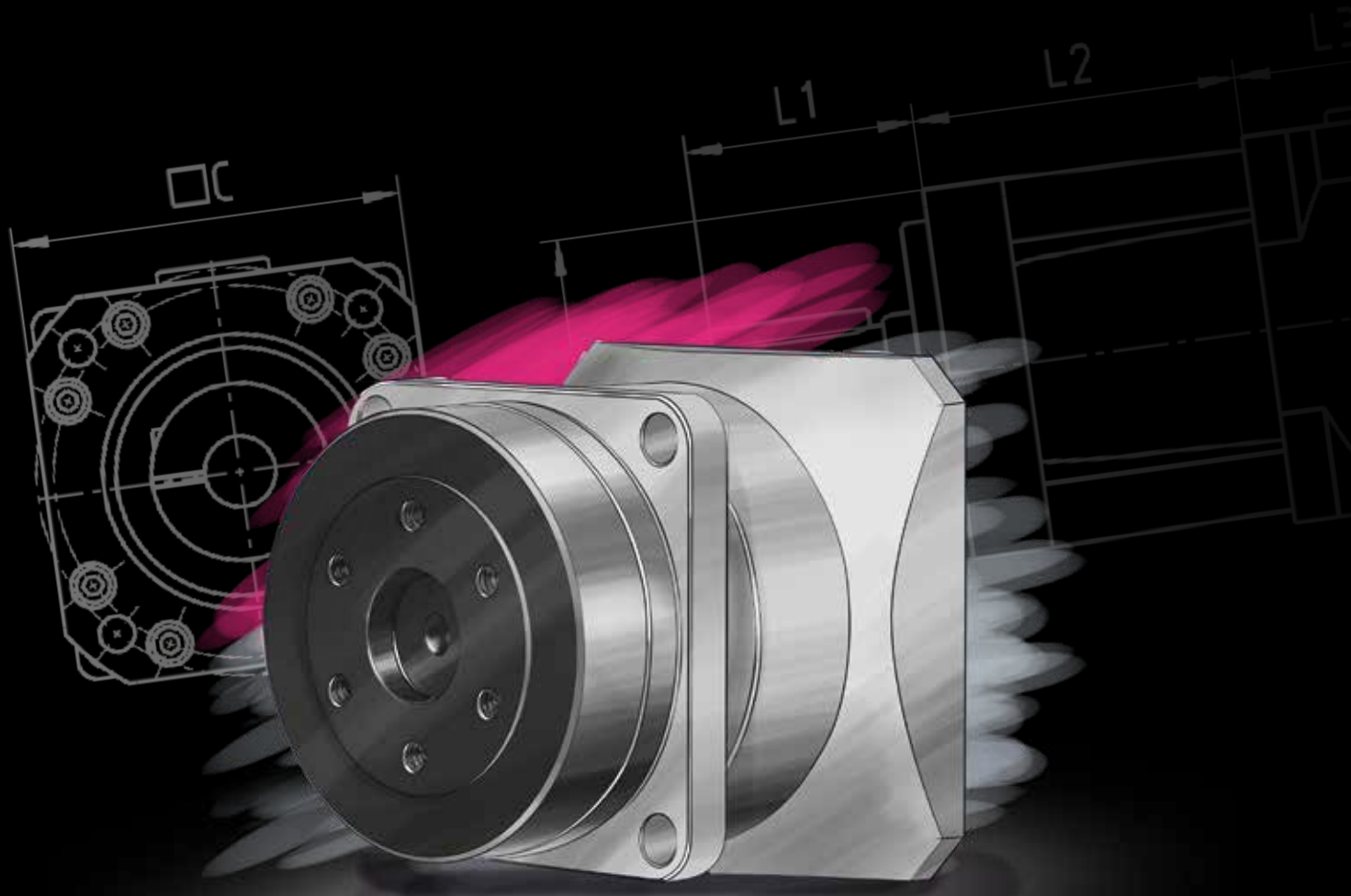
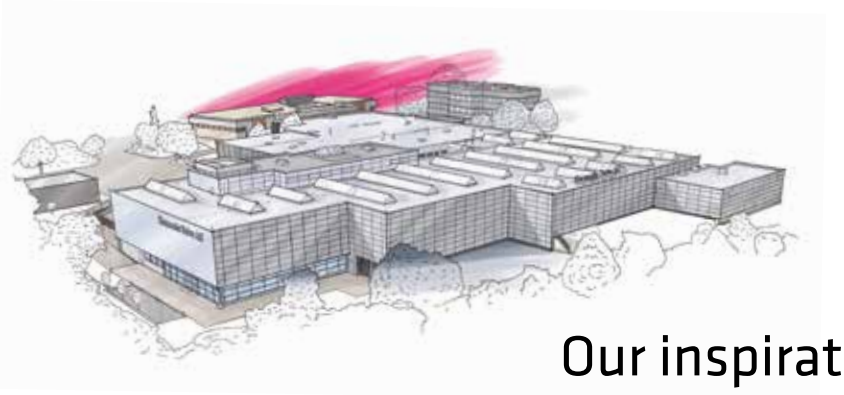
Harmonic Planetary Gears

Harmonic Drive AG




HPGP
HPN
HPF
HPG
HPG-R

Content



Our inspiration

Your business drives us. For every individual set of requirements, we have an equally diverse range of solutions: four out of every five products that leave our company are special versions, developed, designed, and produced to customer specifications – from space saving component sets to customised special drives. Harmonic Drive® Precision Drive Technology based on the strain wave gear principle can be found in machine tools, and of course also in robotics, the aerospace industry, and numerous other key industries.

Our headquarters are in Limburg an der Lahn, Germany, but our marketplace is the entire world. Since the company was founded in 1970, Harmonic Drive AG has grown from a small distribution company to a leading international solution provider with production capability for drive technology – with a parent company in Japan and a sister company in the USA, employees in more than 20 locations worldwide, and a product range of over 23,000 items.

Each product reflects our extensive expertise – and also the conviction that successful innovations are not made for the market, but are created by the market. We are your reliable partner when it comes to developing solutions together that ideally meet your needs – as a result Harmonic Drive AG has been creating pioneering products for nearly half a century.

Find out for yourself: share your next challenge with us and find out how your business can become a driving force for innovation.


Harmonic Drive AG

Far beyond the horizon

Our highly developed drive solutions can be found all over the world – and even above it: gears from Harmonic Drive AG ensure that the "Opportunity" space probe is still operating reliably more than 13 years after its precise landing on the surface of Mars.

Whether it's a red or blue planet: gears, actuators and systems from Harmonic Drive AG are used wherever the highest demands are placed on quality and reliability. It is no wonder that our pioneering mechatronic products are used today in a wide range of key industries.

Thanks to local sites worldwide and close cooperation with our parent company in Japan and our sister company in the USA, we ensure that you can benefit from customised Harmonic Drive® Solutions around the globe – we are there where you need us, crossing national borders and time zones with ease, and facing tricky challenges with enthusiasm.

We successfully meet the requirements of our customers from a wide range of industries. The driving force behind our success is creativity and customer focus: more than 80% of our solutions are developments that we have designed and produced ourselves for specific purposes – from applications in optical machines in India to communications engineering in South Africa.

Let us know what you need: we are sure to have the ideal solution for your requirements.

Maybe you will think of us the next time you travel the globe in a plane from the Airbus range, where high precision Harmonic Drive® Gears for aviation help ensure that you have a safe flight and put the world at your feet.

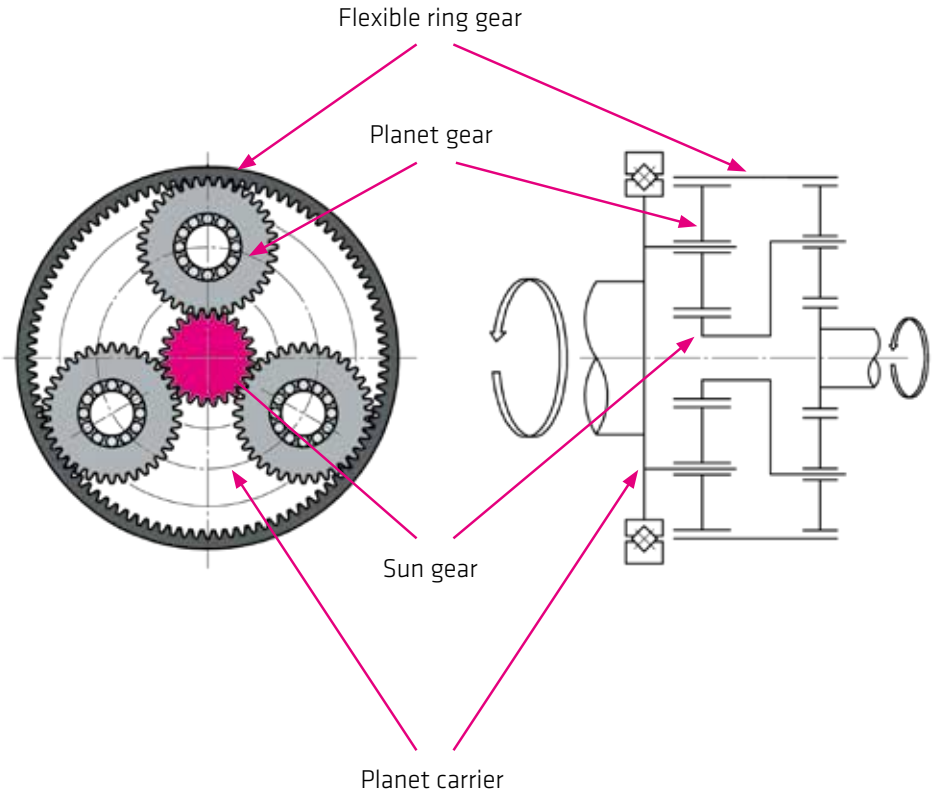
High precision gears with low backlash

permanent precision

There is often a need for highest precision at higher speeds with lower ratios. Our special design with a flexible ring gear in the output stage means that we guarantee constant high precision over the entire lifetime – we call this Permanent Precision®!

The outstanding feature of Harmonic Planetary Gears is the flexible ring gear. This is the result of the engineering and manufacturing know how within the Harmonic Drive® Group. By using a flexible ring gear the planetary gears achieve a backlash of < 3 minutes of arc without requiring an additional backlash adjustment mechanism. For sizes 14 to 65 the backlash can be reduced to lower than one minute or arc.

Until now highly accurate gears and/or an additional adjustment mechanism were necessary to minimise backlash. Tight gear engagement for conventional planetary gears leads to torque ripple and a worsening of noise and wear characteristics. To avoid this problem the planetary gears feature a flexible internally toothed ring gear, thereby exploiting many years of Harmonic Drive® experience with thin walled components. The flexible ring gear ensures that backlash is minimised and that all planet gears share the load equally.

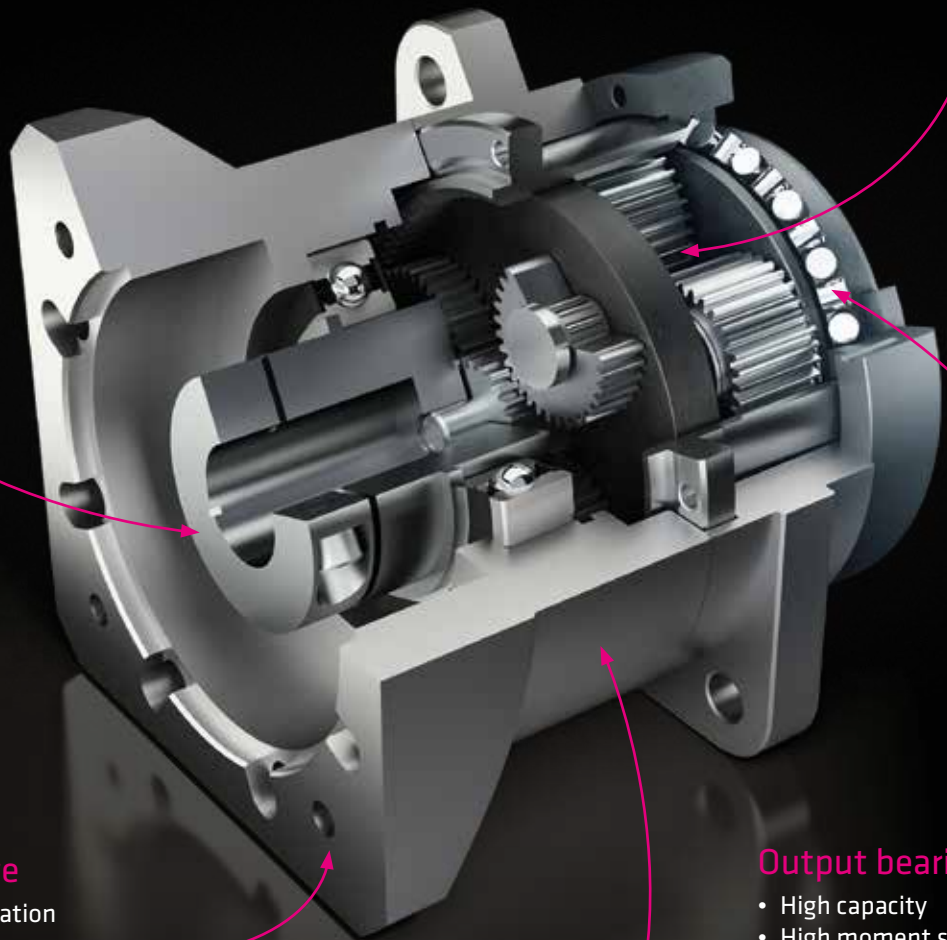


Harmonic Planetary Gear Set

Containing:
- Ring gear
- Planet carrier
- Sun gear
- Planet gear

Clamping element

- Tangential clamping
- Customer specific solution



Motor flange

- Flexible adaptation

Output bearing

- High capacity
- High moment stiffness
- Excellent running properties
- Corrosion protected

Gear housing

- High strength aluminium
- Corrosion protected

Affordability combined with precision

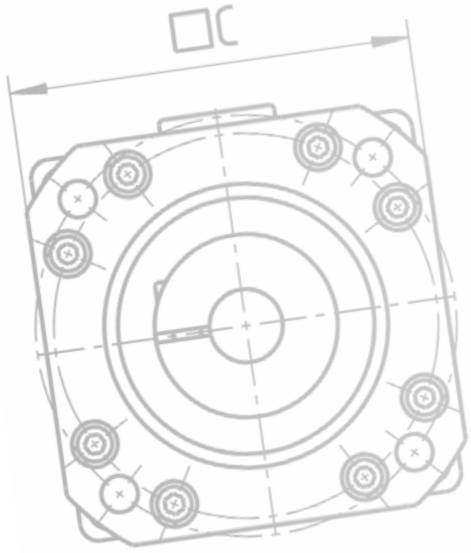
The HPN Series Planetary Gears are available in five sizes with thirteen gear ratios between 3 and 50. Offering repeated peak torque from 9 to 752 Nm with a backlash of just 5 (single-stage) to 7 (double-stage) arcmin, this gear series is ideal for low backlash applications. The outstanding price to performance ratio offers a precision gear solution where low backlash and cost represent a combined value.

The Planetary Gears HPN are an innovative mix between commercial and technical needs. Reduced cost with low backlash characteristics are the main features.

HPN Series is built around a helical gearing concept that exhibits very smooth running and is extremely quiet. To support your application load, the gears are provided with two widely spaced bearings on the output side. The gears are available with standard flanges for various motor types.

Based on a combination of high torque capacity and low backlash, HPN Planetary Gears offer a compact solution for your application. Standard servo motors can be simply coupled to the lifetime lubricated gears.

With the introduction of the new HPN Series we extend our portfolio to supply additional customer cost benefits.



