Wide service temperature range
AFB - LF	Lithium	Mineral oil	184	2	265~295 1/10mm	-15° ~ +100℃	For all purposes	➔Anti-wear and EP-additives ➔High oxidation resistance ➔Long service life ➔High mechanical stability
AFC	Urea	Synthetic oil	25	2	270~310 1/10mm	-54° ~ +177℃	For applications with micro vibrations and micro strokes	➔Long service life ➔High oxidation resistance ➔Anti-tribocorrosion additives ➔Wide service temperature range
AFE - CA	Urea	Synthetic oil	105	2	280 1/10mm	-40° ~ +200℃	For clean room applications	➔Low dust generation ➔High radioactive resistance ➔Long service life
AFF	Lithium	Synthetic oil	100	1	315 1/10mm	-40° ~ +120℃	For clean room applications	➔Anti-tribocorrosion additives ➔Low inner frictional resistance ➔Extremely low dust generation ➔High radioactive resistance ➔Long service life
AFG	Urea	Synthetic oil	25	2	285 1/10mm	-45° ~ +160℃	For ball screws with caged ball technology	➔For high speeds ➔Low inner frictional resistance ➔Low heat generation
AFJ	Urea	Mineral oil	20	1	325 1/10mm	-20° ~ +120℃	For applications with micro vibrations and micro strokes	➔Suitable for automatic greasing systems ➔Low inner frictional resistance

Hint: All THK Greases are RoHS-compliant.

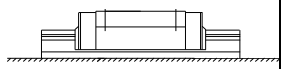
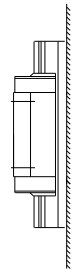
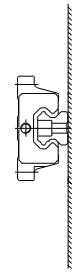
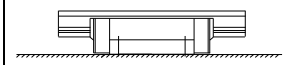
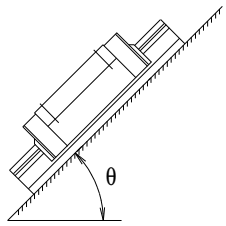
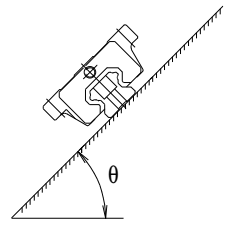
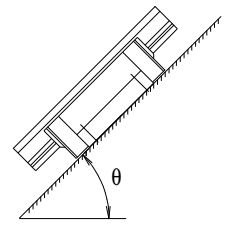
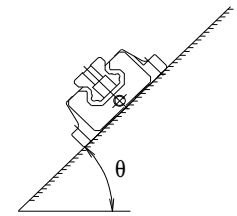
Table 2.2b THK Oils

Technical data	Standard	Unit	THK LM OIL VG32	THK LM OIL VG68
Density (15 °C)	DIN 51 757	g/cm^3	0.869	0.88
Viscosity grade acc. ISO	DIN 51 519	-	VG32	VG68
Viscosity (40 °C)	DIN 51 562	mm^2/s (cSt)	30.29	64.16
Viscosity index	DIN 51 563	-	110	108
Flash point	DIN 51 375	°C	220	248
Pour point	DIN 51 597	°C	-32.5	-30
Total acid number	DIN 51 558 T1	mg KOH/g	1.65	1.65
Copper corrosion test	-	corrosion grade	0	0

2.3 Coding of the mounting orientation (only for oil lubrication)

The LM Guides can be mounted with any of the eight orientations shown below. When ordering LM Guides please specify the mounting orientation and the angle θ. If an oil lubrication system is used, the lubrication passages may have to be changed. In addition, the end caps are equipped inside with a special seal.

