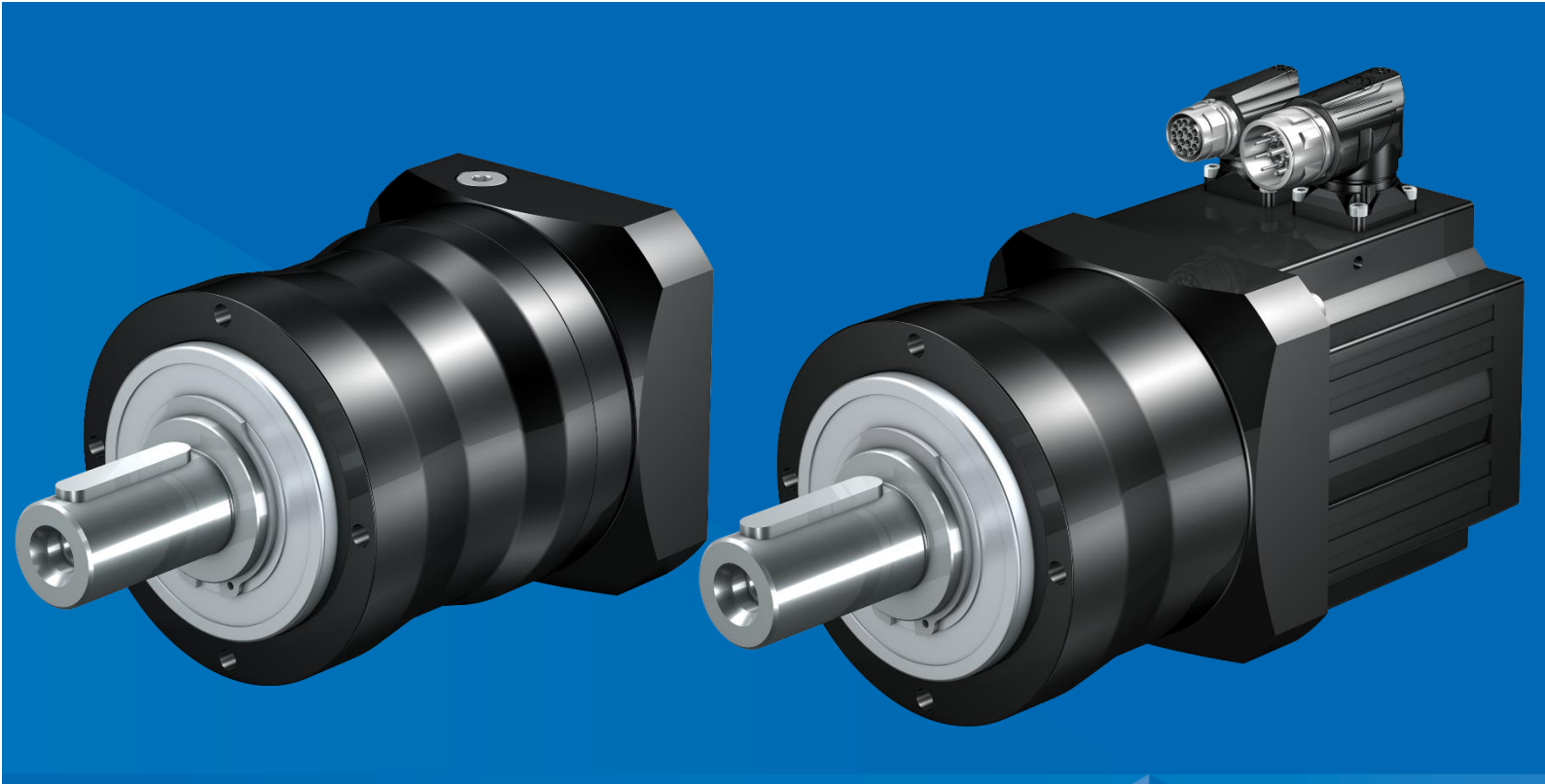


Product Release Brief

PE-Gear units
Generation 2

SPG, April 2021

Version 1.0

STÖBER

Content

1. Intention

This information is for internal use only.

It is an introduction to the new generation PE gear units. In it you will find all the information and tools, for the changeover as well as for sales support.