Optimised for your applications:

- Low backlash
- High dynamic performance
- Low noise
- Direct motor adaptation
- Compact design
- Best possible price/performance ratio

Features

HPN

Ordering code

Table 12.1

Series	Size	Ratio													Version	Code for motor adaption
HPN	11A		4	5	7	10	15	20	25	30	35	40	45	50	J6, J8	xx.xx
	14A	3	4	5	7	10	15	20	25	30	35	40	45	50		
	20A	3	4	5	7	10	15	20	25	30	35	40	45	50		
	32A	3	4	5	7	10	15	20	25	30	35	40	45	50		
	40A	3	4	5	7	10	15	20	25	30	35	40	45	50		
Ordering code																
HPN	**-**	**11A**				**-**			**4**			**-**			**J6**	**BH-AF1**

Table 12.2

Output	
Ordering code	**Description**
J6	Output shaft with key
J8	Output shaft without key

Table 12.3

Version	
Code for motor adaption	**Description**
xx.xx	Depending on motor type

HPN

Technical data

Table 14.1

	Unit	HPN-11A											
Number of stages		single stage				double stage							
Ratio	i [ ]	4	5	7	10	15	20	25	30	35	40	45	50
Repeated peak torque	T_R [Nm]	14	16	11	9	24	24	24	26	26	26	26	26
Rated torque	T_N [Nm]	14	14	11	9	18	22	20	25	26	26	26	26
Momentary peak torque	T_M [Nm]	40	40	40	40	40	40	40	40	40	40	40	40
Maximum input speed (grease lubrication)	$n_{in\ (max)}$ [rpm]	10000											
Average input speed (grease lubrication)	$n_{av\ (max)}$ [rpm]	3000											
Weight	m [kg]	0.44				0.57							
Backlash	[arcmin]	≤ 5				≤ 7							
Torsional stiffness	K_3 [x10³ Nm/rad]	2											
Ambient operating temperature	[°C]	0 ... 40											
Output bearing [1]													
Dynamic radial load	$F_{R\ dyn\ (max)}$ [N]	480											
Dynamic axial load	$F_{A\ dyn\ (max)}$ [N]	640											

[1] Calculated for an L50 life time of 20000 hours operating at an output speed of 100 rpm

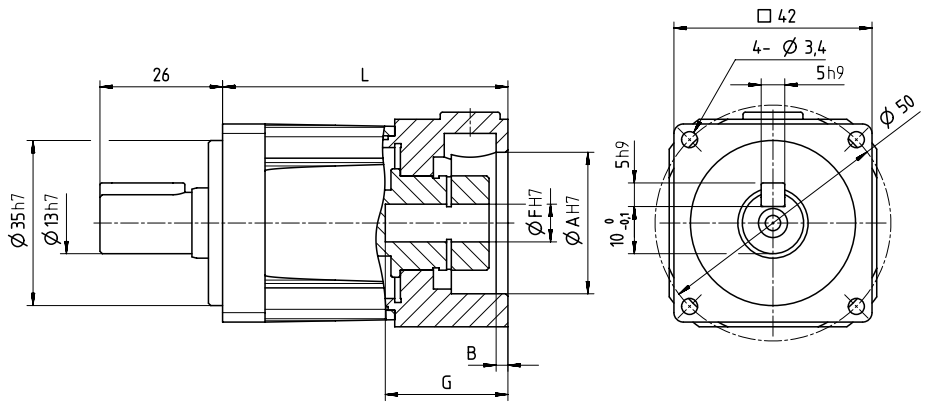
Table 14.2

	Unit	HPN-14A											
Number of stages		single stage					double stage						
Ratio	i [ ]	3	4	5	7	10	15	20	25	30	35	40	45	50
Repeated peak torque	T_R [Nm]	25	50	50	37	18	43	49	38	48	49	38	38	26
Rated torque	T_N [Nm]	22	28	29	30	18	30	30	30	40	40	30	30	26
Momentary peak torque	T_M [Nm]	89	110	107	100	79	97	100	102	98	99	100	100	94
Maximum input speed (grease lubrication)	$n_{in\ (max)}$ [rpm]	6000												
Average input speed (grease lubrication)	$n_{av\ (max)}$ [rpm]	3000												
Weight	m [kg]	0.95					1.3							
Backlash	[arcmin]	≤ 5					≤ 7							
Torsional stiffness	K_3 [x10³ Nm/rad]	9,3												
Ambient operating temperature	[°C]	0 ... 40												
Output bearing [1]														
Dynamic radial load	$F_{R\ dyn\ (max)}$ [N]	840												
Dynamic axial load	$F_{A\ dyn\ (max)}$ [N]	900												

[1] Calculated for an L50 life time of 20000 hours operating at an output speed of 100 rpm

Illustration 15.1

HPN-11A [mm]



A, B, F, G and L depends on the motor type

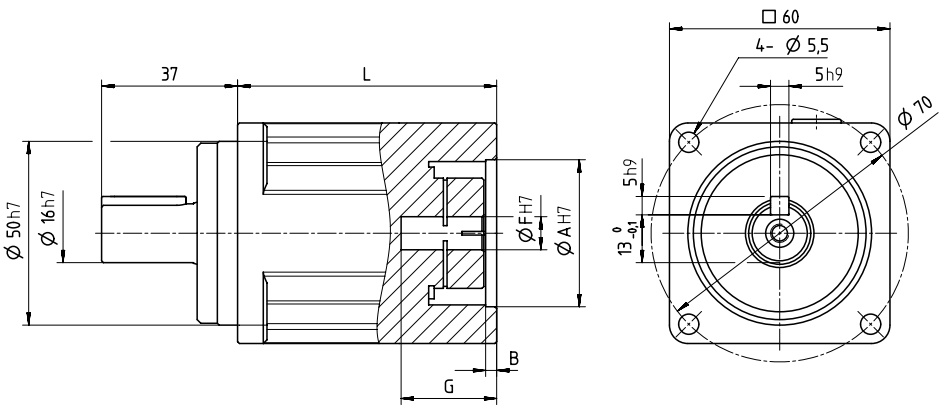
Table 15.2

[mm]

Length	single stage	double stage
L	60	80

Illustration 15.3

HPN-14A [mm]



A, B, F, G and L depends on the motor type

Table 15.4

[mm]

Length	single stage		double stage	
	min	max	min	max
L	70	75	95	100

Technical data

Table 16.1

	Unit	HPN-20A												
Number of stages		single stage					double stage							
Ratio	i [ ]	3	4	5	7	10	15	20	25	30	35	40	45	50
Repeated peak torque	T_R [Nm]	74	130	149	113	54	129	147	114	139	112	112	112	75
Rated torque	T_N [Nm]	51	80	80	80	54	80	80	80	80	80	80	80	75
Momentary peak torque	T_M [Nm]	226	256	256	256	216	256	256	256	250	256	256	256	216
Maximum input speed (grease lubrication)	$n_{in\ (max)}$ [rpm]	6000												
Average input speed (grease lubrication)	$n_{av\ (max)}$ [rpm]	3000												
Weight	m [kg]	2.6					3.2							
Backlash	[arcmin]	≤ 5					≤ 7							
Torsional stiffness	K_3 [x10³ Nm/rad]	26												
Ambient operating temperature	[°C]	0 ... 40												
Output bearing [1]														
Dynamic radial load	$F_{R\ dyn\ (max)}$ [N]	1800												
Dynamic axial load	$F_{A\ dyn\ (max)}$ [N]	2200												

[1] Calculated for an L50 life time of 20000 hours operating at an output speed of 100 rpm

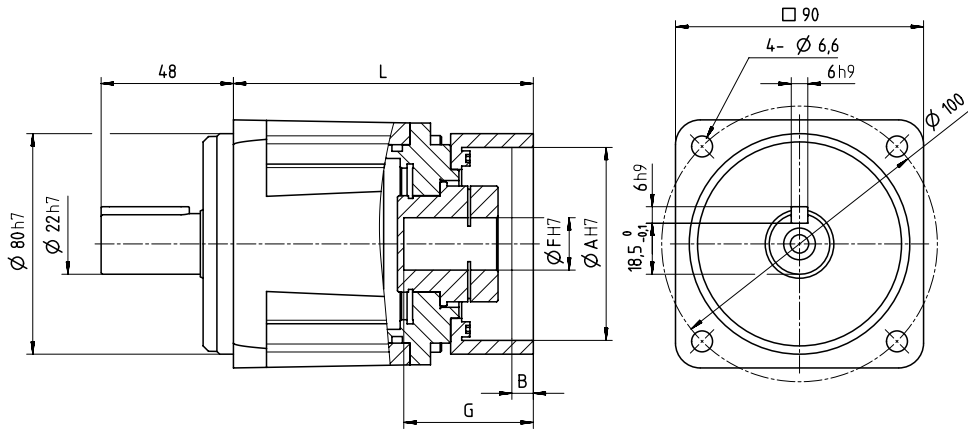
Table 16.2

	Unit	HPN-32A												
Number of stages		single stage					double stage							
Ratio	i [ ]	3	4	5	7	10	15	20	25	30	35	40	45	50
Repeated peak torque	T_R [Nm]	254	376	376	376	185	376	376	376	376	376	376	376	251
Rated torque	T_N [Nm]	153	198	200	200	185	200	200	200	250	250	300	300	251
Momentary peak torque	T_M [Nm]	625	625	625	625	625	625	625	625	625	625	625	625	625
Maximum input speed (grease lubrication)	$n_{in\ (max)}$ [rpm]	6000												
Average input speed (grease lubrication)	$n_{av\ (max)}$ [rpm]	3000												
Weight	m [kg]	6.5					7.2							
Backlash	[arcmin]	≤ 5					≤ 7							
Torsional stiffness	K_3 [x10³ Nm/rad]	94												
Ambient operating temperature	[°C]	0 ... 40												
Output bearing [1]														
Dynamic radial load	$F_{R\ dyn\ (max)}$ [N]	3900												
Dynamic axial load	$F_{A\ dyn\ (max)}$ [N]	3800												

[1] Calculated for an L50 life time of 20000 hours operating at an output speed of 100 rpm

Illustration 17.1

HPN-20A [mm]



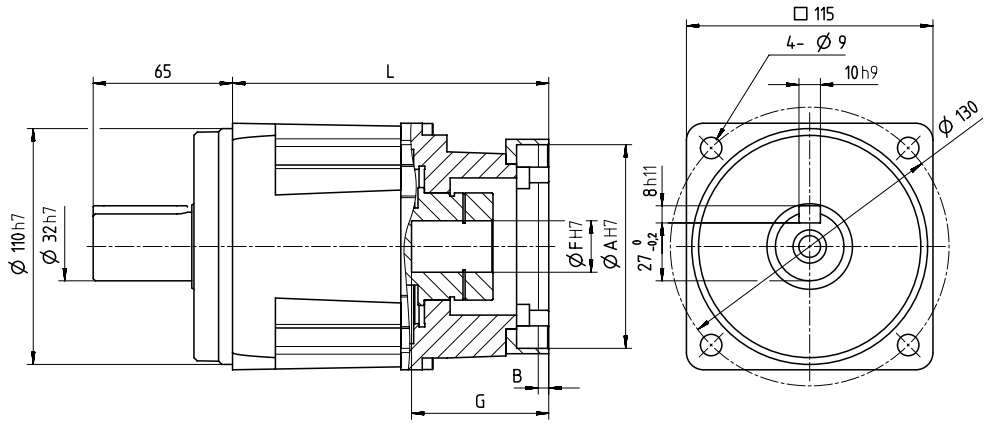
A, B, F, G and L depends on the motor type

Table 17.2 [mm]

Length	single stage		double stage	
	min	max	min	max
L	104	122	126	144

Illustration 17.3

HPN-32A [mm]



A, B, F, G and L depends on the motor type

Table 17.4 [mm]

Length	single stage		double stage	
	min	max	min	max
L	130	169	167	190

Technical data

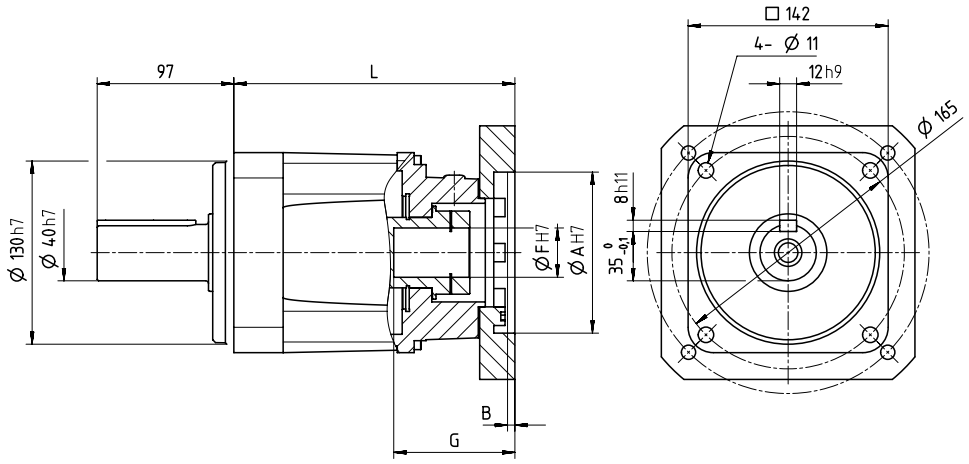
Table 18.1

	Unit	HPN-40A												
Number of stages		single stage					double stage							
Ratio	i [ ]	3	4	5	7	10	15	20	25	30	35	40	45	50
Repeated peak torque	T_R [Nm]	752	752	752	752	509	752	752	752	752	752	752	752	562
Rated torque	T_N [Nm]	440	460	480	510	480	530	600	650	650	700	700	700	562
Momentary peak torque	T_M [Nm]	1137	1265	1265	829	829	1265	1265	1127	1265	1127	1127	1127	1162
Maximum input speed (grease lubrication)	$n_{in\ (max)}$ [rpm]	6000												
Average input speed (grease lubrication)	$n_{av\ (max)}$ [rpm]	3000												
Weight	m [kg]	13					16							
Backlash	[arcmin]	≤ 5					≤ 7							
Torsional stiffness	K_3 [x10^3 Nm/rad]	143												
Ambient operating temperature	[°C]	0 ... 40												
Output bearing [1]														
Dynamic radial load	$F_{R\ dyn\ (max)}$ [N]	5500												
Dynamic axial load	$F_{A\ dyn\ (max)}$ [N]	5400												

[1] Calculated for an L50 life time of 20000 hours operating at an output speed of 100 rpm