Table 2.3a Installation orientations

Horizontal (Symbol: H)	Vertical (Symbol: V)	Wall mount (Symbol: K)	Reverse horizontal (Symbol: R)
			
Vertical slant (Symbol: HV)	Wall mount slant (Symbol: HK)	Reverse vertical slant (Symbol: RV)	Reverse wall mount slant (Symbol: RK)
			
θ = (°)	θ = (°)	θ = (°)	θ = (°)

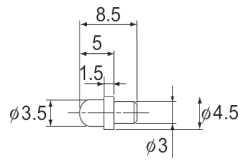
3. THK Grease adapter

3.1 THK Standard grease nipple

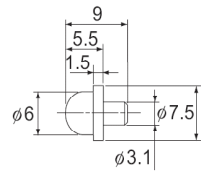
The grease nipples for the necessary lubrication of the linear systems are in different types available from stock. The design of the grease nipple depends on the type and size of the LM Guide. The miniature models have small bores instead of grease nipples due to their small overall size.

3.1.1 Drive-in grease nipple

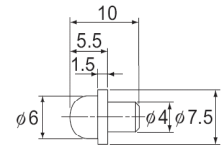
PB107



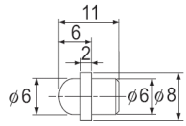
NP3.2×3.5



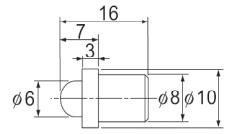
PB1021B



NP6×5

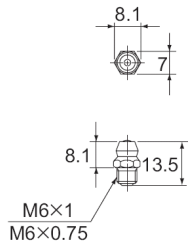


NP8×9

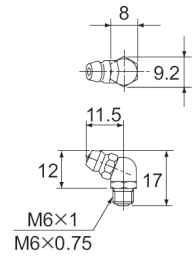


3.1.2 Screwed-in grease nipple

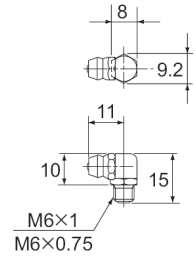
A-MT6×1 (M6×1)
A-M6F (M6×0.75)



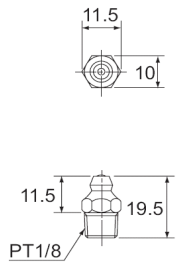
B-MT6×1 (M6×1)
B-M6F (M6×0.75)



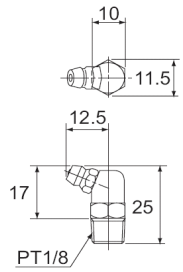
C-MT6×1 (M6×1)
C-M6F (M6×0.75)



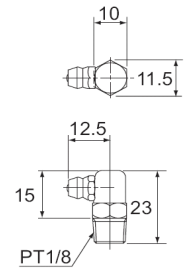
A-PT1/8



B-PT1/8



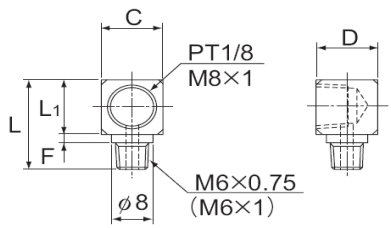
C-PT1/8



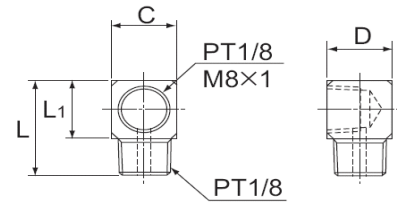
PT 1/8 are conical imperial threads.

3.2 THK Pipe fittings (central lubrication system)

LF-A
LF-B
LF-E



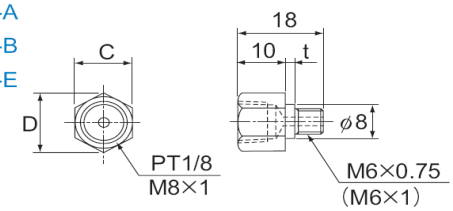
LF-C
LF-D



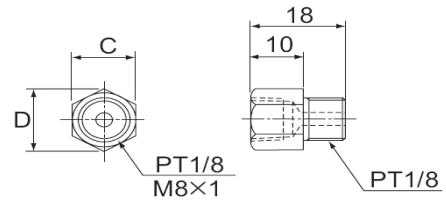
Size measurement table for pipe fittings LF							
Model	**Screw-in external thread**	**Connecting internal thread**	**L [mm]**	**L_1 [mm]**	**F [mm]**	**C [mm]**	**D [mm]**
LF-A	M6x0.75	PT 1/8	20	12	2	12	12
LF-B	M6x0.75	M8x1	18.5	10	2.5	9.5	18
LF-C	PT 1/8	PT 1/8	20	12	0	12	12
LF-D	PT 1/8	M8x1	18	10	0	10	18
LF-E*	M6x1	PT 1/8	20	12	2	12	12

