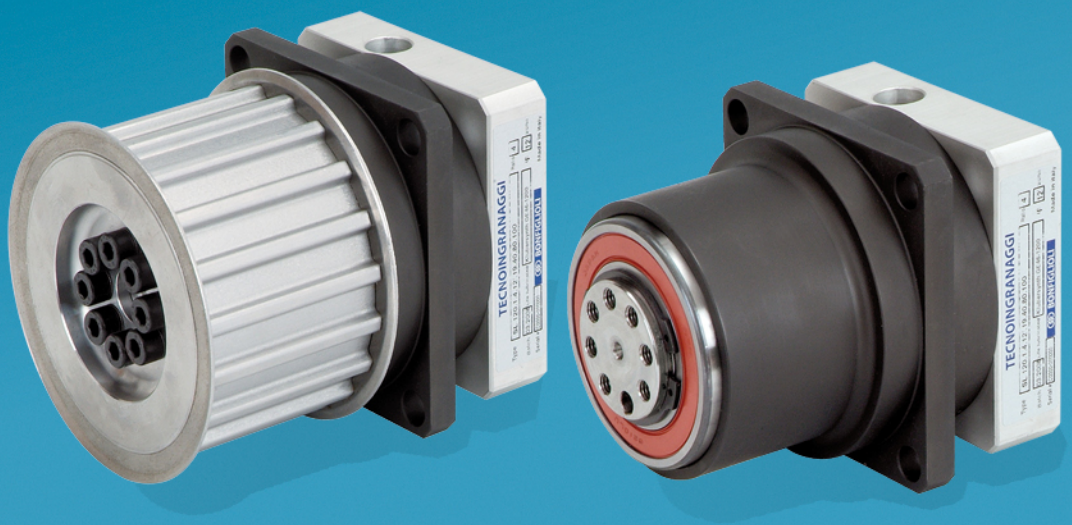
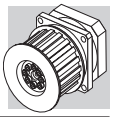
Bonfiglioli
Tecnoingranaggi

SL series

Precision gearboxes for pulley drives



Bonfiglioli
power, control and green solutions

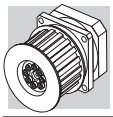


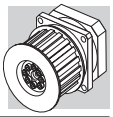
SUMMARY

Revisions

Refer to page 14 for the catalogue revision index.

Visit www.bonfiglioli.com to search for catalogues with up-to-date revisions.





1 GENERAL INFORMATION

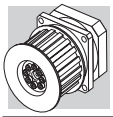
1.1 SYMBOLS, UNITS AND DEFINITIONS

Values depending on the APPLICATION

term	u.m.	definition
A_2	[N]	Thrust force on output shaft
$A_{2\ EQU}$	[N]	Equivalent thrust force applying on output shaft
$A_{2\ MAX}$	[N]	Maximum thrust force applying on output shaft
R_2	[N]	Radial force on output shaft
$R_{2\ EQU}$	[N]	Equivalent radial force applying on output shaft
$R_{2\ MAX}$	[N]	Maximum radial force applying on output shaft
ED	[min]	Loading time
ED%	[%]	Loading time %
$L_{10h\ TARGET}$	[h]	Output shaft bearings' desired basic rating life
$M_{1\ PEAK}$	[Nm]	Maximum input torque (usually motor)
$M_{2(1)}$ ... $M_{2(n)}$	[Nm]	Output torque at each of the time periods t_1 ... t_n
$M_{2\ EQU}$	[Nm]	Equivalent output torque
$M_{2\ MAX}$	[Nm]	Maximum output torque in case of emergency
$M_{T2\ EQU}$	[Nm]	Equivalent tilting moment applying on output shaft
$M_{T2\ MAX}$	[Nm]	Maximum tilting moment applying on output shaft
n_2	[min^{-1}]	Output speed
$n_{2(1)}$ ... $n_{2(n)}$	[min^{-1}]	Output speed based on the time periods t_1 ... t_n
$n_{2\ EQU}$	[min^{-1}]	Equivalent output speed
$n_{2\ MAX}$	[min^{-1}]	Maximum output speed
T	[C°]	Ambient temperature
t_1 ... t_n	[s]	Time periods of motion
t_Σ	[s]	Cycle duration including pause
Z	[1/h]	Cycle number per hour

Values depending on the GEAR DRIVE SELECTION

term	u.m.	definition
$A_{2\ 3\ max}$	[N]	Admissible thrust force on output shaft
$A_2'_{max}$	[N]	Thrust force acting simultaneously with the rated radial force
$R_{1\ max}$	[N]	Admissible radial force at midpoint of input shaft
$R_{2\ 3\ max}$	[N]	Admissible radial force at midpoint of output shaft
C_B	[Nm]	Constant for bearing's lifetime calculation
C_t	$\left[\frac{Nm}{arcmin}\right]$	Torsional stiffness
f_n	—	Speed factor
f_z	—	Cycle factor
f_T	—	Temperature adjusting factor
i	—	Gearbox ratio
J_G	[$kgcm^2$]	Mass moment of inertia of the gearhead
K_n	—	Speed constant
L_{10h}	[h]	Bearings' basic rating life
L_Z	[mm]	Factor for bearing's lifetime calculation
$M_{a\ 2}$	[Nm]	Maximum acceleration output torque
$M_{n\ 2}$	[Nm]	Rated output torque
$M_{p\ 2}$	[Nm]	Emergency stop output torque
$M_{T2\ max}$	[Nm]	Maximum tilting moment applying on output shaft
$n_{1\ max}$	[min^{-1}]	Maximum momentary input speed. The speed the unit can be driven at occasionally and in non-repetitive conditions For cycle duty type S5, it cannot be applied continuously for more than 30 seconds
p	—	Bearing lifetime exponent
η	[%]	Gear efficiency
φ_R	[arcmin]	Reduced backlash is calculated in static conditions and with the application of a torque equal to 2% of the gear unit rated torque
φ_S	[arcmin]	Standard backlash is calculated in static conditions and with the application of a torque equal to 2% of the gear unit rated torque