Illustration 19.1

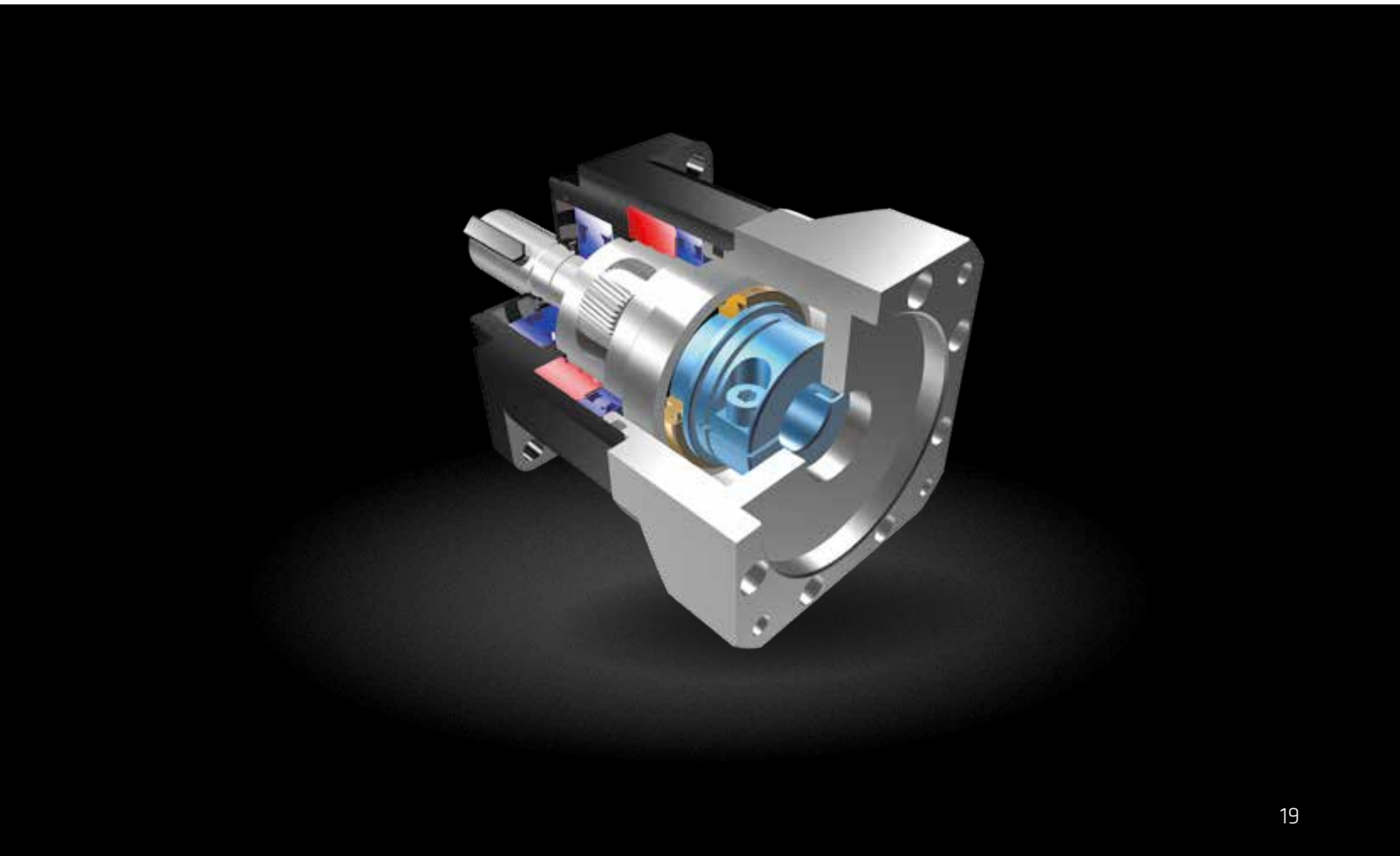
HPN-40A [mm]



A, B, F, G and L depends on the motor type

Table 19.2 [mm]

Length	single stage		double stage	
	min	max	min	max
L	199	232	213	251



Low gear ratios for high dynamics

HPG Series Planetary Gears operate at higher speeds with lower ratios and there is often a need for the highest precision. Our special design with a flexible ring gear in the output stage means that we guarantee constant high precision over the entire lifetime – we call this Permanent Precision®!

The HPG Series Planetary Gears are available in six sizes with fifteen gear ratios between 3 and 50:1 offering repeatable peak torques from 4 to 2200 Nm. The precision output bearing with high tilting rigidity enables the direct introduction of high payloads without further support and thus permits simple and space saving designs.

HPG Series Planetary Gears are available in three versions for the output: with output flange, with smooth output shaft and with output shaft with keyway. On the input side there is a version for motor adaptation, or alternatively it is available with input shaft.

Standard servo motors can be simply coupled to our Planetary Gears. Gear and motor together form a compact and lightweight system capable of withstanding high payloads ensuring stable machine properties with short cycle times are guaranteed.

Optimised for your applications:

- Permanent Precision®
- High dynamics
- Direct motor connection
- Integrated high capacity output bearing
- Optional with input shaft

Features

HPG

Ordering code

Table 22.1

Series	Size	Ratio								Backlash class	Version	Code for motor adaptation	Special design
HPG	11B		5	9		21	37	45		BL3	F0 J2 J6	Exx.xx U1	According to customer requirements
	14A	3	5	11	15	21	33	45		BL3 BL1			
	20A	3	5	11	15	21	33	45					
	32A	3	5	11	15	21	33	45					
	50A	3	5	11	15	21	33	45					
	65A	4	5	12	15	20	25	40	50				
Ordering code													
HPG - 14A - 11 - BL3 - F0 - E14.20 - SP													

Table 22.2

Backlash class	
Ordering code	**Backlash**
BL3	≤ 3 arcmin
BL1	≤ 1 arcmin

Table 22.3

Code for motor adaptation	
Ordering code	**Description**
Exx.xx	Depending on motor type
U1	Input shaft

Table 22.4

Version	
Ordering code	**Description**
F0	Output flange
J2	Output shaft without key
J6	Output shaft with key

Technical data

Table 24.1

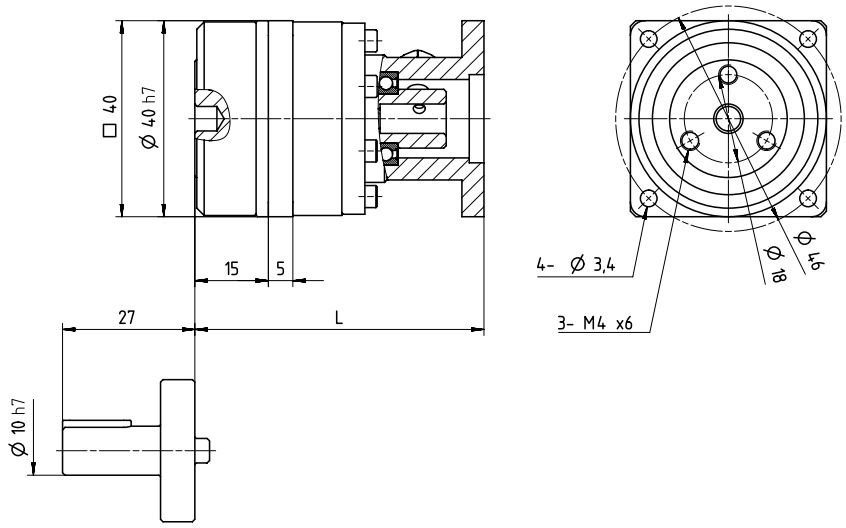
	Unit	HPG-11B				
Ratio	i [ ]	5	9	21	37	45
Repeated peak torque	T_R [Nm]	7.8	3.9	9.8	9.8	9.8
Average torque	T_A [Nm]	5.0	3.9	6.0	6.0	6.0
Rated torque	T_N [Nm]	2.5	2.5	3.5	3.5	3.5
Momentary peak torque	T_M [Nm]	20	20	20	20	20
Maximum input speed (grease lubrication)	$n_{in\ (max)}$ [rpm]	10000				
Average input speed (grease lubrication)	$n_{av\ (max)}$ [rpm]	3000				
Moment of inertia with output flange (F0)	J_{in} [x10^{-6} kgm^2]	0.21	0.07	0.18	0.066	0.048
Moment of inertia with output shaft (Jx)	J_{in} [x10^{-6} kgm^2]	0.36	0.12	0.19	0.068	0.049
Weight with output flange (F0)	m [kg]	0.14		0.20		
Weight with output shaft (Jx)	m [kg]	0.18		0.24		
Transmission accuracy	[arcmin]	< 5				
Repeatability	[arcmin]	< ±0.5				
Backlash	[arcmin]	≤ 3				
Torsional stiffness	K_3 [x10^3 Nm/rad]	2.2				
Ambient operating temperature	[°C]	0 ... 40				
Output bearing						
Dynamic radial load	$F_{R\ dyn\ (max)}$ [N]	280	340	440	520	550
Dynamic axial load	$F_{A\ dyn\ (max)}$ [N]	430	510	660	780	830
Dynamic tilting moment	$M_{dyn\ (max)}$ [Nm]	9.5				

Table 24.2

	Unit	HPG-11B-U1				
Ratio	i [ ]	5	9	21	37	45
Repeated peak torque	T_R [Nm]	7.8	3.9	9.8	9.8	9.8
Average torque	T_A [Nm]	5.0	3.9	6.0	6.0	6.0
Rated torque	T_N [Nm]	2.5	2.5	3.5	3.5	3.5
Momentary peak torque	T_M [Nm]	20	20	20	20	20
Maximum input speed (grease lubrication)	$n_{in\ (max)}$ [rpm]	10000				
Average input speed (grease lubrication)	$n_{av\ (max)}$ [rpm]	3000				
Moment of inertia with output flange (F0)	J_{in} [x10^{-6} kgm^2]	0.72	0.58	0.63	0.52	0.50
Moment of inertia with output shaft (Jx)	J_{in} [x10^{-6} kgm^2]	0.87	0.63	0.64	0.52	0.50
Weight with output flange (F0)	m [kg]	0.2		0.26		
Weight with output shaft (Jx)	m [kg]	0.24		0.3		
Transmission accuracy	[arcmin]	< 5				
Repeatability	[arcmin]	< ±0.5				
Backlash	[arcmin]	≤ 3				
Torsional stiffness	K_3 [x10^3 Nm/rad]	2.2				
Ambient operating temperature	[°C]	0 ... 40				
Output bearing						
Dynamic radial load	$F_{R\ dyn\ (max)}$ [N]	280	340	440	520	550
Dynamic axial load	$F_{A\ dyn\ (max)}$ [N]	430	510	660	780	830
Dynamic tilting moment	$M_{dyn\ (max)}$ [Nm]	9.5				

Illustration 25.1

HPG-11B [mm]



L depends on the motor type

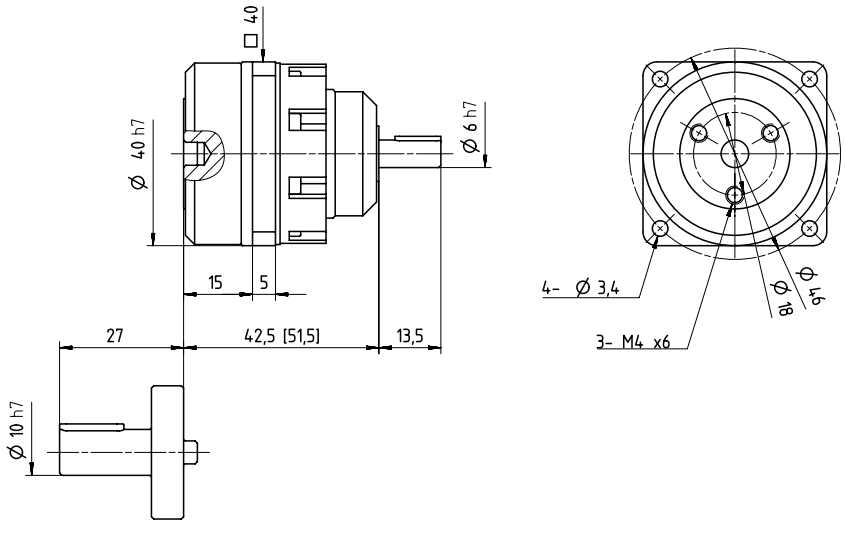
Table 25.2

[mm]

Length	single stage		double stage	
	min	max	min	max
L	55	65	60	70

Illustration 25.3

HPG-11B-U1 [mm]



[ ] Double stage gear

Technical data

Table 26.1

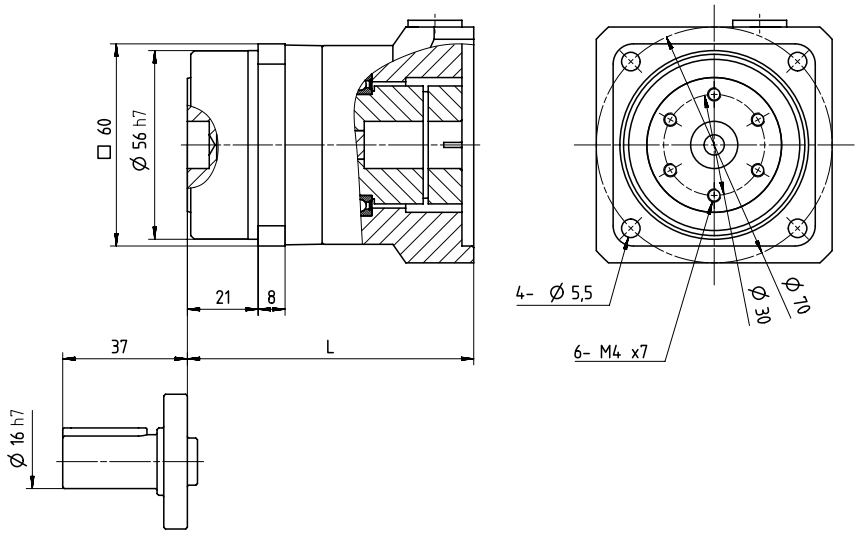
	Unit	HPG-14A						
Ratio	i [ ]	3	5	11	15	21	33	45
Repeated peak torque	T_R [Nm]	15	23	23	23	23	23	23
Average torque	T_A [Nm]	6.4	13	15	15	15	15	15
Rated torque	T_N [Nm]	3.0	6.0	8.0	9.0	9.0	10	10
Momentary peak torque	T_M [Nm]	56	56	56	56	56	56	56
Maximum input speed (grease lubrication)	$n_{in\ (max)}$ [rpm]	5000	6000					
Average input speed (grease lubrication)	$n_{av\ (max)}$ [rpm]	3000						
Moment of inertia with output flange (F0)	J_{in} [x10^{-6} kgm^2]	5.7	2.1	1.6	1.4	0.89	0.29	0.27
Moment of inertia with output shaft (Jx)	J_{in} [x10^{-6} kgm^2]	7.7	2.6	1.9	1.7	0.92	0.30	0.28
Weight with output flange (F0)	m [kg]	0.4		0.5				
Weight with output shaft (Jx)	m [kg]	0.5		0.6				
Transmission accuracy	[arcmin]	< 4						
Repeatability	[arcmin]	< ±0.35						
Backlash	[arcmin]	≤ 3 or ≤ 1						
Torsional stiffness	K_3 [x10^3 Nm/rad]	4.7						
Ambient operating temperature	[°C]	0 ... 40						
Output bearing								
Dynamic radial load	$F_{R\ dyn\ (max)}$ [N]	400	470	600	650	720	830	910
Dynamic axial load	$F_{A\ dyn\ (max)}$ [N]	600	700	890	980	1080	1240	1360
Dynamic tilting moment	$M_{dyn\ (max)}$ [Nm]	32.3						

Table 26.2

	Unit	HPG-14A-U1						
Ratio	i [ ]	3	5	11	15	21	33	45
Repeated peak torque	T_R [Nm]	15	23	23	23	23	23	23
Average torque	T_A [Nm]	6.4	13	15	15	15	15	15
Rated torque	T_N [Nm]	3	6	8	9	9	10	10
Momentary peak torque	T_M [Nm]	56	56	56	56	56	56	56
Maximum input speed (grease lubrication)	$n_{in\ (max)}$ [rpm]	5000	6000					
Average input speed (grease lubrication)	$n_{av\ (max)}$ [rpm]	3000						
Moment of inertia with output flange (F0)	J_{in} [x10^{-6} kgm^2]	11	6.7	5.8	5.6	4.9	4.3	4.3
Moment of inertia with output shaft (Jx)	J_{in} [x10^{-6} kgm^2]	12	7.3	5.9	5.7	4.9	4.3	4.3
Weight with output flange (F0)	m [kg]	0.7		0.8				
Weight with output shaft (Jx)	m [kg]	0.8		0.9				
Transmission accuracy	[arcmin]	< 4						
Repeatability	[arcmin]	< ±0.35						
Backlash	[arcmin]	≤ 3 or ≤ 1						
Torsional stiffness	K_3 [x10^3 Nm/rad]	4.7						
Ambient operating temperature	[°C]	0 ... 40						
Output bearing								
Dynamic radial load	$F_{R\ dyn\ (max)}$ [N]	400	470	600	650	720	830	910
Dynamic axial load	$F_{A\ dyn\ (max)}$ [N]	600	700	890	980	1080	1240	1360
Dynamic tilting moment	$M_{dyn\ (max)}$ [Nm]	32.3						