PT 1/8 are conical imperial threads.
* LF-E: The same size as LF-A; mounting screw: M6x1

SF-A
SF-B
SF-E

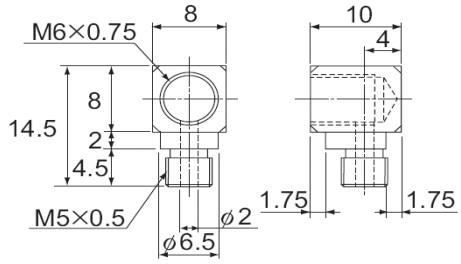


SF-C
SF-D



Size measurement table for pipe fittings SF					
Model	**Screw-in external thread**	**Connecting internal thread**	**C [mm]**	**D [mm]**	**t [mm]**
SF-A	M6x0.75	PT 1/8	12	13.8	2
SF-B	M6x0.75	M8x1	10	11.5	2
SF-C	PT 1/8	PT 1/8	12	13.8	0
SF-D	PT 1/8	M8x1	10	11.5	0
SF-E*	M6x1	PT 1/8	12	13.8	2

PT 1/8 are conical imperial threads.
* SF-E: The same size as SF-A; mounting screw: M6x1

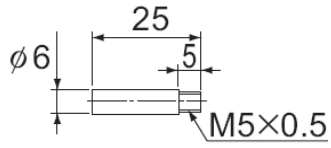
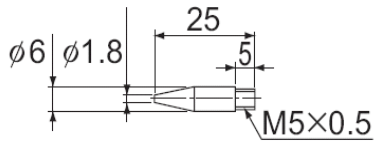
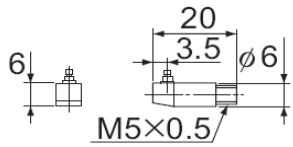
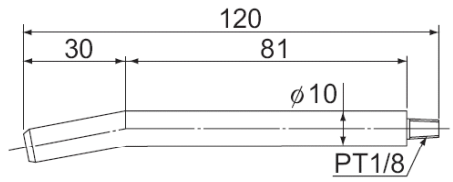
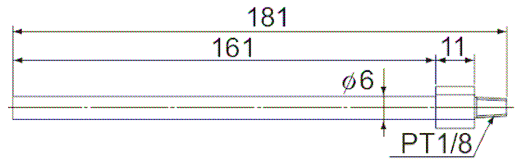


Model	Connecting internal thread
LD	M6x0.75

3.3 THK Grease pump nozzles

With a standard or THK grease pump (inner thread PT1/8) all sizes of LM Guides can be lubricated by using dedicated nozzles. Exclusive attachments are available for small LM Guides so that a suitable attachment can be chosen for the model and restricted space. The following table shows the different available nozzles:

Table 3.3 THK Grease pump nozzles

Type	Dimensions	Supported model numbers	
Type N		LM Guide	Models SSR15, SHS15, SR15, HSR12, HSR15, CSR15, HRW17, GSR15, RSR15, RSH15, HCR12 and HCR15
		Cam Follower	Models CF, CFN and CFH
		Rod End	Models PHS5 to 22, RBH and POS8 to 22
Type P		LM Guide	Models HSR8, HSR10, HRW12, HRW14, RSR12 and RSH12
Type L		LM Guide	Models HSR8, HSR10, HRW12, HRW14, RSR12 and RSH12
Type H		LM Guide	Models with grease nipple M6F or PT 1/8
		Ball screw	
		Rod End	Models PHS25, PHS30, POS25 and POS30
Dedicated nozzle Type U		Dedicated nozzle for type N, P, L with internal thread M5x0.5	

Note) Types P and L are also capable of greasing less accessible areas other than the model numbers above (by dropping grease on the raceway).