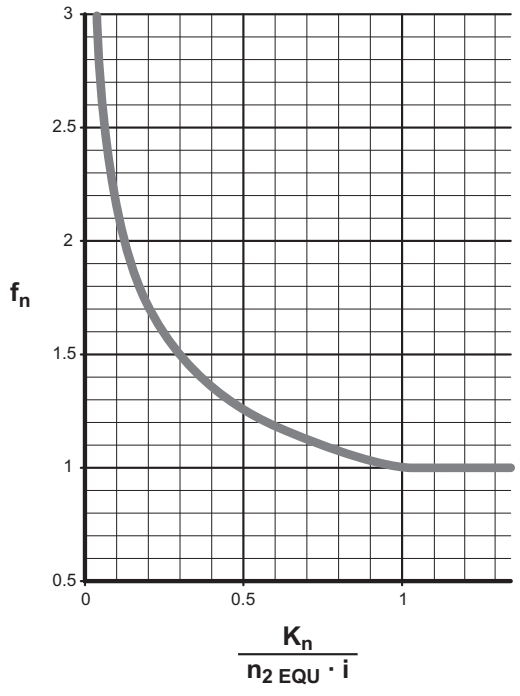
1.2 SELECTING THE GEAR UNIT

(a)	Ratio	i	—	$i = \frac{n_1}{n_2}$
(b)	Equivalent output torque	$M_{2\,EQU}$	[Nm]	$M_{2\,EQU} = \sqrt[3]{\frac{n_{2(1)} \cdot t_1 \cdot \lvert M_{2(1)} \rvert^3 + \ldots + n_{2(n)} \cdot t_n \cdot \lvert M_{2(n)} \rvert^3}{n_{2(1)} \cdot t_1 + \ldots + n_{2(n)} \cdot t_n}}$
(c)	Equivalent output speed	$n_{2\,EQU}$	[min^{-1}]	$n_{2\,EQU} = \frac{n_{2(1)} \cdot t_1 + n_{2(2)} \cdot t_2 + \ldots + n_{2(n)} \cdot t_n}{t_\Sigma}$
(d)	Speed factor	f_n	—	If $\frac{K_n}{n_{2\,EQU} \cdot i} \geq 1 \Rightarrow f_n = 1$ If $\frac{K_n}{n_{2\,EQU} \cdot i} < 1 \Rightarrow f_n$ = Obtain from diagram
(e)	Loading time % Loading time	ED% ED	[%] [min]	$ED\% = \frac{t_1 + t_2 + \ldots + t_n}{t_\Sigma} \cdot 100$ $ED = t_1 + t_2 + \ldots + t_n$
(f)	Cycle number per hour	Z	[1/h]	$Z = \frac{3600}{t_\Sigma}$
(g)	Cycle factor	f_z	—	See table below
(h)	Temperature adjusting factor	f_T	—	If T ≤ 30°C ⇨ $f_T = 1$ If T > 30°C ⇨ $f_T = 1 + \frac{T° - 30\ C}{100\,°C}$
(i)	Maximum input torque	$M_{1\,PEAK}$	[Nm]	a) maximum possible application torque b) limited motor torque by inverter c) maximum motor torque

Z	f_z
Z ≤ 1000	1.00
1000 < Z ≤ 1500	1.25
1500 < Z ≤ 2500	1.50
2500 < Z ≤ 4000	1.75
4000 < Z ≤ 6000	2.00
Z > 6000	contact us

K_n - speed constant			
i	**SL 070**	**SL 090**	**SL 120**
3	1392	2900	2500
4	1584	2500	2167
5	2047	2733	2367
7	3032	3500	3000
10	4000	4000	3500