Illustration 27.1

HPG-14A [mm]



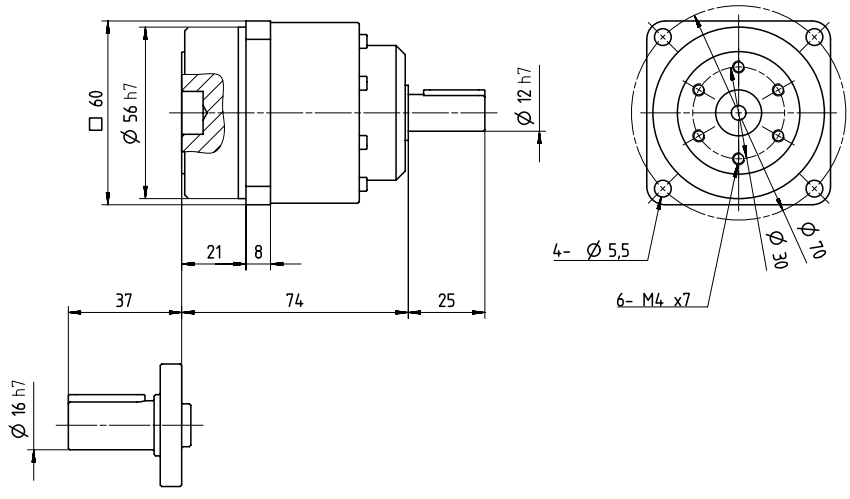
L depends on the motor type

Table 27.2 [mm]

Length	single stage		double stage	
	min	max	min	max
L	80	95	85	95

Illustration 27.3

HPG-14A-U1 [mm]



Technical data

Table 28.1

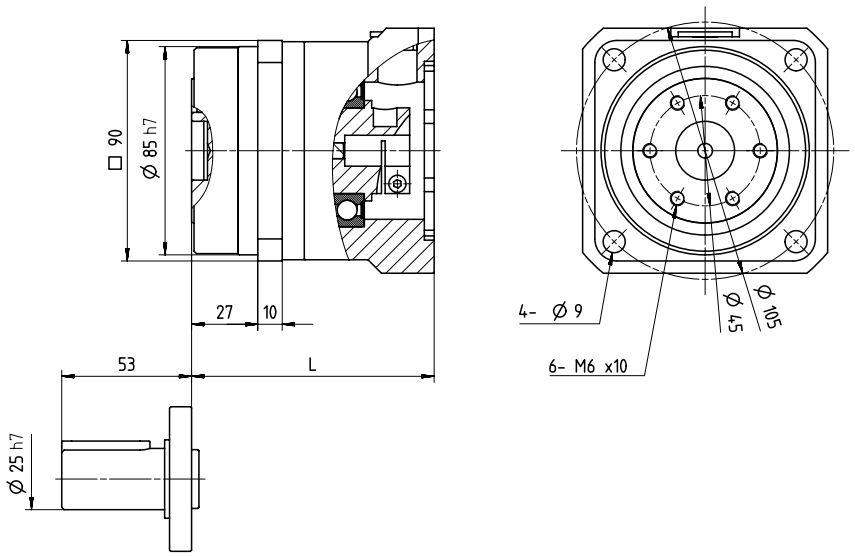
	Unit	HPG-20A						
Ratio	i [ ]	3	5	11	15	21	33	45
Repeated peak torque	T_R [Nm]	64	100	100	100	100	100	100
Average torque	T_A [Nm]	19	35	45	53	55	60	60
Rated torque	T_N [Nm]	9	16	20	24	25	29	29
Momentary peak torque	T_M [Nm]	124	217	217	217	217	217	217
Maximum input speed (grease lubrication)	$n_{in\ (max)}$ [rpm]	4000	6000					
Average input speed (grease lubrication)	$n_{av\ (max)}$ [rpm]	3000						
Moment of inertia with output flange (F0)	J_{in} [x10^{-6} kgm^2]	46	17	15	14	6.9	2.3	2.2
Moment of inertia with output shaft (Jx)	J_{in} [x10^{-6} kgm^2]	57	21	16	14	7.1	2.4	2.2
Weight with output flange (F0)	m [kg]	1.2		1.4				
Weight with output shaft (Jx)	m [kg]	1.6		1.8				
Transmission accuracy	[arcmin]	< 4						
Repeatability	[arcmin]	< ±0.25						
Backlash	[arcmin]	≤ 3 or ≤ 1						
Torsional stiffness	K_3 [x10^3 Nm/rad]	18.5						
Ambient operating temperature	[°C]	0 ... 40						
Output bearing								
Dynamic radial load	$F_{R\ dyn\ (max)}$ [kN]	0.84	0.98	1.24	1.36	1.51	1.73	1.89
Dynamic axial load	$F_{A\ dyn\ (max)}$ [kN]	1.25	1.41	1.85	2.03	2.25	2.58	2.83
Dynamic tilting moment	$M_{dyn\ (max)}$ [Nm]	183						

Table 28.2

	Unit	HPG-20A-U1						
Ratio	i [ ]	3	5	11	15	21	33	45
Repeated peak torque	T_R [Nm]	64	100	100	100	100	100	100
Average torque	T_A [Nm]	19	35	45	53	55	60	60
Rated torque	T_N [Nm]	9	16	20	24	25	29	29
Momentary peak torque	T_M [Nm]	124	217	217	217	217	217	217
Maximum input speed (grease lubrication)	$n_{in\ (max)}$ [rpm]	4000	6000					
Average input speed (grease lubrication)	$n_{av\ (max)}$ [rpm]	3000						
Moment of inertia with output flange (F0)	J_{in} [x10^{-6} kgm^2]	69	40	31	30	23	19	18
Moment of inertia with output shaft (Jx)	J_{in} [x10^{-6} kgm^2]	80	44	32	30	23	19	18
Weight with output flange (F0)	m [kg]	2.0		2.1				
Weight with output shaft (Jx)	m [kg]	2.4		2.7				
Transmission accuracy	[arcmin]	< 4						
Repeatability	[arcmin]	< ±0.25						
Backlash	[arcmin]	≤ 3 or ≤ 1						
Torsional stiffness	K_3 [x10^3 Nm/rad]	18.5						
Ambient operating temperature	[°C]	0 ... 40						
Output bearing								
Dynamic radial load	$F_{R\ dyn\ (max)}$ [kN]	0.84	0.98	1.24	1.36	1.51	1.73	1.89
Dynamic axial load	$F_{A\ dyn\ (max)}$ [kN]	1.250	1.41	1.85	2.03	2.25	2.58	2.83
Dynamic tilting moment	$M_{dyn\ (max)}$ [Nm]	183						

Illustration 29.1

HPG-20A [mm]



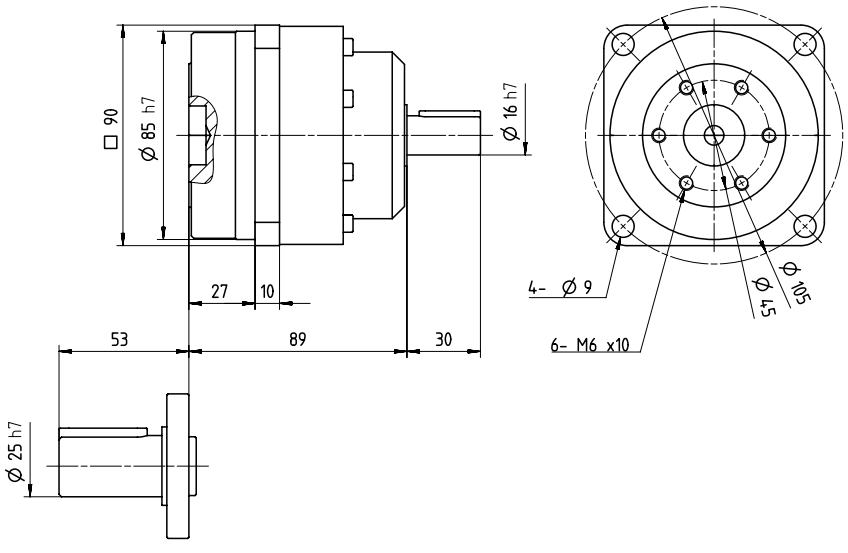
L depends on the motor type

Table 29.2 [mm]

Length	single stage		double stage	
	min	max	min	max
L	90	105	95	105

Illustration 29.3

HPG-20A-U1 [mm]



Technical data

Table 30.1

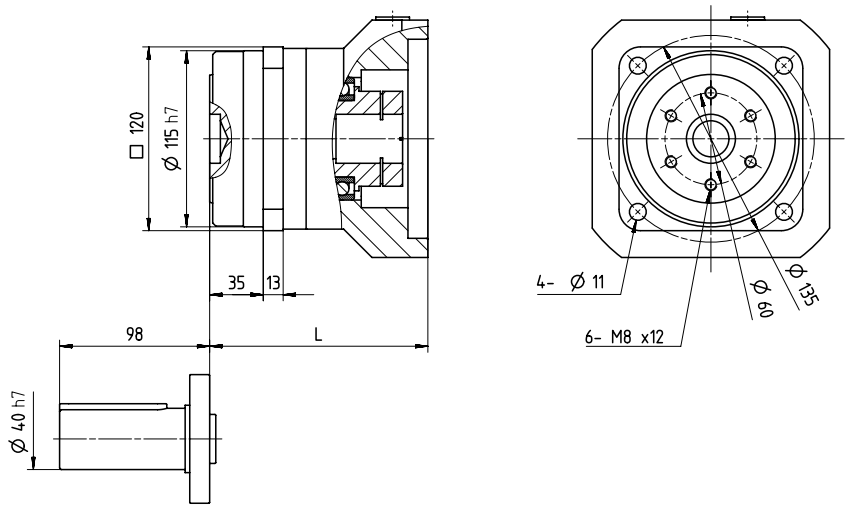
	Unit	HPG-32A						
Ratio	i [ ]	3	5	11	15	21	33	45
Repeated peak torque	T_R [Nm]	255	300	300	300	300	300	300
Average torque	T_A [Nm]	71	150	170	170	170	200	200
Rated torque	T_N [Nm]	31	66	88	92	98	108	108
Momentary peak torque	T_M [Nm]	507	650	650	650	650	650	650
Maximum input speed (grease lubrication)	$n_{in\ (max)}$ [rpm]	3600	6000					
Average input speed (grease lubrication)	$n_{av\ (max)}$ [rpm]	3000						
Moment of inertia with output flange (F0)	J_{in} [x10^{-6} kgm^2]	200	73	78	62	34	12	11
Moment of inertia with output shaft (Jx)	J_{in} [x10^{-6} kgm^2]	280	100	84	65	36	13	12
Weight with output flange (F0)	m [kg]	2.9		3.5				
Weight with output shaft (Jx)	m [kg]	4.3		4.9				
Transmission accuracy	[arcmin]	< 4						
Repeatability	[arcmin]	< ± 0.25						
Backlash	[arcmin]	≤ 3 or ≤ 1						
Torsional stiffness	K_3 [x10^3 Nm/rad]	74.1						
Ambient operating temperature	[°C]	0 ... 40						
Output bearing								
Dynamic radial load	$F_{R\ dyn\ (max)}$ [kN]	1.63	1.90	2.41	2.64	2.92	3.34	3.67
Dynamic axial load	$F_{A\ dyn\ (max)}$ [kN]	2.43	2.83	3.59	3.94	4.36	4.99	5.48
Dynamic tilting moment	$M_{dyn\ (max)}$ [Nm]	452						

Table 30.2

	Unit	HPG-32A-U1						
Ratio	i [ ]	3	5	11	15	21	33	45
Repeated peak torque	T_R [Nm]	255	300	300	300	300	300	300
Average torque	T_A [Nm]	71	150	170	170	170	200	200
Rated torque	T_N [Nm]	31	66	88	92	98	108	108
Momentary peak torque	T_M [Nm]	507	650	650	650	650	650	650
Maximum input speed (grease lubrication)	$n_{in\ (max)}$ [rpm]	3600	6000					
Average input speed (grease lubrication)	$n_{av\ (max)}$ [rpm]	3000						
Moment of inertia with output flange (F0)	J_{in} [x10^{-6} kgm^2]	340	220	190	180	150	130	130
Moment of inertia with output shaft (Jx)	J_{in} [x10^{-6} kgm^2]	420	240	200	180	150	130	130
Weight with output flange (F0)	m [kg]	4.9		5.3				
Weight with output shaft (Jx)	m [kg]	6.3		6.9				
Transmission accuracy	[arcmin]	< 4						
Repeatability	[arcmin]	< ±0.25						
Backlash	[arcmin]	≤ 3 or ≤ 1						
Torsional stiffness	K_3 [x10^3 Nm/rad]	74.1						
Ambient operating temperature	[°C]	0 ... 40						
Output bearing								
Dynamic radial load	$F_{R\ dyn\ (max)}$ [kN]	1.63	1.90	2.41	2.64	2.92	3.34	3.67
Dynamic axial load	$F_{A\ dyn\ (max)}$ [kN]	2.43	2.83	3.59	3.94	4.36	4.99	5.48
Dynamic tilting moment	$M_{dyn\ (max)}$ [Nm]	452						

Illustration 31.1

HPG-32A [mm]



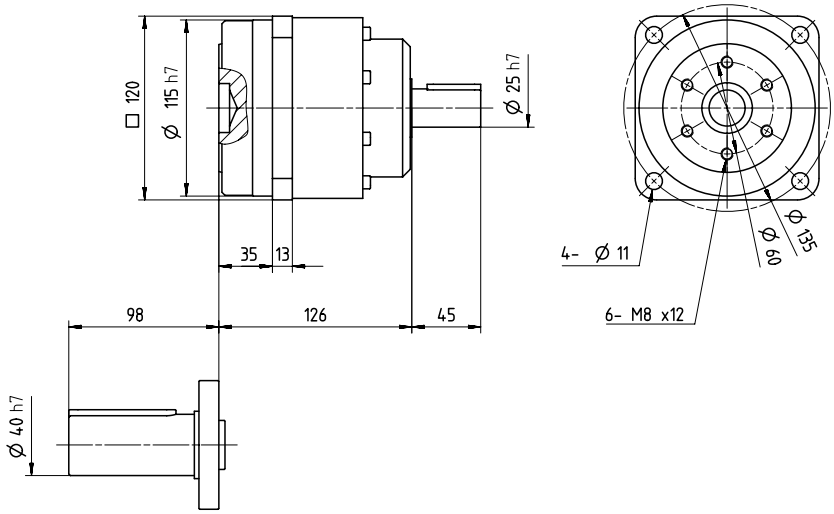
L depends on the motor type

Table 31.2 [mm]

Length	single stage		double stage	
	min	max	min	max
L	135	145	135	150

Illustration 31.3

HPG-32A-U1 [mm]