4. Lubrication process and handling

4.1 General Information

The grease application must be effected properly according to THK specifications. When the LM Guide is delivered without grease (only with corrosion inhibition oil) the initial lubrication quantity must be inserted before start-up (see chapter 5).

When the LM Guide is delivered with initial lubrication only the refill quantity should be inserted before start-up. The initial lubrication quantity is twice the relubrication quantity. These amounts should not be exceeded.

In general, it is not recommended to insert the full lubrication quantity during standstill but to move the carriage at least twice of his length forward and backward after every stroke.

Also, when a centralized lubrication system is used the lubrication process should either be executed during operation or in steps of 20% of the recommended lubrication amount. The carriage should be moved at least double of its length. Thus, an optimal lubrication dispersion is guaranteed within the carriage and, therefore, the piling up of grease in the end caps is being avoided.

All lubrication equipments should be in a proper and non-corrosive condition.

The exact lubrication intervals can only be determined under real operating conditions. The observation period has to be sufficient. If the lubrication interval is too long or the lubricant quantity too low, the colour of the lubricant will change (mostly reddish) at the reverse point of the stroke. In this case take care to lubricate the system immediately and change the lubrication interval and quantity.

After a longer standstill and before the restarting of the LM Guide the unit has to be lubricated with the initial filling lubrication quantity.

In case of a lubricant change or replacement (sort or producer), it is necessary to check whether the THK materials go with the new lubricant and whether the guarantee of miscibility is given for both lubricants.

Please comply with the lubrication specification of the producers, the protection of labour and the environment. Used and foul lubricants have to be disposed of appropriately.

4.2 Lubrication methods

LM systems can either be lubricated manually by using a grease gun (Fig. 4.2a) or a manual pump or via a centralized lubrication system. The latter method is mainly used for machine tools, in which the LM system is already provided with a recirculating oil or bath oil lubrication system.

In case of a manual centralized lubrication system, several greasing points in one machine can be provided simultaneously (Fig. 4.2b).

An automatic centralized lubrication system ensures in general a smooth and constant lubricant supply (Fig. 4.2c).

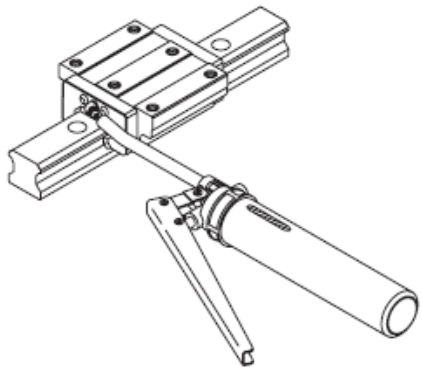


Fig. 4.2a Lubrication with grease gun

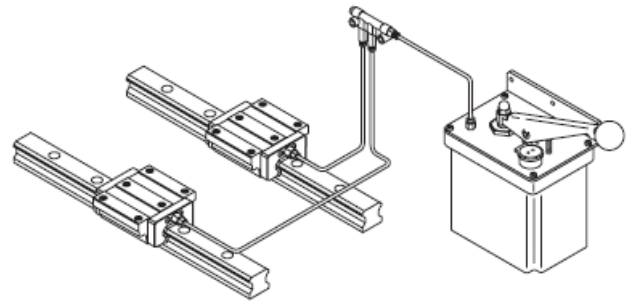


Fig. 4.2b Lubrication with centralized hand pump

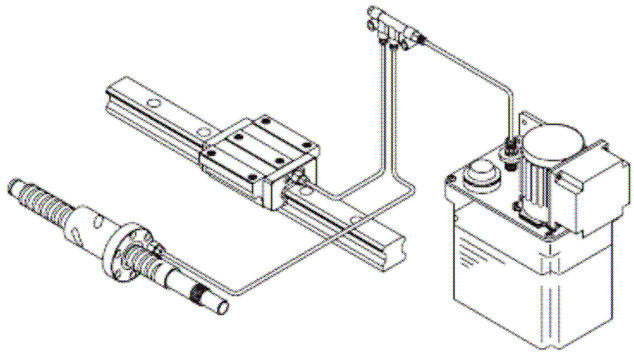


Fig. 4.2c Centralized lubrication system

4.2.1 Grease gun

A grease gun of which lubrication pressure and flow rate per stroke is not too high must be used for LM Guides. It is recommended to use the grease gun MG70 of THK.