f_n - speed factor

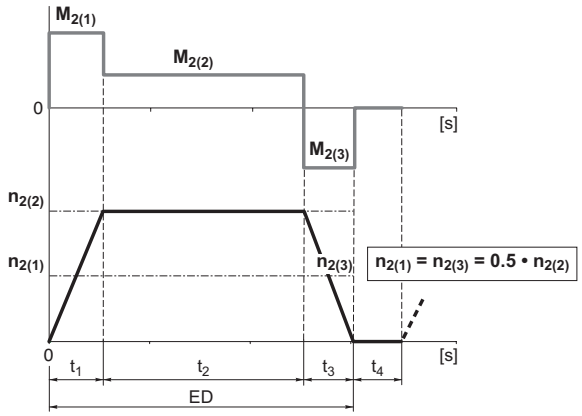


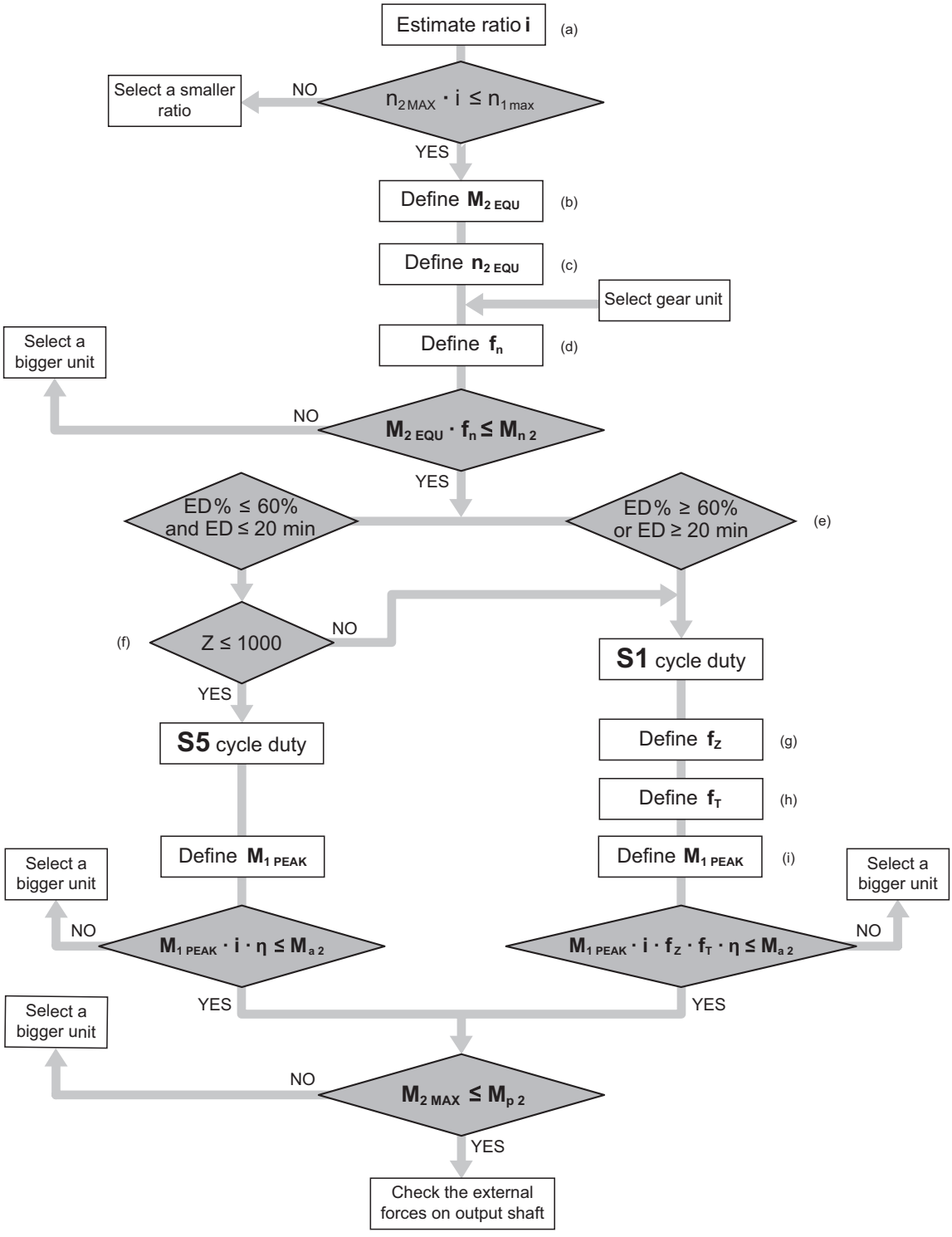
Load diagram

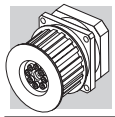
M_2: Output torque

Speed diagram

n_2: Output speed







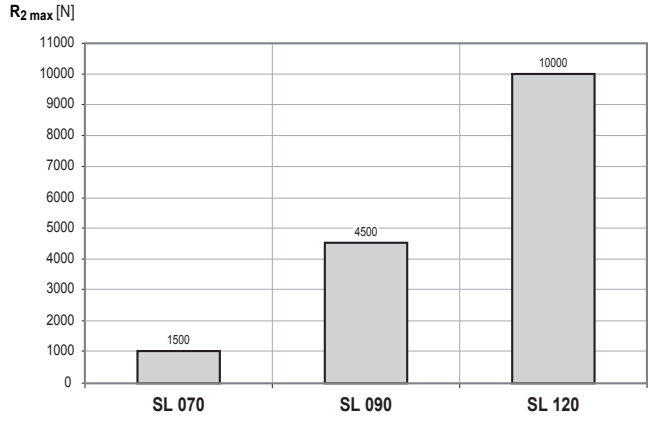
2 FEATURES OF SL SERIES

The new SL Series from Tecnoingranaggi knows no rivals in compactness, efficiency and optimisation for timing belt pulley drive systems. Reduced backlash units from the SL Series are the ideal complement to conveyor belt servo-drives and all other applications needing to combine high precision with ultra-compact size.

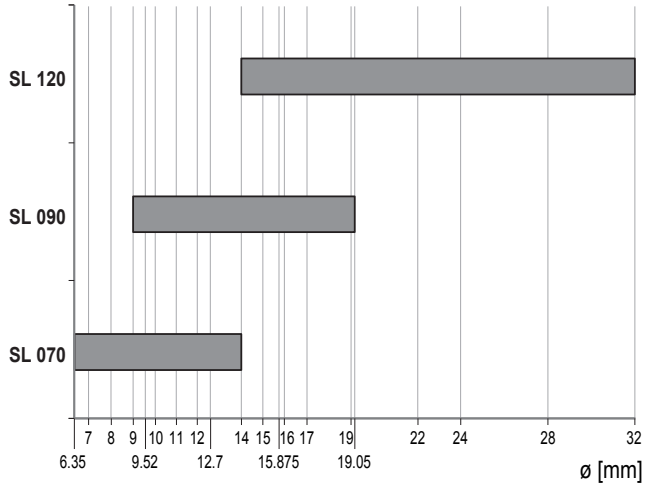
- Available with either standard (φ_S = 12') or reduced backlash (φ_R = 6')
- Single-stage configuration: transmission ratios i = 3, 4, 5, 7, 10
- Radial ball bearings, suitably rated for an average service life of 20,000 hours under nominal operating conditions.
- Degree of protection IP64
- Oil seals from Viton® compound as standard
- Noise level $L_P \leq 70$ dB(A) @ $n_1 = 3000$ min^{-1}
- Numerous input configurations
- Units are factory packed with synthetic grease to NLGI consistency class 00, suitable for operation in any mounting position and ambient temperature ranging from 0°C to 40°C.
  In the absence of contamination the lubricant requires no periodical changes.

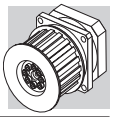
Distribution of nominal torque M_{n2} [Nm]					
[i]	**3**	**4**	**5**	**7**	**10**
SL 070	18	25	25	25	18
SL 090	37	43	43	43	37
SL 120	95	110	110	110	95

Output shaft max. loading capacity



Available motor shaft bores





3 ORDERING CODE

SL	120	1	5	STD	80A	CD	19	YP

PULLEY FOR TIMING BELT
- **YP** pulley provided
- **NP** pulley not provided

INPUT SHAFT BORE

TYPE OF MOTOR COUPLING
- **CD** clamping device

INPUT SECTION
- **25 ... 130** motor adapter
- **FM** without motor adapter

BACKLASH
- **STD** φ_S = 12’
- **LOW** φ_R = 6’