Technical data

Table 32.1

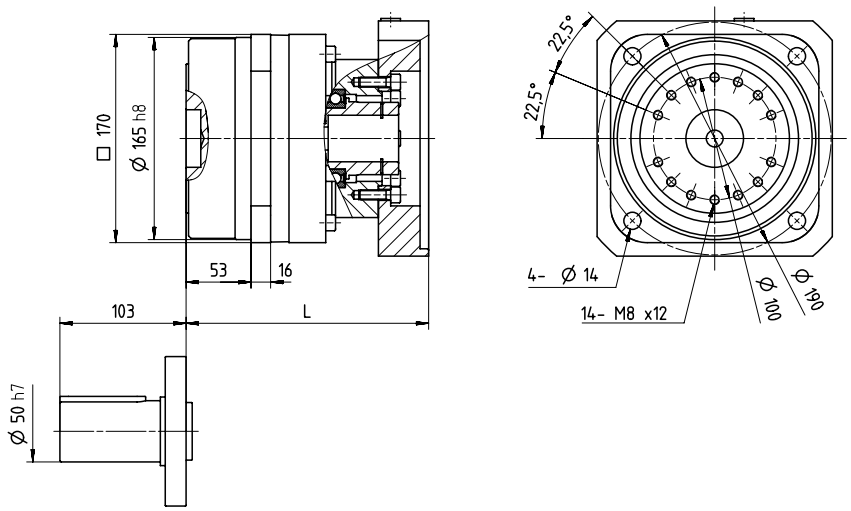
	Unit	HPG-50A						
Ratio	i [ ]	3	5	11	15	21	33	45
Repeated peak torque	T_R [Nm]	657	850	850	850	850	850	850
Average torque	T_A [Nm]	195	340	400	450	500	500	500
Rated torque	T_N [Nm]	97	170	200	230	260	270	270
Momentary peak torque	T_M [Nm]	1200	1850	1850	1850	1850	1850	1850
Maximum input speed (grease lubrication)	$n_{in\ (max)}$ [rpm]	3000	4500					
Average input speed (grease lubrication)	$n_{av\ (max)}$ [rpm]	2000						
Moment of inertia with output flange (F0)	J_{in} [x10^{-6} kgm^2]	1300	480	330	290	160	60	60
Moment of inertia with output shaft (Jx)	J_{in} [x10^{-6} kgm^2]	1700	610	360	310	170	63	59
Weight with output flange (F0)	m [kg]	10		12				
Weight with output shaft (Jx)	m [kg]	13		15				
Transmission accuracy	[arcmin]	< 3						
Repeatability	[arcmin]	< ±0.25						
Backlash	[arcmin]	≤ 3 oder ≤ 1						
Torsional stiffness	K_3 [x10^3 Nm/rad]	230						
Ambient operating temperature	[°C]	0 ... 40						
Output bearing								
Dynamic radial load	$F_{R\ dyn\ (max)}$ [kN]	5.57	6.49	8.22	9.03	9.98	11.4	12.5
Dynamic axial load	$F_{A\ dyn\ (max)}$ [kN]	5.57	6.49	8.22	9.03	9.98	11.4	12.5
Dynamic tilting moment	$M_{dyn\ (max)}$ [Nm]	1076						

Table 32.2

	Unit	HPG-50A-U1						
Ratio	i [ ]	3	5	11	15	21	33	45
Repeated peak torque	T_R [Nm]	657	850	850	850	850	850	850
Average torque	T_A [Nm]	195	340	400	450	500	500	500
Rated torque	T_N [Nm]	97	170	200	230	260	270	270
Momentary peak torque	T_M [Nm]	1200	1200	1850	1850	1850	1850	1850
Maximum input speed (grease lubrication)	$n_{in\ (max)}$ [rpm]	3000	4500					
Average input speed (grease lubrication)	$n_{av\ (max)}$ [rpm]	2000						
Moment of inertia with output flange (F0)	J_{in} [x10^{-6} kgm^2]	1800	920	710	670	540	430	430
Moment of inertia with output shaft (Jx)	J_{in} [x10^{-6} kgm^2]	2100	1100	740	680	550	440	430
Weight with output flange (F0)	m [kg]	14		16				
Weight with output shaft (Jx)	m [kg]	17		19				
Transmission accuracy	[arcmin]	< 3						
Repeatability	[arcmin]	< ±0.25						
Backlash	[arcmin]	≤ 3 oder ≤ 1						
Torsional stiffness	K_3 [x10^3 Nm/rad]	230						
Ambient operating temperature	[°C]	0 ... 40						
Output bearing								
Dynamic radial load	$F_{R\ dyn\ (max)}$ [kN]	5.57	6.49	8.22	9.03	9.98	11.4	12.5
Dynamic axial load	$F_{A\ dyn\ (max)}$ [kN]	5.57	6.49	8.22	9.03	9.98	11.4	12.5
Dynamic tilting moment	$M_{dyn\ (max)}$ [Nm]	1076						

Illustration 33.1

HPG-50A [mm]



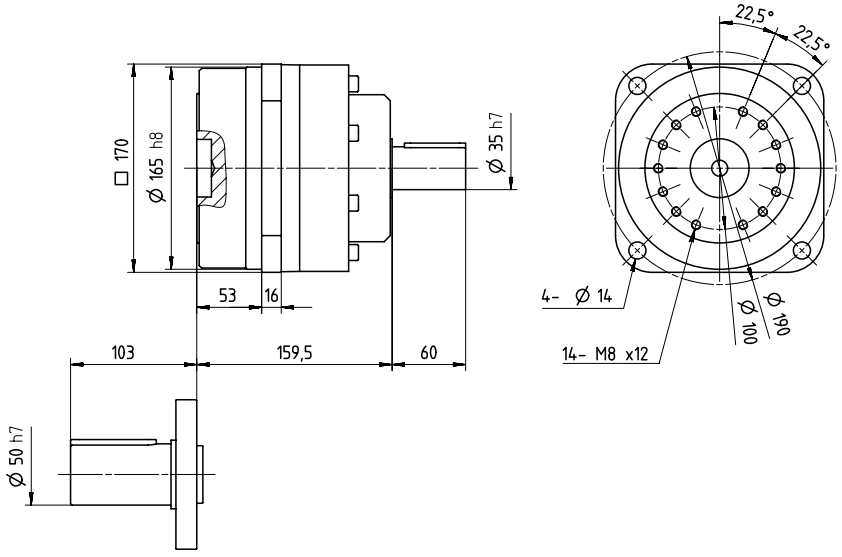
L depends on the motor type

Table 33.2 [mm]

Length	single stage		double stage	
	min	max	min	max
L	180	200	180	200

Illustration 33.3

HPG-50A-U1 [mm]



Technical data

Table 34.1

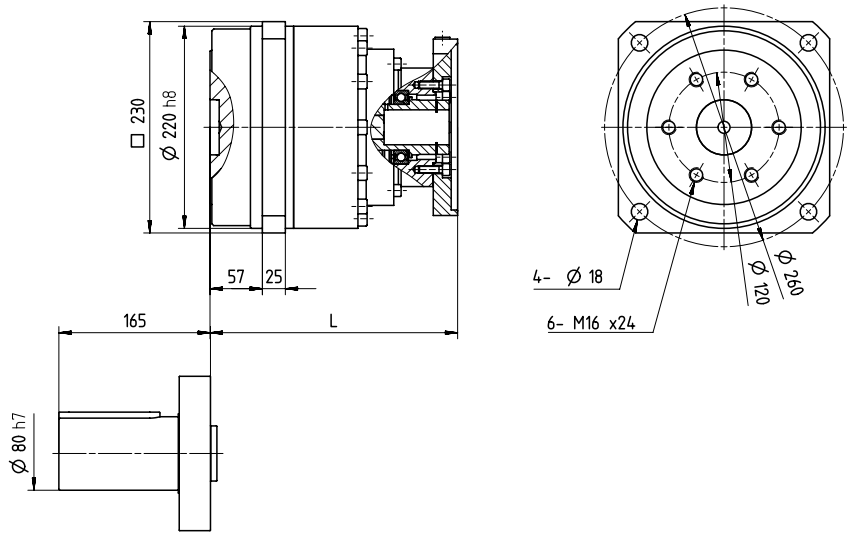
	Unit	HPG-65A							
Ratio	i [ ]	4	5	12	15	20	25	40	50
Repeated peak torque	T_R [Nm]	2200	2200	2200	2200	2200	2200	1900	2200
Average torque	T_A [Nm]	900	1000	1100	1300	1500	1500	1300	1500
Rated torque	T_N [Nm]	500	530	600	730	800	850	640	750
Momentary peak torque	T_M [Nm]	4500							
Maximum input speed (grease lubrication)	$n_{in\ (max)}$ [rpm]	2500	3000						
Average input speed (grease lubrication)	$n_{av\ (max)}$ [rpm]	2000							
Moment of inertia with output flange (F0)	J_{in} [x10^{-6} kgm^2]	2800	1800	1700	1600	650	610	130	120
Moment of inertia with output shaft (Jx)	J_{in} [x10^{-6} kgm^2]	4200	2700	1800	1700	710	650	150	130
Weight with output flange (F0)	m [kg]	22		37					
Weight with output shaft (Jx)	m [kg]	32		47					
Transmission accuracy	[arcmin]	< 3							
Repeatability	[arcmin]	< ±0.25							
Backlash	[arcmin]	≤ 3 or ≤ 1							
Torsional stiffness	K_3 [x10^3 Nm/rad]	1290							
Ambient operating temperature	[°C]	0 ... 40							
Output bearing									
Dynamic radial load	$F_{R\ dyn\ (max)}$ [kN]	13.2	14.1	18.3	19.6	21.4	22.9	26.3	28.2
Dynamic axial load	$F_{A\ dyn\ (max)}$ [kN]	13.2	14.1	12.3	13.1	14.3	15.3	17.6	18.9
Dynamic tilting moment	$M_{dyn\ (max)}$ [Nm]	3900							

Table 34.2

	Unit	HPG-65A-U1							
Ratio	i [ ]	4	5	12	15	20	25	40	50
Repeated peak torque	T_R [Nm]	2200	2200	2200	2200	2200	2200	1900	2200
Average torque	T_A [Nm]	900	1000	1100	1300	1500	1500	1300	1500
Rated torque	T_N [Nm]	500	530	600	730	800	850	640	750
Momentary peak torque	T_M [Nm]	4500							
Maximum input speed (grease lubrication)	$n_{in\ (max)}$ [rpm]	2500	3000						
Average input speed (grease lubrication)	$n_{av\ (max)}$ [rpm]	2000							
Moment of inertia with output flange (F0)	J_{in} [x10^{-6} kgm^2]	4400	3400	3200	3100	2100	2100	1600	1600
Moment of inertia with output shaft (Jx)	J_{in} [x10^{-6} kgm^2]	5800	4300	3300	3200	2200	2100	1600	1600
Weight with output flange (F0)	m [kg]	33		48					
Weight with output shaft (Jx)	m [kg]	43		58					
Transmission accuracy	[arcmin]	< 3							
Repeatability	[arcmin]	< ±0.25							
Backlash	[arcmin]	≤ 3 or ≤ 1							
Torsional stiffness	K_3 [x10^3 Nm/rad]	1290							
Ambient operating temperature	[°C]	0 ... 40							
Output bearing									
Dynamic radial load	$F_{R\ dyn\ (max)}$ [kN]	13.2	14.1	18.3	19.6	21.4	22.9	26.3	28.2
Dynamic axial load	$F_{A\ dyn\ (max)}$ [kN]	13.2	14.1	12.3	13.1	14.3	15.3	17.6	18.9
Dynamic tilting moment	$M_{dyn\ (max)}$ [Nm]	3900							

Illustration 35.1

HPG-65A [mm]



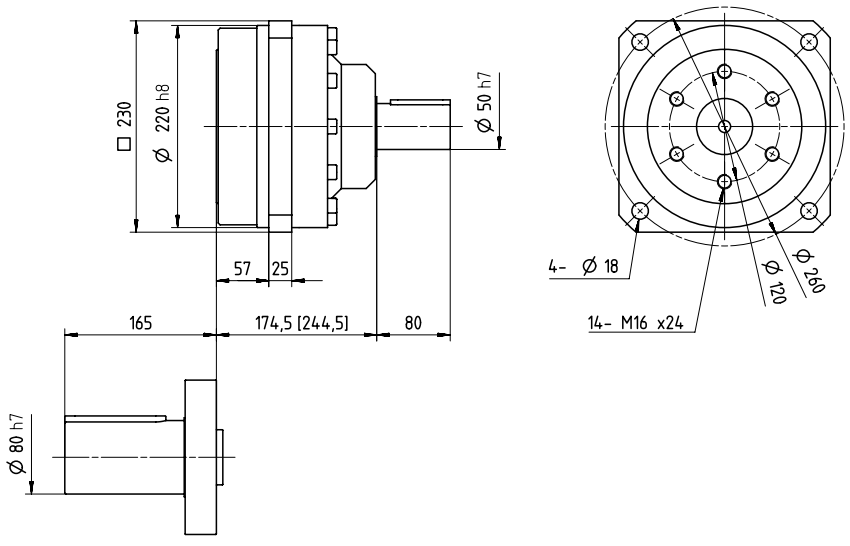
L depends on the motor type

Table 35.2 [mm]

Length	single stage		double stage	
	min	max	min	max
L	200	220	270	290

Illustration 35.3

HPG-65A-U1 [mm]



[ ] Double stage gear

Enhanced performance with Permanent Precision®

HPGP Series Planetary Gears operate at higher speeds with lower ratios and there is often a need for the highest precision. Our special design with a flexible ring gear in the output stage means that we guarantee constant high precision over the entire lifetime – we call this Permanent Precision®!

The HPGP Series Planetary Gears are available in six sizes with eleven gear ratios between 4 and 45:1 offering repeatable peak torques from 10 to 2920 Nm. The precision output bearing with high tilting rigidity enables the direct introduction of high payloads without further support and thus permits simple and space saving designs.

HPGP enhanced series of Planetary Gears are available in three versions: with output flange, with smooth output shaft and output shaft with keyway.

Standard servo motors can be simply coupled to our Planetary Gears.
Gearbox and motor together form a compact and lightweight system capable of withstanding high payloads ensuring stable machine properties with short cycle times are guaranteed.