Specifications of the grease gun MG70:

Maximal discharge pressure: $p_{s,max}$=195 bar

Discharge rate: V_s=0.6 cm³/stroke

4.2.2 Relubrication

When pressing the lubricant into the carriage a maximal flow rate may not be exceeded. Therefore, the minimal discharge time per stroke of the grease gun may not fall below a certain threshold. This time depends on the quantity of lubricant per stroke and the discharge pressure of the used grease gun.

The minimal discharge time ($t_{discharge}$) can be calculated with the following formula:

$$t_{discharge} = \frac{\text{max. discharge pressure}}{245\ \text{bar}} * \frac{\text{max. lubricant quantity per stroke}}{1\,\text{cm}^3/\text{Hub}} * 2 \quad [s]$$

4.2.3 Lubrication cycle

The lubrication cycle depends on different conditions (see page 3). The exact lubrication cycles can solely be determined under real operating conditions.

The use of the ball/roller chain technology can considerably extend the necessary lubrication cycle compared to conventional LM systems. More information can be found in THK catalogues/brochures or on the Internet at www.thk.eu.

5. Tables of lubrication quantity of different THK LM Guides

The following tables show the lubrication quantity of different THK LM Guides before start-up (initial lubrication quantity). An initial lubrication filling of THK LM Guides is necessary prior to start running the system. Normally, the initial filling quantity is twice the relubrication quantity.

If THK LM blocks have no lubrication equipments because of their size, a solution to lubricate the system is to distribute the lubricant directly on the rail.

5.1 Initial lubrication quantity: LM guide with ball/roller caged technology

For high dynamic applications (v>2m/s or a>2g) it is advisable to insert the relubrication quantity in several portions and to move the unit while doing this.

Tab. 5.1a Type SHS...

Model number SHS	Initial lubrication [cm^3]
15	0.7
15L	0.9
20	1.4
20L	1.8
25	2.0
25L	2.4
30	3.2
30L	4.2
35	3.5
35L	5.2
45	6.5
45L	8.5
55	12.3
55L	16.3
65	22
65L	29.9

Tab. 5.1b Type SSR...

Model number SSR	Initial lubrication [cm^3]
15XV	0.3
15XW	0.5
20XV	0.5
20XW	0.7
25XV	0.8
25XW	1.3
30XW	2.2
35XW	3.6

Tab. 5.1c Type SNR/SNS...

Model number SNR/SNS	Initial lubrication [cm^3]
25	1.7
25 L	2.1
30	3.0
30 L	3.6
35	4.7
35 L	5.6
45	8.0
45 L	10.6
55	9.9
55 L	13.0
65	12.5
65 L	17.8
85	35
85 L	51.1

Tab. 5.1d Type SHW...

Model number SHW	Initial lubrication [cm^3]
12C	0.3
12H	0.4
14	0.6
17	0.7
21	0.8
27	1.2
35	3.6
50	8.0

Tab. 5.1e Type SRG…

Model number SRG	Initial lubrication [cm^3]
15	0.6
20	1.2
20L	1.5
25	2.3
25L	2.8
30	3.3
30L	4.2
35	3.2
35L	4.0
45	5.8
45L	7.2
55	8.1
55L	10.5
65L	21

Tab. 5.1f Type SRS…

Model number SRS	Initial lubrication [cm^3]
9	0.15
9W	0.18
12	0.28
12W	0.36
15	0.59
15W	0.75
20	0.68
25	1.44

5.2 Initial lubrication quantity: LM guides conventional (without caged ball technology)

Tab. 5.2a Type HSR...

Model number HSR/CSR/HCR/ JR/HPR	Initial lubrication [cm^3]
8	0.01
10	0.02
12	0.06
15	2.0
20	4.0
20L	5.0
25	5.0
25L	6.0
30	7.0
30L	8.0
35	10.0
35L	12.0
45	12.0
45L	14.0
55	17.0
55L	20.0
65	25.0
65L	33.0

Tab. 5.2b Type NR/NRS...