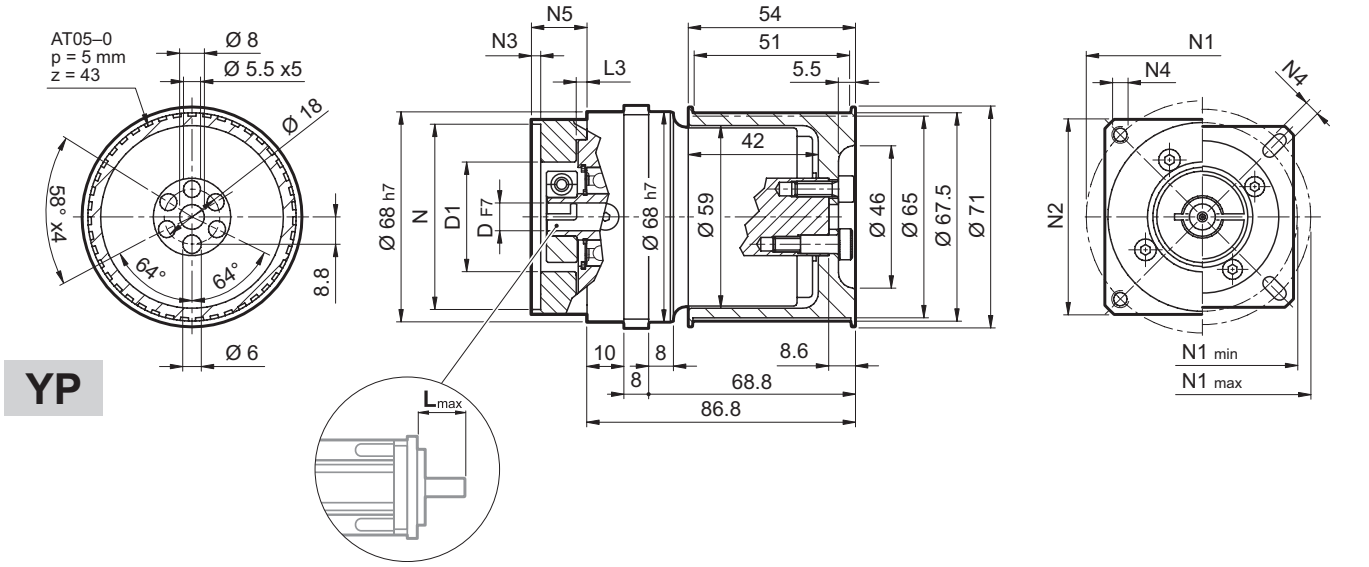
GEAR RATIO
3 **4** **5** **7** **10**

REDUCTIONS
1

FRAME SIZE
070 **090** **120**

SERIES
SL

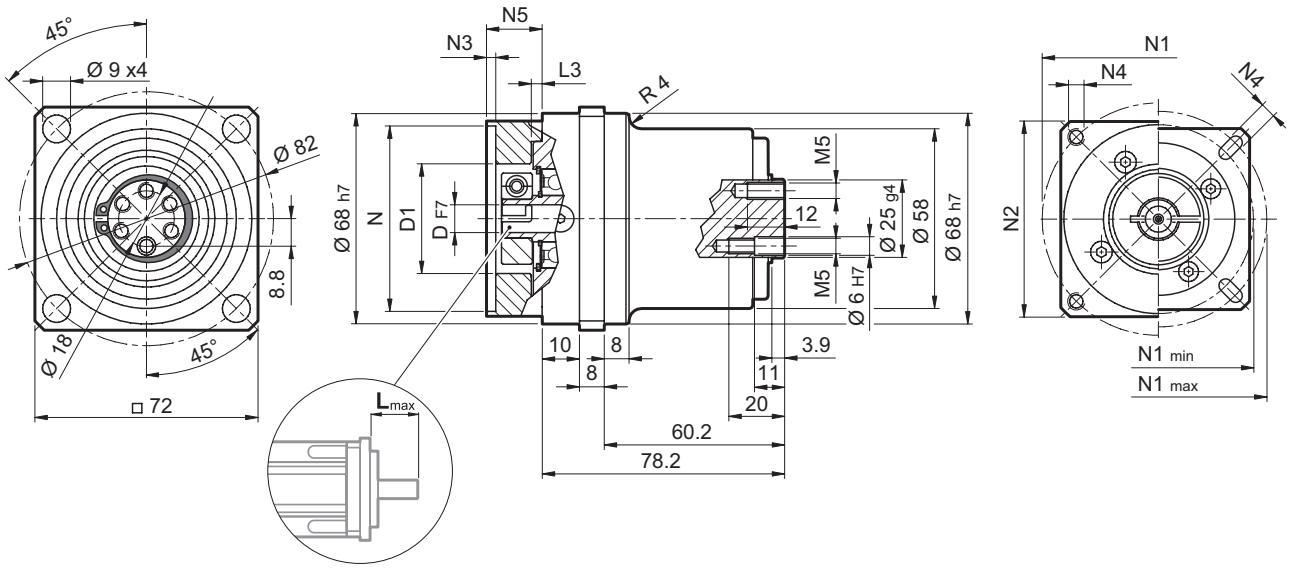
4 DIMENSIONS AND TECHNICAL SPECIFICATIONS

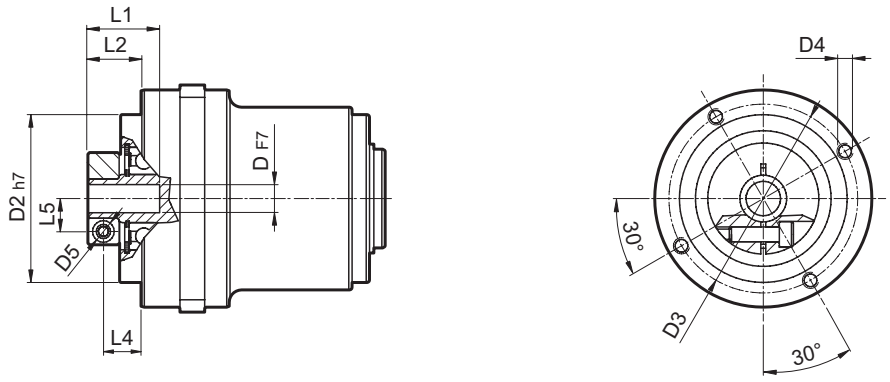


YP

Kg	2.0	0.5

	D										N	N1		N2	N3	N4	N5	L_{max}
												min	max					
25AH	6.35	7	8	9	9.52	–	–	–	–	–	25	39	56					
26AH	6.35	7	8	9	9.52	–	–	–	–	–	26	39	56					
28AH	6.35	7	8	9	9.52	–	–	–	–	–	28	39	56					
30AH	6.35	7	8	9	9.52	–	–	–	–	–	30	39	56					
32AH	6.35	7	8	9	9.52	–	–	–	–	–	32	39	56	65	3.5	4.5	25	25
34AH	6.35	7	8	9	9.52	–	–	–	–	–	34	40	56					
36AH	6.35	7	8	9	9.52	–	–	–	–	–	36	42	56					
39AH	6.35	7	8	9	9.52	–	–	–	–	–	39	45	56					
40AH	6.35	7	8	9	9.52	–	–	–	–	–	40	46	56					
38B	6.35	7	8	9	9.52	10	11	12	12.7	–	38.1	66.6		60	3	M4x10	18	25
40B	6.35	7	8	9	9.52	10	11	12	12.7	–	40	63		60	3	M4x10	18	25
50A	6.35	7	8	9	9.52	10	11	12	12.7	–	50	60		60	3	M4x10	18	25
50B	6.35	7	8	9	9.52	10	11	12	12.7	14	50	65		60	3	M5x12	23	30
50BH	6.35	7	8	9	9.52	10	11	12	12.7	14	50	65		65	3	5.5	25	32
50C	6.35	7	8	9	9.52	10	11	12	12.7	14	50	70		60	3	M4x10	23	30
55MH	6.35	7	8	9	9.52	10	11	12	12.7	–	55	80		65	2	5.5	16	23
60A	6.35	7	8	9	9.52	10	11	12	12.7	–	60	75		63	3	M5x12	18	25