Optimised for your applications:

- Permanent Precision®
- High torque density
- High dynamics
- Direct motor connection
- Integrated high capacity output bearing

Features

HPGP

Ordering code

Table 38.1

Series	Size	Ratio							Version	Code for motor adaptation	Backlash class	Special design
HPGP	11A		5			21	37	45	FO, J20, J60	Depending on motor type	BL3	According to customer requirements
	14A		5	11	15	21	33	45	FO J2 J6		BL1 BL3	
	20A		5	11	15	21	33	45				
	32A		5	11	15	21	33	45				
	50A		5	11	15	21	33	45				
	65A	4	5	12	15	20	25					

Ordering code

HPGP	-	14A	-	11	-	FO	-	E14.20	-	BL1	-	SP

Table 38.2

Backlash class	
Ordering code	**Backlash**
BL1	≤ 1 arcmin
BL3	≤ 3 arcmin

Table 38.3

Code for motor adaptation	
Ordering code	**Description**
Exx.xx	Depending on motor type

Table 38.4

Version	
Ordering code	**Description**
FO	Output flange
J2/J20	Output shaft without key
J6/J60	Output shaft with key

Technical data

Table 40.1

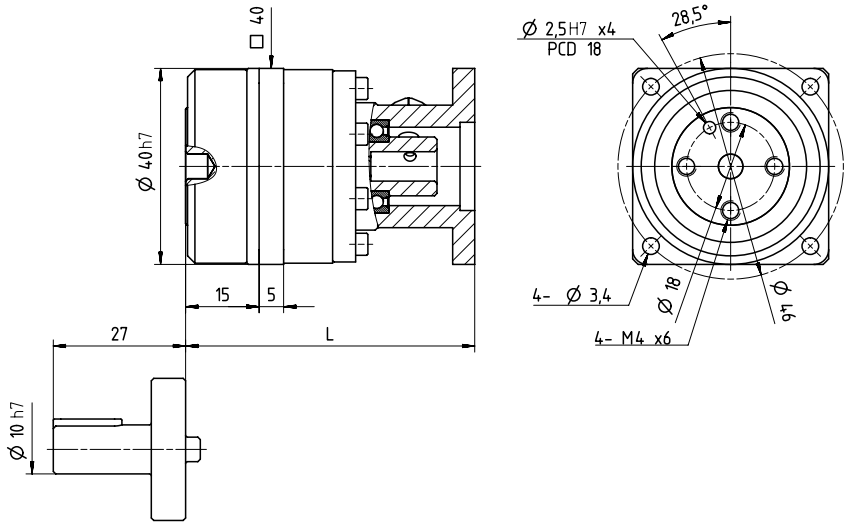
	Unit	HPGP-11			
Ratio	i [ ]	5	21	37	45
Repeated peak torque	T_R [Nm]	10	13	13	13
Average torque	T_A [Nm]	6.7	8.0	8.0	8.0
Rated torque	T_N [Nm]	3.4	4.6	4.6	4.6
Momentary peak torque	T_M [Nm]	20	20	20	20
Maximum input speed (grease lubrication)	$n_{in\ (max)}$ [rpm]	10000			
Average input speed (grease lubrication)	$n_{av\ (max)}$ [rpm]	3000			
Moment of inertia with output flange (F0)	J_{in} [x10^{-6} kgm^2]	0.24	0.18	0.07	0.05
Moment of inertia with output shaft (Jx)	J_{in} [x10^{-6} kgm^2]	0.40	0.19	0.07	0.05
Weight with output flange (F0)	m [kg]	0.14	0.20		
Weight with output shaft (Jx)	m [kg]	0.18	0.24		
Transmission accuracy	[arcmin]	< 5			
Repeatability	[arcmin]	< ±0.5			
Backlash	[arcmin]	≤ 3			
Torsional stiffness	K_3 [x10^3 Nm/rad]	2.2			
Ambient operating temperature	[°C]	0 ... 40			
Output bearing					
Dynamic radial load	$F_{R\ dyn\ (max)}$ [N]	280	440	520	550
Dynamic axial load	$F_{A\ dyn\ (max)}$ [N]	430	660	780	830
Dynamic tilting moment	$M_{dyn\ (max)}$ [Nm]	9.5			

Table 40.2

	Unit	HPGP-14					
Ratio	i [ ]	5	11	15	21	33	45
Repeated peak torque	T_R [Nm]	30	30	30	30	30	30
Average torque	T_A [Nm]	17	20	20	20	20	20
Rated torque	T_N [Nm]	7.8	10	12	12	13	13
Momentary peak torque	T_M [Nm]	56	56	56	56	56	56
Maximum input speed (grease lubrication)	$n_{in\ (max)}$ [rpm]	6000					
Average input speed (grease lubrication)	$n_{av\ (max)}$ [rpm]	3000					
Moment of inertia with output flange (F0)	J_{in} [x10^{-6} kgm^2]	1.7	1.8	1.6	0.90	0.29	0.27
Moment of inertia with output shaft (Jx)	J_{in} [x10^{-6} kgm^2]	2.3	1.9	1.7	0.93	0.30	0.28
Weight with output flange (F0)	m [kg]	0.42	0.51				
Weight with output shaft (Jx)	m [kg]	0.54	0.63				
Transmission accuracy	[arcmin]	< 4					
Repeatability	[arcmin]	< ±0.35					
Backlash	[arcmin]	≤ 3 or ≤ 1					
Torsional stiffness	K_3 [x10^3 Nm/rad]	4.7					
Ambient operating temperature	[°C]	0 ... 40					
Output bearing							
Dynamic radial load	$F_{R\ dyn\ (max)}$ [N]	470	600	650	720	830	910
Dynamic axial load	$F_{A\ dyn\ (max)}$ [N]	700	890	980	1080	1240	1360
Dynamic tilting moment	$M_{dyn\ (max)}$ [Nm]	32.3					

Illustration 41.1

HPGP-11 [mm]



L depends on the motor type

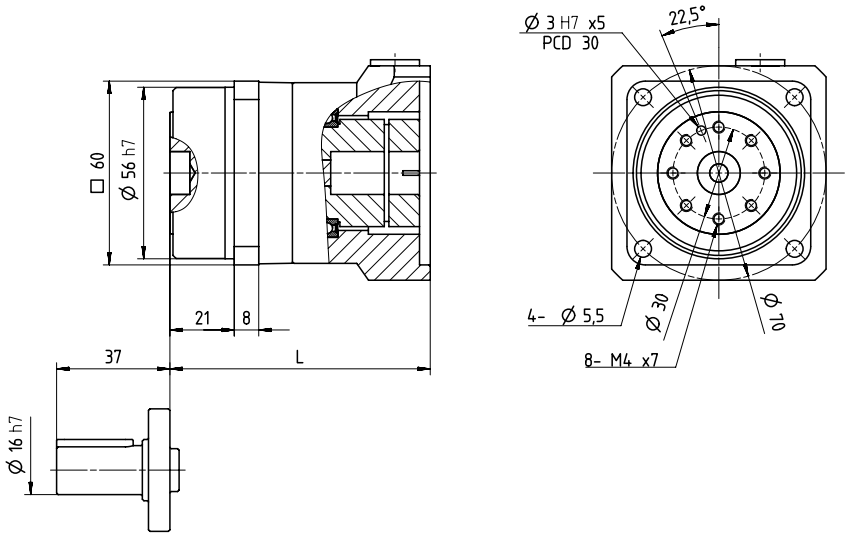
Table 41.2

[mm]

Length	single stage		double stage	
	min	max	min	max
L	55	65	60	70

Illustration 41.3

HPGP-14 [mm]



L depends on the motor type

Table 41.4

[mm]

Length	single stage		double stage	
	min	max	min	max
L	80	95	85	95

Technical data

Table 42.1

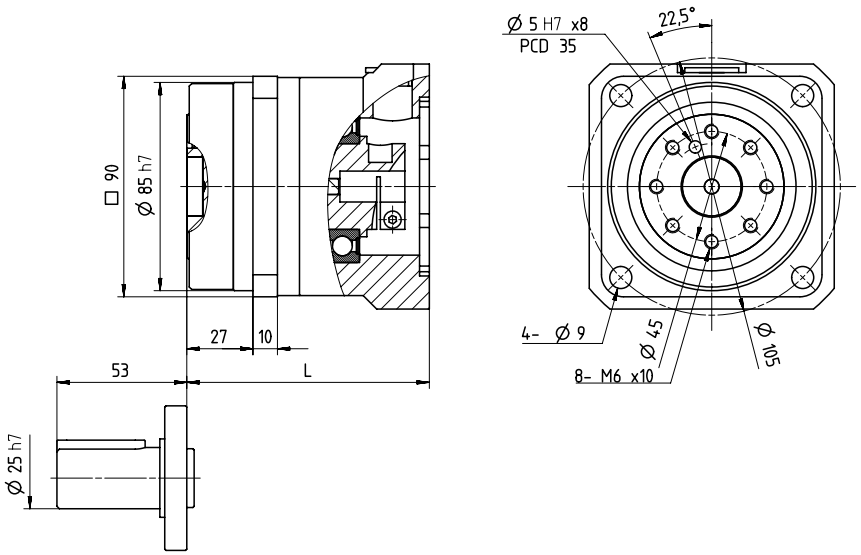
	Unit	HPGP-20					
Ratio	i [ ]	5	11	15	21	33	45
Repeated peak torque	T_R [Nm]	133	133	133	133	133	133
Average torque	T_A [Nm]	47	60	70	73	80	80
Rated torque	T_N [Nm]	21	26	32	33	39	39
Momentary peak torque	T_M [Nm]	217	217	217	217	217	217
Maximum input speed (grease lubrication)	$n_{in\ (max)}$ [rpm]	6000					
Average input speed (grease lubrication)	$n_{av\ (max)}$ [rpm]	3000					
Moment of inertia with output flange (F0)	J_{in} [x10^{-6} kgm^2]	16	17	15	7.1	2.9	2.2
Moment of inertia with output shaft (Jx)	J_{in} [x10^{-6} kgm^2]	20	17	16	7.3	3.0	2.3
Weight with output flange (F0)	m [kg]	1.2	1.5	1.5	1.5	1.6	1.5
Weight with output shaft (Jx)	m [kg]	1.6	1.9	1.9	1.9	2.0	1.9
Transmission accuracy	[arcmin]	< 4					
Repeatability	[arcmin]	< ±0.25					
Backlash	[arcmin]	≤ 3 or ≤ 1					
Torsional stiffness	K_3 [x10^3 Nm/rad]	18					
Ambient operating temperature	[°C]	0 ... 40					
Output bearing							
Dynamic radial load	$F_{R\ dyn\ (max)}$ [N]	980	1240	1360	1510	1729	1890
Dynamic axial load	$F_{A\ dyn\ (max)}$ [N]	1460	1850	2030	2250	2580	2830
Dynamic tilting moment	$M_{dyn\ (max)}$ [Nm]	183					

Table 42.2

	Unit	HPGP-32					
Ratio	i [ ]	5	11	15	21	33	45
Repeated peak torque	T_R [Nm]	400	400	400	400	400	400
Average torque	T_A [Nm]	200	226	226	226	266	266
Rated torque	T_N [Nm]	87	104	122	130	143	143
Momentary peak torque	T_M [Nm]	650	650	650	650	650	650
Maximum input speed (grease lubrication)	$n_{in\ (max)}$ [rpm]	6000					
Average input speed (grease lubrication)	$n_{av\ (max)}$ [rpm]	3000					
Moment of inertia with output flange (F0)	J_{in} [x10^{-6} kgm^2]	80	100	74	35	17	12
Moment of inertia with output shaft (Jx)	J_{in} [x10^{-6} kgm^2]	110	110	77	37	17	12
Weight with output flange (F0)	m [kg]	3.0	3.7	3.7	3.7	4.0	3.7
Weight with output shaft (Jx)	m [kg]	4.4	5.1	5.1	5.1	5.4	5.1
Transmission accuracy	[arcmin]	< 4					
Repeatability	[arcmin]	< ±0.25					
Backlash	[arcmin]	≤ 3 or ≤ 1					
Torsional stiffness	K_3 [x10^3 Nm/rad]	74					
Ambient operating temperature	[°C]	0 ... 40					
Output bearing							
Dynamic radial load	$F_{R\ dyn\ (max)}$ [N]	1900	2410	2640	2920	3340	3670
Dynamic axial load	$F_{A\ dyn\ (max)}$ [N]	2830	3590	3940	4360	4990	5480
Dynamic tilting moment	$M_{dyn\ (max)}$ [Nm]	452					

Illustration 43.1

HPGP-20 [mm]



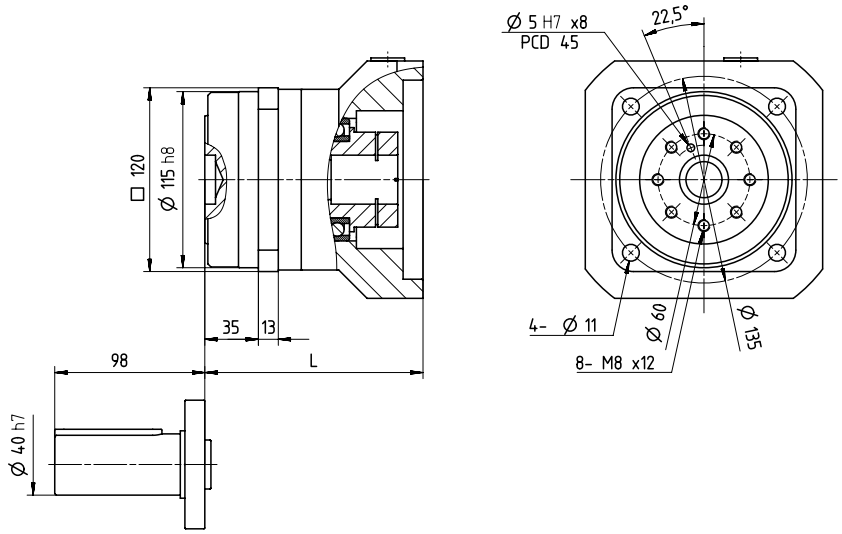
L depends on the motor type

Table 43.2 [mm]

Length	single stage		double stage	
	min	max	min	max
L	90	105	95	105

Illustration 43.3

HPGP-32 [mm]



L depends on the motor type

Table 43.4 [mm]

Length	single stage		double stage	
	min	max	min	max
L	135	145	135	150

Technical data

Table 44.1

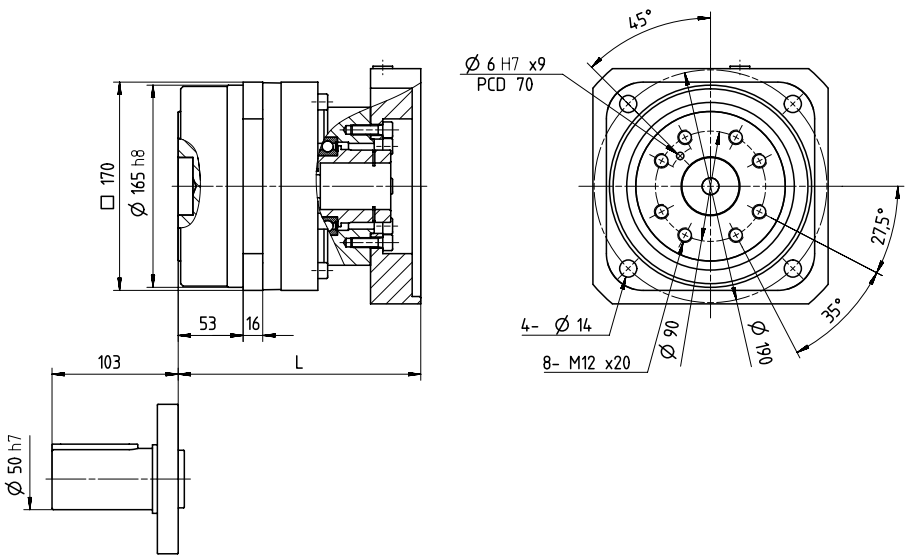
	Unit	HPGP-50					
Ratio	i [ ]	5	11	15	21	33	45
Repeated peak torque	T_R [Nm]	1130	1130	1130	1130	1130	1130
Average torque	T_A [Nm]	452	532	600	665	665	665
Rated torque	T_N [Nm]	226	266	306	346	359	359
Momentary peak torque	T_M [Nm]	1850	1850	1850	1850	1850	1850
Maximum input speed (grease lubrication)	$n_{in\ (max)}$ [rpm]	4500					
Average input speed (grease lubrication)	$n_{av\ (max)}$ [rpm]	2000					
Moment of inertia with output flange (F0)	J_{in} [x10^{-6} kgm^2]	490	400	350	160	72	50
Moment of inertia with output shaft (Jx)	J_{in} [x10^{-6} kgm^2]	620	420	370	170	75	52
Weight with output flange (F0)	m [kg]	10	12				
Weight with output shaft (Jx)	m [kg]	13	15				
Transmission accuracy	[arcmin]	< 3					
Repeatability	[arcmin]	< ±0.25					
Backlash	[arcmin]	≤ 3 or ≤ 1					
Torsional stiffness	K_3 [x10^3 Nm/rad]	470					
Ambient operating temperature	[°C]	0 ... 40					
Output bearing							
Dynamic radial load	$F_{R\ dyn\ (max)}$ [N]	4350	5500	6050	6690	7660	8400
Dynamic axial load	$F_{A\ dyn\ (max)}$ [N]	6490	8220	9030	9980	11400	12500
Dynamic tilting moment	$M_{dyn\ (max)}$ [Nm]	1076					