This Product Release Brief and all documents referred to in this document are available at the following link:

https://stoebergermany-my.sharepoint.com/:f:/g/personal/ulla_goeransson_stoeber_de/EmVQn1U1dTFMgMsrYIxLjOgBB_rzZ9F29Z80Y0RcgV8upg

Changes and errors excepted.

1.1 Intention New Generation

The development of the P/PH G3 planetary gearboxes has changed the interface between the gearbox and the motor adapter or between the gearbox and the motor.

In order to avoid having to produce two ME variants in the future, it is imperative to revise the PE gearbox and adapt it to this interface.

For this reason, the following priorities for the revision were set by the sales department:

1. cost reduction

2. multiple use of parts

The first priority is to reduce costs in order to generate a better contribution margin for this product series in the future and to remain competitive in terms of price.

2. Competitive situation

There are many competitors in a highly competitive but growing market.

The market leaders offer a wide range of series:

- Wittenstein: Value Line with NP / NPL / NPS / NPR / NPT
- Neugart: PLE / PLPE / PLQE / PLHE / PLFE
- APEX: PEll / PGll / PAll / PSll / PNll / PD / PL

If we want to react to this, this has consequences for our variants.

At least 4 different housings would then be required per size. Furthermore, at least 5 planet carriers would be required per gear ratio. In addition, this variance would have to be illustrated and maintained in the documentation.

Since such a large revision obviously leads to a very high parts variance, it was decided in consultation with the management to tackle only the small necessary revision.

3. Product Launch

3.1 Schedule

- Sales release 01.04.2021
- Presentation to OD and AD
  Presentation G1 - G2
  End of March / beginning of April
- Launch SDI planned for Q4 in 2021

By the date of the sales release all tools are ready. SAP, Configurator, CAD download, etc.

From this point on, quotations may be created and orders entered.

The delivery times for Generation 2 are identical to those for Generation 1.

3.2 Conversion Process - SAP

Documentation and tools for the changeover

- Catalogues (for more information see chapter 10.1 Catalogues)
- Operating and assembly instructions
- Customer information on the conversion of Economy planetary gearboxes PE from G1 to G2
- STOBER Configurator (for more information, see chapter 10.2 Internet/Intranet)
- The homepage (for more information, see chapter 10.2 Internet/Intranet)
- SAP Configurator
- CAD Download
- Comparison Presentation PE G1 vs. G2
- Comparison diagrams of the most important criteria
- Price lists (PDF) will follow in the next few weeks
- SERVOSoft (more information in chapter 11.1 SERVOSoft)
- GETBER (more information in chapter 11.2 GETBER)
- Easy Drive

Conversion process

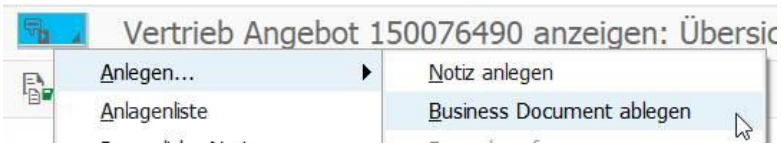
- All special components of the G1 will be blocked for new disposition as of 01.04.2021.
- All standard gear units can be selected in SAP as of 01.04.2021.
- Standard gear units:
  All orders and inquiries from C – N customers will be proactively changed to G2 by the OD, without consulting the sales consult, as of 01.04.2021. A + B customers will be addressed by the sales consult and converted as soon as possible. For foreign customers where the customer classification is not known, the changeover will be coordinated with the subsidiary or the dealer.

- Special Gearboxes:
  These are not yet enabled for selection in SAP, so inevitably when the changeover is attempted, the OD will recognize that it is a special gearbox.
  In this case the order is started as G1 in SAP.
  Since the special components are locked for reordering, the dispatcher contacts the OD if necessary. The OD starts a VC-Support ticket for the changeover from G1 to G2.
  VC-Support creates the variant as G2 in SAP for selection, locks the old MV and informs the OD and the responsible dispatcher. The order can be started as G2 and the dispatcher can schedule the G2 parts according to the history of the G1 parts.