60A1	6.35	7	8	9	9.52	10	11	12	12.7	14	60	75		63	3	M5x12	23	30
60B	6.35	7	8	9	9.52	10	11	12	12.7	14	60	85		75	3	M5x12	23	30
60C	6.35	7	8	9	9.52	10	11	12	12.7	14	60	90		75	3	M5x12	23	30
70A	6.35	7	8	9	9.52	10	11	12	12.7	14	70	85		75	3	M6x15	23	30
70B	6.35	7	8	9	9.52	10	11	12	12.7	14	70	90		75	3	M5x12	23	30
73A	6.35	7	8	9	9.52	10	11	12	12.7	14	73	98.4		85	3	M5x12	25	32
80A	6.35	7	8	9	9.52	10	11	12	12.7	14	80	100		85	3	M6x15	23	30



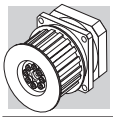


FM

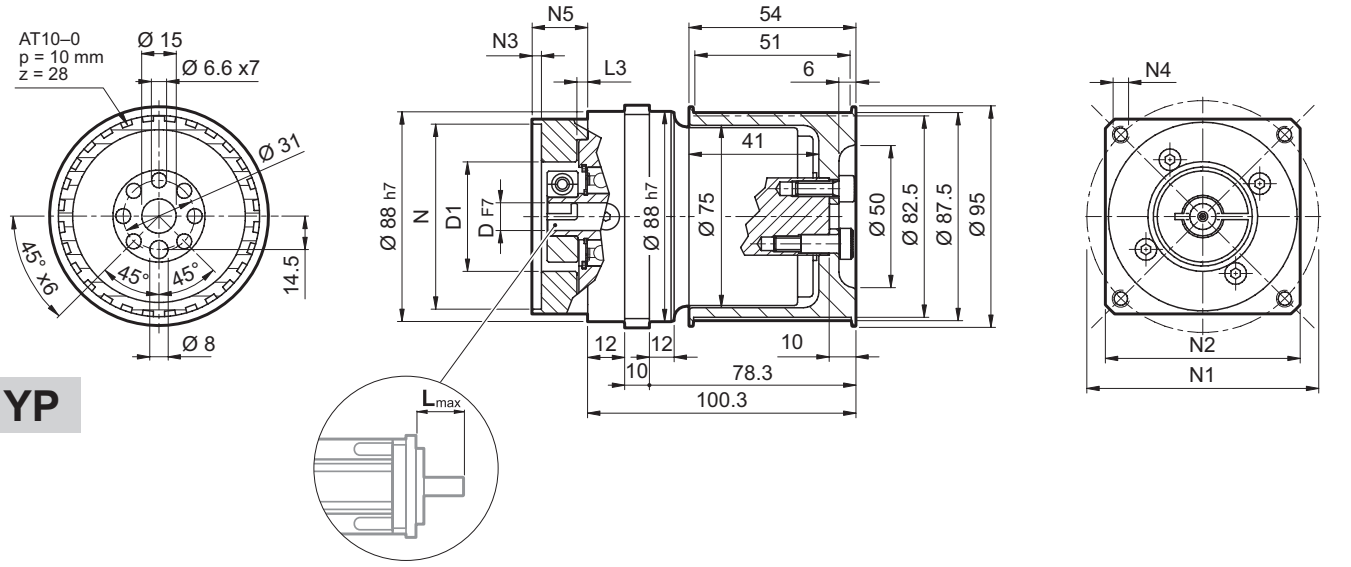
D				D1	D2	D3	D4	D5	L1	L2	L3	L4	L5
6.35	7			32.5	50	42.5	M4x8	M4	21.7	13.2	3	8.2	8
8	9	9.52	10	32.5	50	42.5	M4x8	M4	21.7	13.2	3	8.2	9
11	12	12.7		35.5	50	42.5	M4x8	M4	22	13.5	3	8.5	11
14				35.5	50	42.5	M4x8	M4	25	17	3	10.2	11.5

i	$M_{n\,2}$ [Nm]	$M_{a\,2}$ [Nm]	$M_{p\,2}$ [Nm]	$n_{1\,max}$ [min^{-1}]	φ_S [arcmin]	φ_R [arcmin]	C_t [Nm/arcmin]	$R_{2\,max}$ * [N]	η %	J_G [kgcm^2] D 6 ... 9.52	J_G [kgcm^2] D 11 ... 14	
SL 070_3	18	30	60	4000	12’	6’	3	3500	97	0.14	0.16	
SL 070_4	25	35	70	5000	12’	6’	3	3500	97	0.09	0.11	
SL 070_5	25	35	70	5000	12’	6’	3	3500	97	0.07	0.09	3.86
SL 070_7	25	35	70	5000	12’	6’	3	3500	97	0.05	0.07	
SL 070_10	18	30	60	6000	12’	6’	3	3500	97	0.04	0.06	