Table 44.2

	Unit	HPGP-65					
Ratio	i [ ]	4	5	12	15	20	25
Repeated peak torque	T_R [Nm]	2920	2920	2920	2920	2920	2920
Average torque	T_A [Nm]	1200	1330	1460	1730	2000	2000
Rated torque	T_N [Nm]	605	705	798	971	1060	1130
Momentary peak torque	T_M [Nm]	4500	4500	4500	4500	4500	4500
Maximum input speed (grease lubrication)	$n_{in\ (max)}$ [rpm]	2500	3000				
Average input speed (grease lubrication)	$n_{av\ (max)}$ [rpm]	2000					
Moment of inertia with output flange (F0)	J_{in} [x10^{-6} kgm^2]	3100	2100	2000	1900	730	680
Moment of inertia with output shaft (Jx)	J_{in} [x10^{-6} kgm^2]	4600	3000	2200	2000	780	720
Weight with output flange (F0)	m [kg]	22		37			
Weight with output shaft (Jx)	m [kg]	32		47			
Transmission accuracy	[arcmin]	< 3					
Repeatability	[arcmin]	< ±0.25					
Backlash	[arcmin]	≤ 3 or ≤ 1					
Torsional stiffness	K_3 [x10^3 Nm/rad]	1300					
Ambient operating temperature	[°C]	0 ... 40					
Output bearing							
Dynamic radial load	$F_{R\ dyn\ (max)}$ [N]	8860	9470	12300	13100	14300	15300
Dynamic axial load	$F_{A\ dyn\ (max)}$ [N]	13200	14100	18300	19600	21400	22900
Dynamic tilting moment	$M_{dyn\ (max)}$ [Nm]	3900					

Illustration 45.1

HPGP-50 [mm]



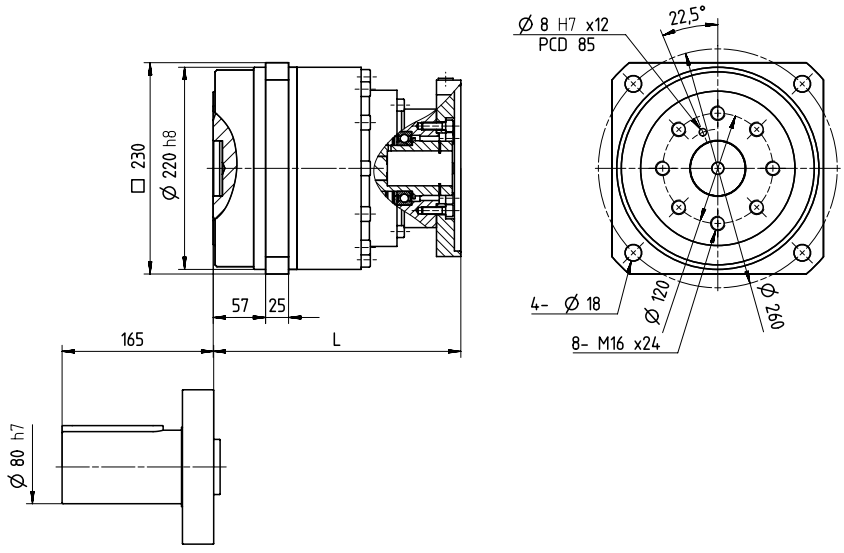
L depends on the motor type

Table 45.2 [mm]

Length	single stage		double stage	
	min	max	min	max
L	180	200	180	200

Illustration 45.3

HPGP-65 [mm]



L depends on the motor type

Table 45.4 [mm]

Length	single stage		double stage	
	min	max	min	max
L	200	220	270	290

Precision gear with newly developed helical gearing

HPG Series Planetary Gears operate at higher speeds with lower ratios and there is often a need for the highest precision. Our special design with a flexible ring gear in the output stage means that we guarantee constant high precision over the entire lifetime – we call this Permanent Precision®!

The HPG-R Series planetary gear units are available in four sizes with eight gear ratios from 3 to 10 offering repeated peak torque from 5 and 400 Nm. The precision output bearing with high tilting rigidity allows direct introduction of high payloads without further support, thus providing a simple, space saving design.

The newly developed helical gearing, in combination with the flexible ring gear, ensures a long service life and low backlash gearbox. Further advantages of the helical gearing include uniform running behaviour and low noise.

HPG-R Series planetary gearboxes are available in three versions for the output: with output flange, with smooth output flange and with output shaft with keyway. The input shaft with integrated clamping elements allows standard servo motors to be simply coupled to the planetary gears creating a compact and lightweight system capable of withstanding high payloads and ensuring stable machine properties with short cycle times.

Optimised for your applications:

- Permanent Precision®
- Low noise
- Numerous gear ratios
- High dynamics
- Direct motor connection
- Integrated high capacity output bearing

Features

HPG-R

Ordering code

Table 48.1

Series	Size	Ratio								Version	Code for motor adaptation	Backlash class	Special design
HPG	11R		4	5	6	7	8	9	10	F0, J20, J60	Depending on motor type	BL3	According to customer requirements
	14R	3	4	5	6	7	8	9	10	F0 J2 J6		BL1 BL3	
	20R	3	4	5	6	7	8	9	10				
	32R	3	4	5	6	7	8	9	10				

Ordering code

HPG	**-**	**14R**	**-**	**10**		**-**	**F0**	**-**	**E14.20**	**-**	**BL3**	**-**	**SP**

Table 48.2

Backlash class	
Ordering code	**Backlash**
BL1	≤ 1 arcmin
BL3	≤ 3 arcmin

Table 48.3

Code for motor adaptation	
Ordering code	**Description**
Exx.xx	Depending on motor type

Table 48.4

Version	
Ordering code	**Description**
F0	Output flange
J2	Output shaft without key
J6	Output shaft with key

Technical data

Table 50.1

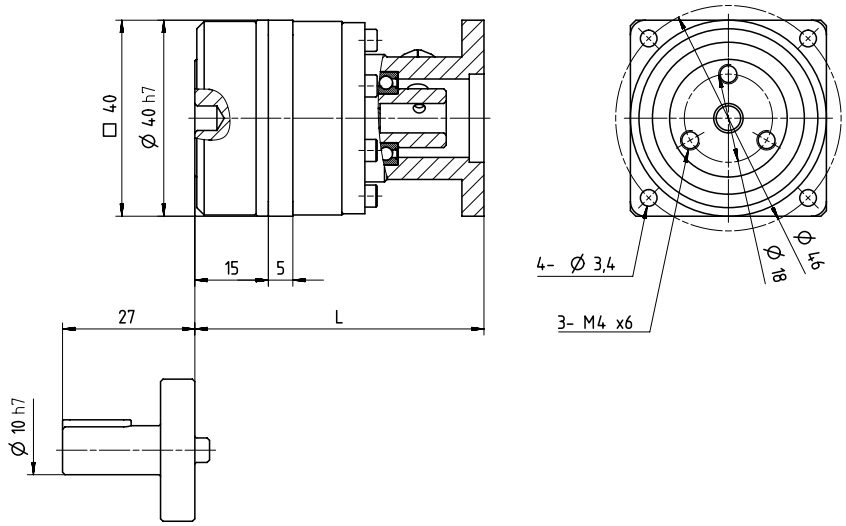
	Unit	HPG-11R						
Number of stages		single stage						
Ratio	i [ ]	4	5	6	7	8	9	10
Repeated peak torque	T_R [Nm]	10	10	10	9	7	6	5
Average torque	T_A [Nm]	6.3	6.5	6.5	7	7	6	5
Rated torque	T_N [Nm]	2.8	2.9	2.9	3.1	3.1	3.1	3.4
Momentary peak torque	T_M [Nm]	20						
Maximum input speed (grease lubrication)	$n_{in\ (max)}$ [rpm]	10000						
Average input speed (grease lubrication)	$n_{av\ (max)}$ [rpm]	3000						
Moment of inertia with output flange (F0)	J_{in} [x10^{-6} kgm^2]	0.84	0.53	0.36	0.27	0.2	0.16	0.13
Moment of inertia with output shaft (Jx)	J_{in} [x10^{-6} kgm^2]	1.1	0.69	0.47	0.35	0.26	0.21	0.17
Weight with output flange (F0)	m [kg]	0.19						
Weight with output shaft (Jx)	m [kg]	0.24						
Transmission accuracy	[arcmin]	< 5						
Repeatability	[arcmin]	< ± 0.33						
Backlash	[arcmin]	≤ 3						
Torsional stiffness	K_3 [x10^3 Nm/rad]	2.2						
Ambient operating temperature	[°C]	0 ... 40						
Output bearing								
Dynamic radial load	$F_{R\ dyn\ (max)}$ [N]	260	280	300	315	330	340	350
Dynamic axial load	$F_{A\ dyn\ (max)}$ [N]	400	430	455	475	495	510	525
Dynamic tilting moment	$M_{dyn\ (max)}$ [Nm]	9.5						

Table 50.2

	Unit	HPG-14R							
Number of stages		single stage							
Ratio	i [ ]	3	4	5	6	7	8	9	10
Repeated peak torque	T_R [Nm]	20	30	30	30	26	20	17	15
Average torque	T_A [Nm]	9	16	16	16	18	18	17	15
Rated torque	T_N [Nm]	4	7	7.2	7.3	7.8	7.8	7.9	8.5
Momentary peak torque	T_M [Nm]	37	56						
Maximum input speed (grease lubrication)	$n_{in\ (max)}$ [rpm]	5000	6000						
Average input speed (grease lubrication)	$n_{av\ (max)}$ [rpm]	3000							
Moment of inertia with output flange (F0)	J_{in} [x10^{-6} kgm^2]	7.2	3.7	2.3	2.4	1.8	1.4	1.1	0.87
Moment of inertia with output shaft (Jx)	J_{in} [x10^{-6} kgm^2]	8.9	4.7	3	2.8	2.1	1.6	1.3	1
Weight with output flange (F0)	m [kg]	0.45							
Weight with output shaft (Jx)	m [kg]	0.55							
Transmission accuracy	[arcmin]	< 4							
Repeatability	[arcmin]	< ± 0.25							
Backlash	[arcmin]	≤ 3 or ≤ 1							
Torsional stiffness	K_3 [x10^3 Nm/rad]	4.7							
Ambient operating temperature	[°C]	0 ... 40							
Output bearing									
Dynamic radial load	$F_{R\ dyn\ (max)}$ [N]	405	440	470	500	525	545	565	580
Dynamic axial load	$F_{A\ dyn\ (max)}$ [N]	600	655	700	740	775	810	840	865
Dynamic tilting moment	$M_{dyn\ (max)}$ [Nm]	32.3							

Illustration 51.1

HPG-11R [mm]



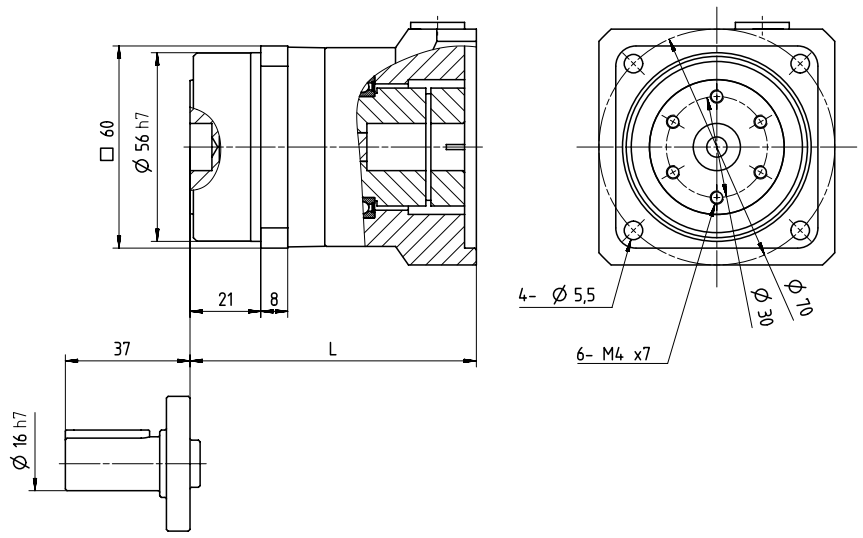
L depends on the motor type

Table 51.2 [mm]

Length	single stage	
	min	max
L	55	65

Illustration 51.3

HPG-14R [mm]



L depends on the motor type

Table 51.4 [mm]

Length	single stage	
	min	max
L	80	95

Technical data

Table 52.1

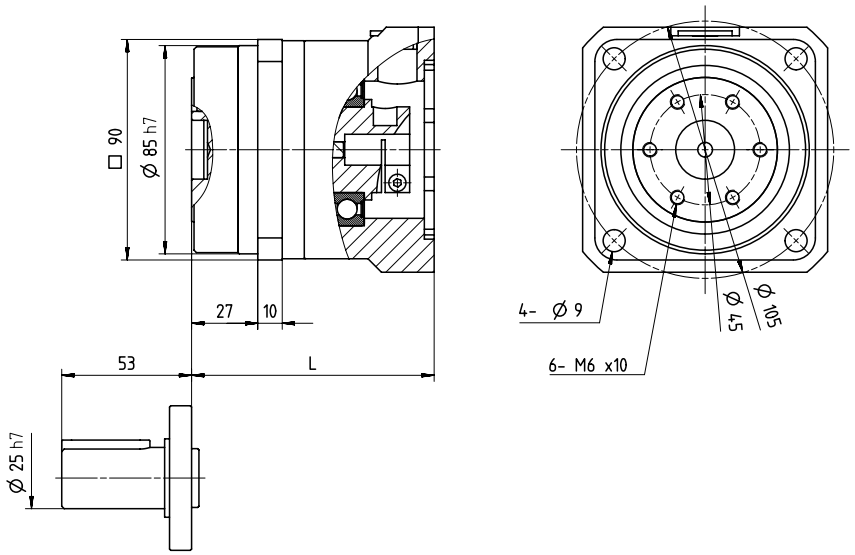
	Unit	HPG-20R							
Number of stages		single stage							
Ratio	i [ ]	3	4	5	6	7	8	9	10
Repeated peak torque	T_R [Nm]	90	133	133	126	108	84	73	65
Average torque	T_A [Nm]	25	51	53	53	56	56	57	61
Rated torque	T_N [Nm]	11	23	23	23	25	25	25	27
Momentary peak torque	T_M [Nm]	124	217						
Maximum input speed (grease lubrication)	$n_{in\ (max)}$ [rpm]	4000	6000						
Average input speed (grease lubrication)	$n_{av\ (max)}$ [rpm]	3000							
Moment of inertia with output flange (F0)	J_{in} [x10^{-6} kgm^2]	53	30	19	13	9.3	7	5.5	4.6
Moment of inertia with output shaft (Jx)	J_{in} [x10^{-6} kgm^2]	64	36	23	15	11	8.5	6.7	5.5
Weight with output flange (F0)	m [kg]	1.3							
Weight with output shaft (Jx)	m [kg]	1.7							
Transmission accuracy	[arcmin]	4							
Repeatability	[arcmin]	< ± 0.16							
Backlash	[arcmin]	≤ 3 oder ≤ 1							
Torsional stiffness	K_3 [x10^3 Nm/rad]	18							
Ambient operating temperature	[°C]	0 ... 40							
Output bearing									
Dynamic radial load	$F_{R\ dyn\ (max)}$ [kN]	0.84	0.92	0.98	1.05	1.1	1.14	1.18	1.2
Dynamic axial load	$F_{A\ dyn\ (max)}$ [kN]	1.25	1.35	1.41	1.52	1.6	1.65	1.73	1.8
Dynamic tilting moment	$M_{dyn\ (max)}$ [Nm]	183							