Model number NR/NRS	Initial lubrication [cm^3]
25	1.5
25 L	1.9
30	2.5
30 L	3.2
35	3.5
35 L	4.5
45	5.0
45 L	6.6
55	9.6
55 L	11.8
65	16.2
65 L	22.5
75	22.9
75 L	29.0
85	36.0
85 L	45.3
100	39.2
100 L	55.7

Tab. 5.2c Type HRW...

Model number HRW	Initial lubrication [cm^3]
12	0.03
14	0.04
17	0.2
21	0.3
27	0.5
35	1.7
50	4.2
60	12.5

Tab. 5.2d Type SR...

Model number SR	Initial lubrication [cm^3]
15 V/SB	0.5
15 W/TB	1.0
20 V/SB	1.0
20 W/TB	2.0
25 V/SB	2.5
25 W/TB	4.0
30 V/SB	3.0
30 W/TB	5.0
35 V/SB	4.0
35 W/TB	7.0
45 W/TB	10.0
55 W/TB	12.0
70 T	17.0

Tab. 5.2e Type RSR..

Model number RSR	Initial lubrication [cm^3]
5	0.006
5N	0.009
7	0.01
7N	0.015
9	0.04
9N	0.06
12	0.06
12N	0.09
15	0.1
15N	0.15
20	0.2
20N	0.3

Tab.5.2f Type RSR...W

Model number RSR..W	Initial lubrication [cm^3]
3W	0.004
3WN	0.006
5W	0.006
5WN	0.009
7W	0.02
7WN	0.03
9W	0.04
9WN	0.06
12W	0.06
12WN	0.09
15W	0.1
15WN	0.15

Tab.5.2g Type KR...

Model number KR	Initial lubrication [cm^3]
20...	0.5
26...	1
33...C	1.5
33...A	2
46...C	3.8
46...A	5
55...A	7
65...A	10

Tab.5.2h Type GSR...

Model number GSR	Initial lubrication [cm^3]
15 T	0.3
15 V	0.2
20 T	0.4
20 V	0.3
25 T	0.7
25 V	0.5
30 T	0.9
35 T	1.0

Tab. 5.2i Type HR and HR-T

Model number	HR Initial lubrication [cm^3]	Initial lubrication HR-T [cm^3]
918	0.06	-
1123	0.1	-
1530	0.3	-
2042	0.8	1.0
2555	1.9	2.3
3065	2.5	3.0
3575	4.2	4.8
4085	6.3	7.6
50105	12.4	15.0
60125	25.7	-

5.3 Initial lubrication quantity: Ball splines

Tab. 5.3a Type LBS/LBST...

Model number LBS/LBST/LBF/LBR/LBH/LBG	Initial lubrication [cm^3]
15	0.4
20	0.6
T 20	0.8
25	1.0
T 25	1.5
30	2.0
T 30	2.5
40	5.0
T40	5.5
50	8.5
T 50	9.5
T 60	17
70	20
T 70	25
85	27
T 85	30
100	45
T 100	55
T 120	60
T 150	100

Tab. 5.3b Type LT...

Model number LT/LF/LTR	Initial lubrication [cm^3]
4	0.03
5	0.06
6	0.08
8	0.1
10	0.2
13	0.3
16	0.5
20	0.8
25	1.5
30	2.5
40	6
50	10
60	20

5.4 : Oil lubrication ; Oil volume

When using an oil recirculation greasing system like a forced lubrication, the oil values from the table below can be used.

Tab. 5.4 Oil volume depending on the LM sizes for all 4 – row ball- and roller THK LM Guides with or without Caged Technology

Sizes	Oil volume for oil recirculation systems cm^3/10min
15	0.05
20	0.05
20L	0.05
25	0.05
25L	0.05
30	0.05
30L	0.06
35	0.07
35L	0.08
45	0.1
45L	0.1
55	0.1
55L	0.15
65	0.15
65L	0.2

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