* Applies for timing belt application



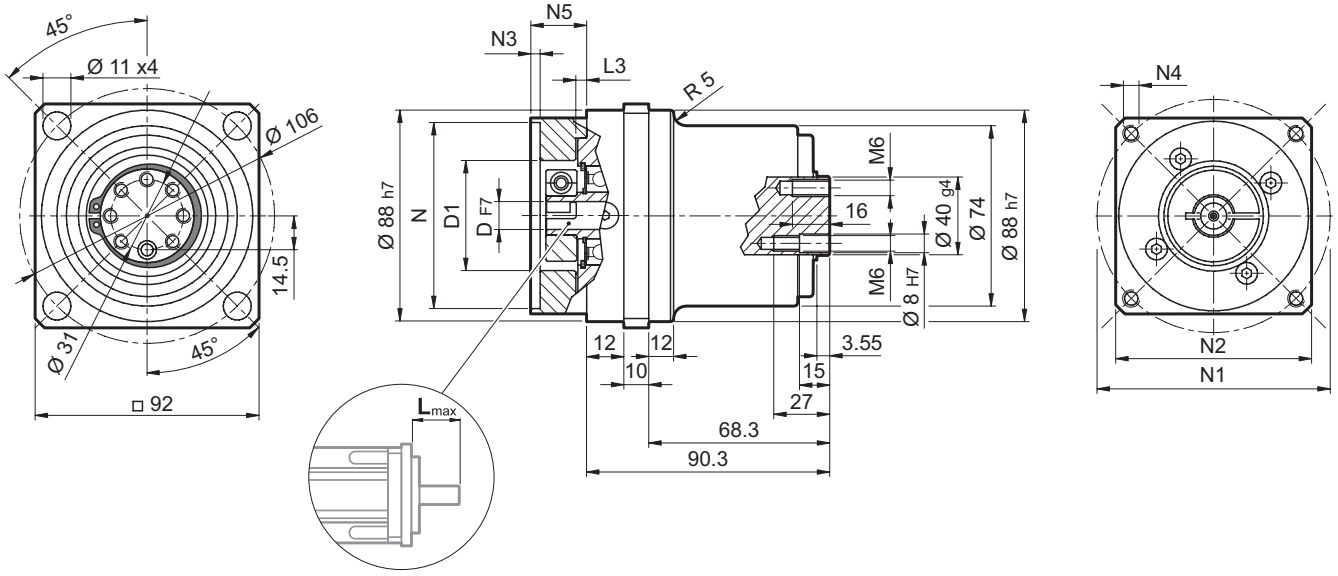
SL 090

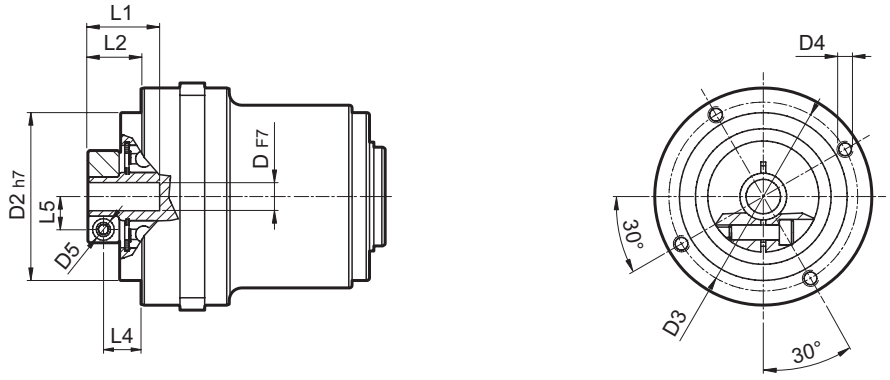


YP

Kg	3.6	0.8

	D											N	N1	N2	N3	N4	N5	L_{max}
40B1	9	9.52	11	12	12.7	14	–	–	–	–	–	40	63	80	4	M4x10	34	40
45A	9	9.52	11	12	12.7	–	–	–	–	–	–	45	63	80	4	M4x10	34	40
50B1	9	9.52	11	12	12.7	14	–	–	–	–	–	50	65	80	4	M5x16	34	40
50BH1	9	9.52	11	12	12.7	14	–	–	–	–	–	50	65	80	4	5.5	34	40
50C1	9	9.52	11	12	12.7	14	–	–	–	–	–	50	70	80	4	M4x10	34	40
50D	9	9.52	11	12	12.7	14	–	–	–	–	–	50	95	80	4	M6x10	34	40
55A	9	9.52	11	12	12.7	14	15.875	16	17	19	19.05	55.5	125.7	105	4	M6x16	34	40
60A2	9	9.52	11	12	12.7	14	–	–	–	–	–	60	75	80	4	M5x16	34	40
60AH2	9	9.52	11	12	12.7	14	–	–	–	–	–	60	75	90	4	5.5	34	40
60B1	9	9.52	11	12	12.7	14	15.875	16	–	–	–	60	85	80	4	M5x16	34	40
60C1	9	9.52	11	12	12.7	14	15.875	16	–	–	–	60	90	80	4	M5x16	34	40
70A1	9	9.52	11	12	12.7	14	15.875	16	17	19	19.05	70	85	80	4	M6x20	34	40
70AH1	9	9.52	11	12	12.7	14	15.875	16	17	19	19.05	70	85	90	4	6.5	34	40
70B1	9	9.52	11	12	12.7	14	15.875	16	17	19	19.05	70	90	80	4	M5x16	34	40
73A1	9	9.52	11	12	12.7	14	–	–	–	–	–	73	98.4	85	4	M5x16	34	40
80A1	9	9.52	11	12	12.7	14	15.875	16	17	19	19.05	80	100	90	4	M6x16	34	40
95A	9	9.52	11	12	12.7	14	15.875	16	17	19	19.05	95	115	100	4	M8x20	34	40
95B	9	9.52	11	12	12.7	14	15.875	16	17	19	19.05	95	130	115	4	M8x20	34	40
110A	9	9.52	11	12	12.7	14	15.875	16	17	19	19.05	110	130	115	4	M8x20	34	40
110B	9	9.52	11	12	12.7	14	15.875	16	17	19	19.05	110	145	120	6.5	M8x20	44	50
110B1	9	9.52	11	12	12.7	14	15.875	16	17	19	19.05	110	145	120	6.5	M8x20	54	60