Table 52.2

	Unit	HPG-32R							
Number of stages		single stage							
Ratio	i [ ]	3	4	5	6	7	8	9	10
Repeated peak torque	T_R [Nm]	290	400	400	390	330	260	220	200
Average torque	T_A [Nm]	110	170	180	180	190	190	190	200
Rated torque	T_N [Nm]	50	77	80	80	85	85	86	92
Momentary peak torque	T_M [Nm]	507	650						
Maximum input speed (grease lubrication)	$n_{in\ (max)}$ [rpm]	3600	6000						
Average input speed (grease lubrication)	$n_{av\ (max)}$ [rpm]	3000							
Moment of inertia with output flange (F0)	J_{in} [x10^{-6} kgm^2]	280	130	79	55	41	33	26	22
Moment of inertia with output shaft (Jx)	J_{in} [x10^{-6} kgm^2]	350	170	110	73	55	43	34	28
Weight with output flange (F0)	m [kg]	3.1							
Weight with output shaft (Jx)	m [kg]	4.5							
Transmission accuracy	[arcmin]	4							
Repeatability	[arcmin]	< ± 0.16							
Backlash	[arcmin]	≤ 3 oder ≤ 1							
Torsional stiffness	K_3 [x10^3 Nm/rad]	74							
Ambient operating temperature	[°C]	0 ... 40							
Output bearing									
Dynamische Radiallast	$F_{R\ dyn\ (max)}$ [kN]	1.63	1.78	1.9	2	2.1	2.2	2.27	2.34
Dynamische Axiallast	$F_{A\ dyn\ (max)}$ [kN]	2.43	2.65	2.83	3	3.13	3.26	3.38	2.48
Dynamisches Kippmoment	$M_{dyn\ (max)}$ [Nm]	452							

Illustration 53.1

HPG-20R [mm]



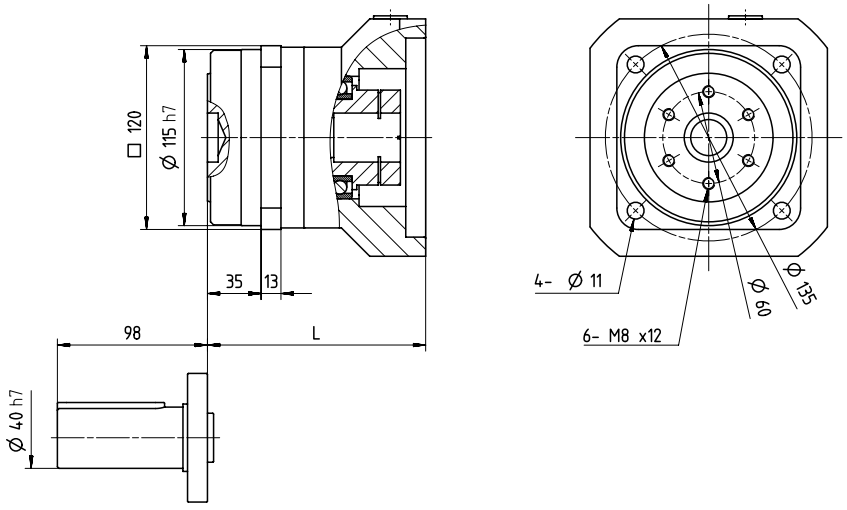
L depends on the motor type

Table 53.2 [mm]

Length	single stage	
	min	max
L	90	105

Illustration 53.3

HPG-32R [mm]



L depends on the motor type

Table 53.4 [mm]

Length	single stage	
	min	max
L	135	145

Hollow shaft gear with Permanent Precision®

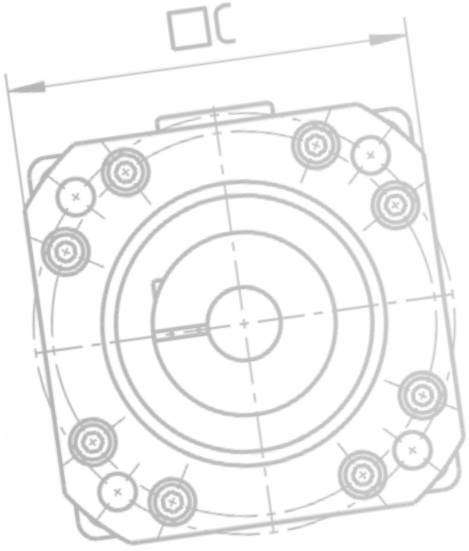
HPG Series Planetary Gears operate at higher speeds with lower ratios and there is often a need for the highest precision. Our special design with a flexible ring gear in the output stage means that we guarantee constant high precision over the entire lifetime – we call this Permanent Precision®!

HPF Planetary Gears are available in two sizes with ratio 11:1 offering a repeated peak torque between 100 and 220 Nm. Due to the low backlash of < 3 minutes of arc and the hollow shaft, this series is ideally suited for applications where supply lines or lead screws can be passed through the gear.

At the core of the HPF Series is a high precision gear with a flexible ring gear for clearance compensation. This allows a lifelong, continuous precision.

In order to be able to absorb high speeds on the output bearing, the HPF series has a large cross roller bearing. Additionally the large hollow shaft enables cable, shaft, ball screws or laser beams to be guided directly through the axis of rotation.

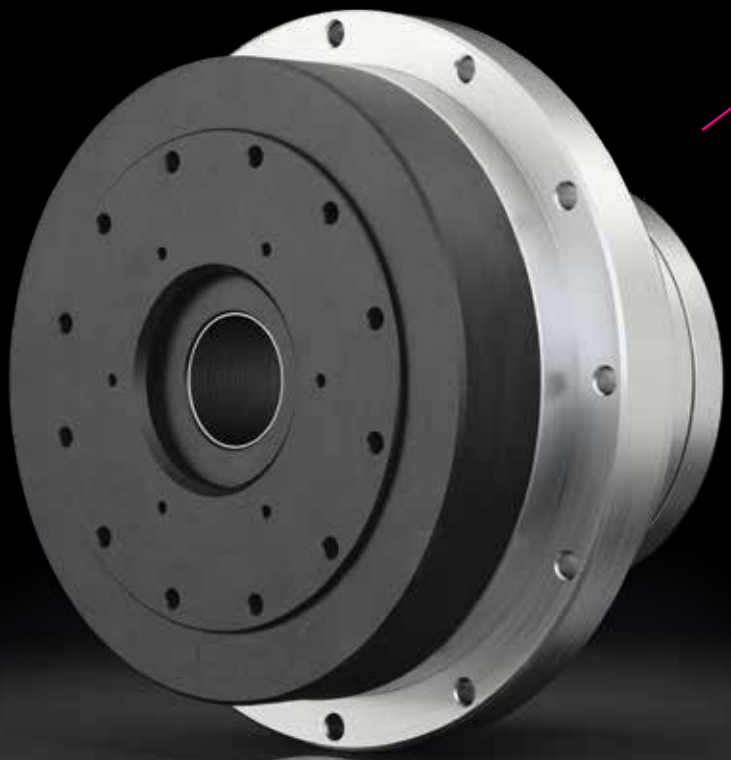
The integral input shaft allows easy attachment of timing pulleys to the gear.
The HPF Series provides a low gear ratio, hollow shaft gearbox for highly dynamic applications.



Optimised for your applications:

- Permanent Precision®
- Large hollow shaft
- High dynamics
- Integrated high capacity input und output bearing

Features



HPF

Ordering code

Table 56.1

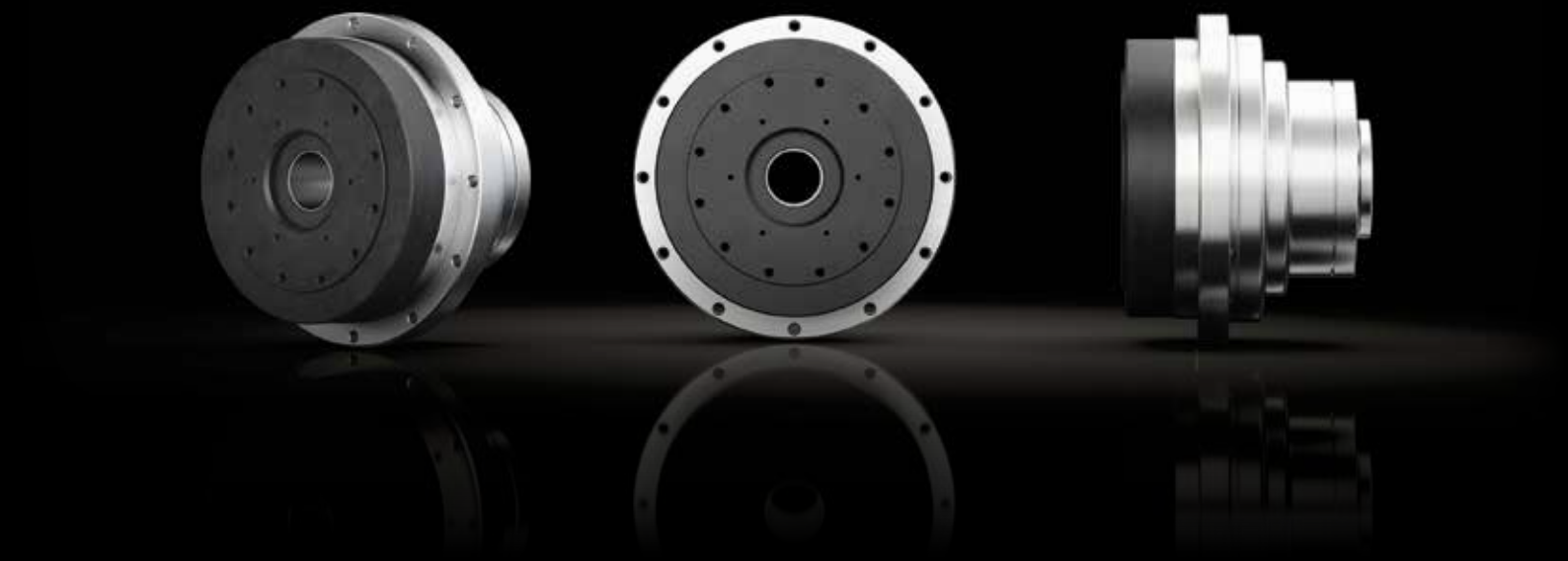
Series	Size	Ratio	Version	Code for motor adaption	Special design
HPF	25A 32A	11	F0	U1	According to customer requirements
Ordering code					
HPF - 25A - 11 - F0 - U1 - SP					

Table 56.2

Version	
Ordering code	**Description**
F0	Output flange

Table 56.3

Code for motor adaption	
Ordering code	**Description**
U1	Input shaft



HPF

Technical data

Table 58.1

	Unit	HPF-25A
Ratio	i [ ]	11
Hollow shaft diameter	d_H [mm]	25
Repeated peak torque	T_R [Nm]	100
Rated torque (2000 rpm)	T_N [Nm]	48
Rated torque (3000 rpm)	T_N [Nm]	21
Momentary peak torque	T_M [Nm]	170
Maximum input speed	$n_{in\ (max)}$ [rpm]	5600
Average input speed	$n_{av\ (max)}$ [rpm]	3000
Weight	m [kg]	3.8
Backlash	[arcmin]	< 3
Torsional stiffness	K_3 [x10^3 Nm/rad]	57
Ambient operating temperature	[°C]	0 ... 40

Table 58.2

	Unit	HPF-32A
Ratio	i [ ]	11
Hollow shaft diameter	d_H [mm]	30
Repeated peak torque	T_R [Nm]	220
Rated torque (2000 rpm)	T_N [Nm]	100
Rated torque (3000 rpm)	T_N [Nm]	44
Momentary peak torque	T_M [Nm]	450
Maximum input speed	$n_{in\ (max)}$ [rpm]	4800
Average input speed	$n_{av\ (max)}$ [rpm]	3000
Weight	m [kg]	7.2
Backlash	[arcmin]	< 3
Torsional stiffness	K_3 [x10^3 Nm/rad]	117
Ambient operating temperature	[°C]	0 ... 40

Illustration 59.1

HPF-25A [mm]

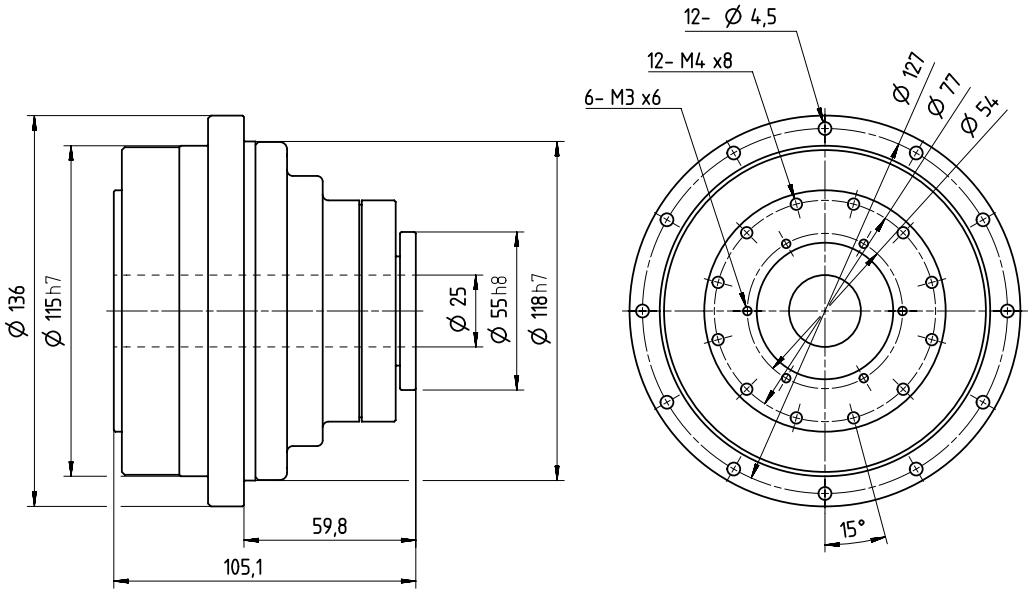
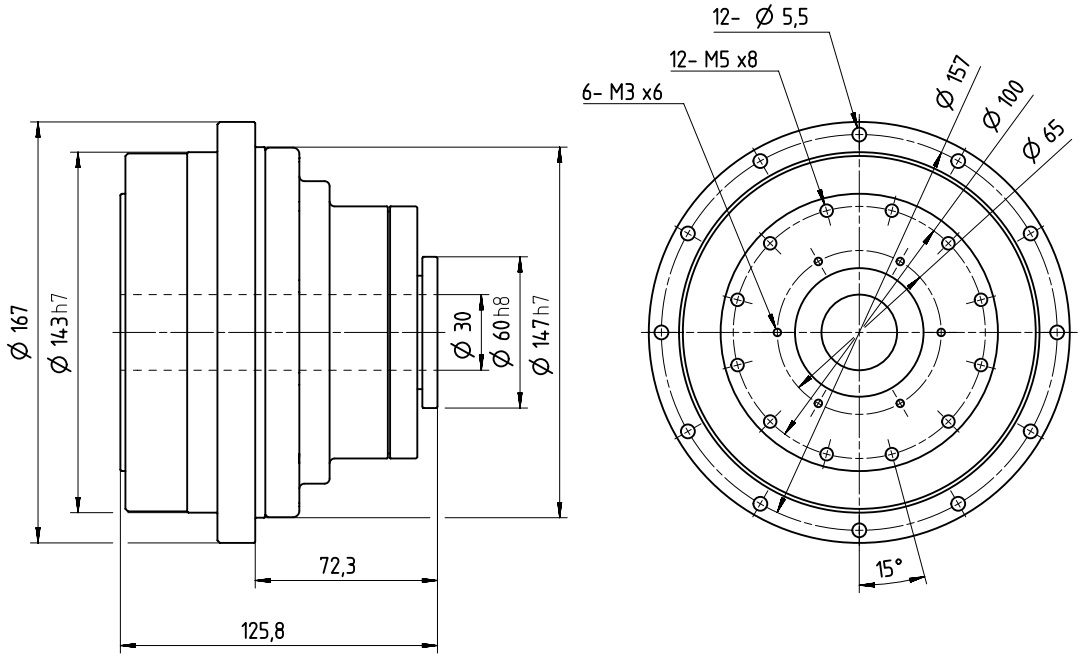


Illustration 59.2

HPF-32A [mm]



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