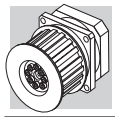


FM

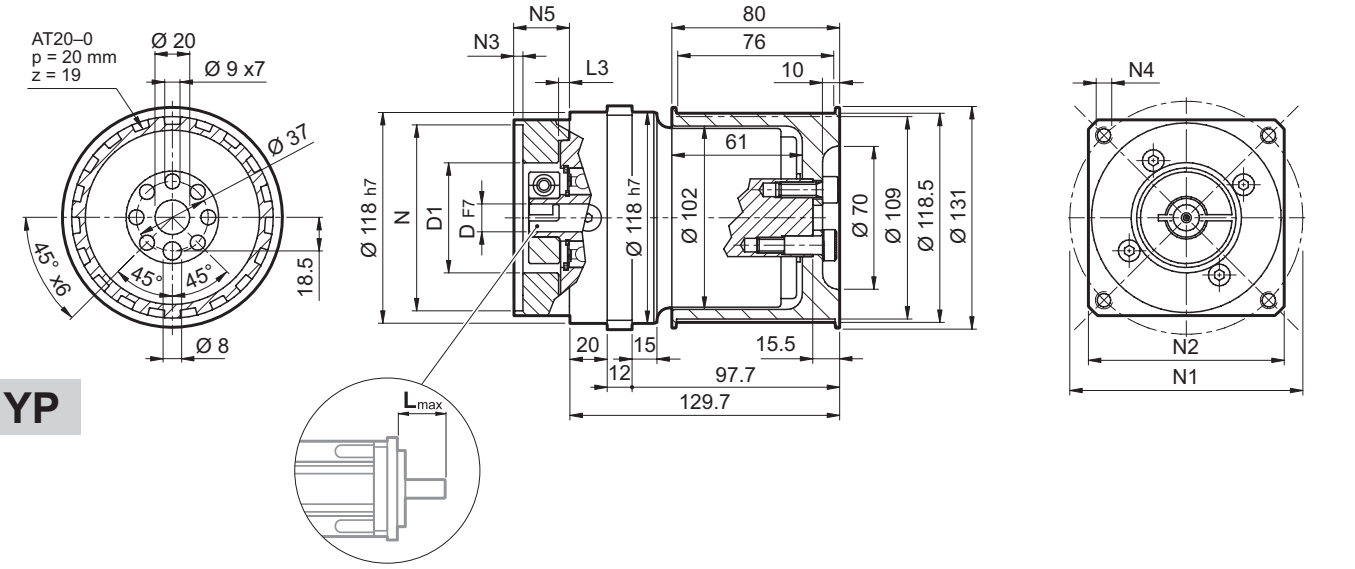
D				D1	D2	D3	D4	D5	L1	L2	L3	L4	L5
9	9.52			38	68	76.5	M6x10	M6	34	26.8	9.5	18.8	10.5
11	12	12.7		43	68	76.5	M6x10	M6	34	26.8	9.5	18.8	12.5
14	15.875	16	17	48	68	76.5	M6x10	M6	34	26.8	9.5	18.8	14.5
19	19.05			51	68	76.5	M6x10	M6	34	26.8	9.5	18.8	16.5

i	$M_{n\,2}$ [Nm]	$M_{a\,2}$ [Nm]	$M_{p\,2}$ [Nm]	$n_{1\,max}$ [min^{-1}]	φ_S [arcmin]	φ_R [arcmin]	C_t [Nm/arcmin]	$R_{2\,max}$ * [N]	η %	J_G [kgcm^2] D 8 ... 12.7	J_G [kgcm^2] D 14 ... 19	
SL 090_3	37	70	150	3500	12’	6’	7	4500	97	0.72	0.81	10.95
SL 090_4	43	80	160	4500	12’	6’	7	4500	97	0.49	0.58	
SL 090_5	43	80	160	4500	12’	6’	7	4500	97	0.39	0.48	
SL 090_7	43	80	160	4500	12’	6’	7	4500	97	0.31	0.40	
SL 090_10	37	70	150	6000	12’	6’	7	4500	97	0.27	0.35	

* Applies for timing belt application



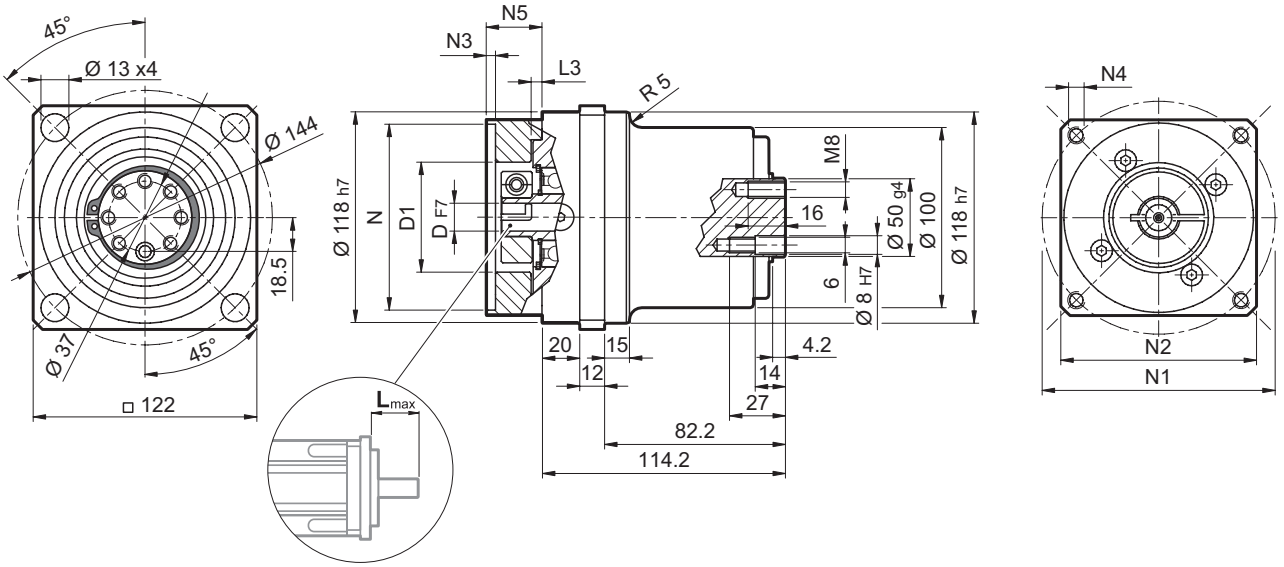
SL 120

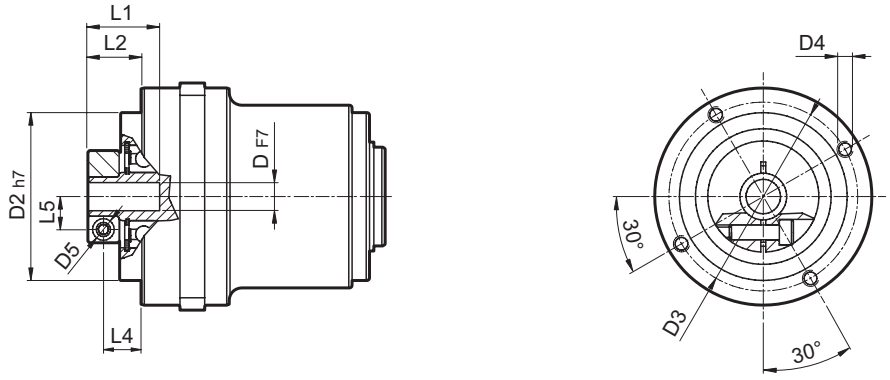


YP

Kg	8.4	2.6

	D									N	N1	N2	N3	N4	N5	L_{max}
50D	14	15	15.875	16	19	–	–	–	–	50	95	100	5	M6x14	28	40
55A	14	15	15.875	16	19	–	–	–	–	55.5	125.7	105	5	M6x16	28	40
60A2	14	15	15.875	16	19	–	–	–	–	60	75	100	5	M5x14	28	40
60AH2	14	15	15.875	16	19	–	–	–	–	60	75	100	5	6.5	33	40
60B1	14	15	15.875	16	19	–	–	–	–	60	85	100	6.5	M5x14	28	40
70A1	14	15	15.875	16	19	–	–	–	–	70	85	100	5	M6x14	28	40
70AH1	14	15	15.875	16	19	–	–	–	–	70	85	100	5	6	33	40
70B1	14	15	15.875	16	19	–	–	–	–	70	90	100	5	M5x12	28	40
80A1	14	15	15.875	16	19	–	–	–	–	80	100	100	5	M6x16	28	40
80AH1	14	15	15.875	16	19	–	–	–	–	80	100	100	5	6.5	28	40
95A	14	15	15.875	16	19	–	–	–	–	95	115	100	5	M8x18	28	40
95A1	14	15	15.875	16	19	22	24	–	–	95	115	100	5	M8x18	38	50
95B	14	15	15.875	16	19	–	–	–	–	95	130	115	5	M8x18	28	40
110A	14	15	15.875	16	19	–	–	–	–	110	130	115	5	M8x18	28	40
110A1	14	15	15.875	16	19	22	24	–	–	110	130	115	6.5	M8x20	38	50
110B	14	15	15.875	16	19	22	24	–	–	110	145	120	6.5	M8x20	38	50
110B1	14	15	15.875	16	19	22	24	28	–	110	145	120	6.5	M8x20	48	60
130A	14	15	15.875	16	19	22	24	–	–	130	165	140	6.5	M10x20	38	50
130A1	14	15	15.875	16	19	22	24	28	32	130	165	140	6.5	M10x25	48	60



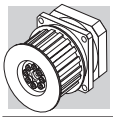


FM

D				D1	D2	D3	D4	D5	L1	L2	L3	L4	L5
14	15	15.875	16	48	90	98	M6x15	M6	33.5	20	7.6	12.5	14.5
19				51	90	98	M6x15	M6	33.5	20	7.6	12.5	16.5
22	24			56.5	90	98	M6x15	M6	36.5	23	7.6	14	19
28				67	90	98	M6x15	M8	36.5	23	7.6	14	22.5
32				71	90	98	M6x15	M8	38	24.5	7.6	15.5	24.5

i	$M_{n\,2}$ [Nm]	$M_{a\,2}$ [Nm]	$M_{p\,2}$ [Nm]	$n_{1\,max}$ [min^{-1}]	φ_S [arcmin]	φ_R [arcmin]	C_t [Nm/arcmin]	$R_{2\,max}$ * [N]	η %	J_G [kgcm^2] D 12.7	14 ... 19	22 ; 24	28 ; 32	
SL 120_3	95	160	300	3500	12’	6’	22	10000	97	2.10	2.18	2.81	3.25	50.62
SL 120_4	110	190	360	4500	12’	6’	22	10000	97	1.23	1.30	1.93	2.37	
SL 120_5	110	190	360	4500	12’	6’	22	10000	97	0.89	0.96	1.59	2.03	
SL 120_7	110	190	360	4500	12’	6’	22	10000	97	0.58	0.66	1.28	1.72	
SL 120_10	95	160	300	5000	12’	6’	22	10000	97	0.41	0.49	1.11	1.55	

* Applies for timing belt application



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4	Sect 1.2 “Selecting the gear unit”: - new selection procedure
6	Sect 2 “Features of SL series”: - information about oil seals newly added
7	Sect 3 “Ordering code”: - ordering code for timing belt pulley provided (YP) and not provided (NP) newly added
8 ... 13	Sect. 4 “Dimensions and technical specifications”: - updated dimensions - updated availability for motor shaft bores - updated weight of gear units

120208

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