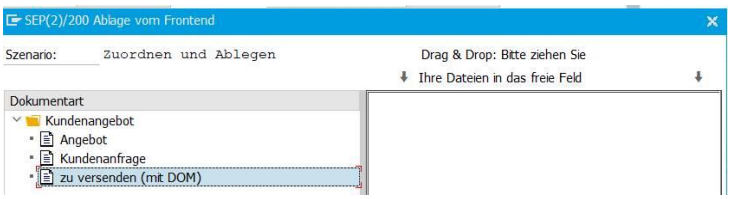
  Conversions of customers with MVL (Trumpf) or special gearboxes that run in larger quantities can basically be handled in the same way. However, it makes sense to coordinate the procedure between field service, OD, K&E, dispatchers and, if necessary, SPG.
  Sample gear units for evaluation tests can be started in coordination with production from 01.04.2021.

- For the changeover, a quotation with the same discount or net price as the G1 gearbox requested/ordered will be prepared by the OD. This offer will be sent to the customer together with the following documents:
  - Customer information for conversion of PE planetary gear units from Generation 1 to Generation 2.
  - Attach STEP file to quotation
  - Comparison diagrams G1 vs. G2 for the offered series and size only if required on request.
  - (For special gearboxes only if there is no restriction due to the special design. Consult SPG if necessary).

  PDF documents can be sent from SAP offers as follows:

  Click to 

  Select document type "to send (with DOM)" and drag and drop the document into the free field



  Output offer via output type ZAN3 instead of ZAN0.

4. Marketing

Marketing – Rollout-Plan

- Press releases from 01.04.2021 to press distribution list
- Update Marketing presentation
- Homepage - banner advertising with press information
- Application in the Xing and LinkedIn platforms
- Internal publication via intranet

5. Product Phase Out G1

- The Generation 1 PE will be discontinued on 01.08.2022.
- The prices for G1 will be increased by 10% as of 01.08.2022.
- A corresponding sales information with a customer information will be prepared and distributed in Q1 2022.
- After the discontinuation, the gearboxes (catalogue standard) can still be purchased via the service for at least 5 years.
  This only applies if the G2 gearboxes cannot be used for technical or dimensional reasons.
  Special versions require separate agreements.

6. Description

Economy planetary gearboxes in single and two-stage versions.

The sizes PE2, PE3, PE4 and PE5 have been revised.

The following mounting parts are affected by the new standardised interface on the input side for mounting to the planetary gearboxes:

- ME- adapter
- MEL- adapter
- side EZ- motor
- side Lean motor

6.1 Combinations

The input stage of the 2-stage gearboxes will now be one size smaller, as with the P/PH G3 series. This affects the combinatorics with the attached servo motors EZ, LM and third-party motors. This makes it possible to attach the same motor sizes as for P/PH G3. As shown in the table below.

- Same combinations with the motors as for P series.
- Motor adapter ME(L) is taken over from series P.
- Motor adapter MEI is omitted (see VI-016/18). MEI is not provided in the G2.

- General

	ME(L)	MF(L)	MEI	MB	EZ	LM	ED/EK	KX	K
PE	X	-	-	-	X	X	O	O	-

X= catalogue variant

O= not catalogue variant

- = no attachment planned

- Direct mounted

As there is no corresponding EZ for ED2, ED2 is also shown in the following table.

PE G1	ED2	EZ3	EZ4/ LM4	EZ5/ LM5	EZ7/ LM7	EZ8	PE G2	ED2	EZ3	EZ4/ LM4	EZ5/ LM5	EZ7/ LM7	EZ8
PE211	o	x					PE221	o	x				
PE212	o	x					PE222	o	x				
PE311		x	x	x			PE321		x	x			
PE312		x	x	x			PE322	o	x				
PE411			x	x	x		PE421			x	x		
PE412			x	x	x		PE422		x	x			
PE511				x	x	x	PE521				x	x	
PE512				x	x	x	PE522			x	x		

X= catalogue variant

O= not catalogue variant

X/O= Combinations NEW in Generation 2

6.2 Type Code

Gearbox type	Size	Generation number	Number of stages	Housing type	Shaft design	Bearing design	Backlash	Ratio	Input option
PE	4	2	1	S	P	S	S	0050	ME
Varianten:									
PE				X	G	S	S		ME(L)

Option

Type code change

Special

Changes G2 vs. G1:

- Gearbox type: no change
- Frame size: no change
- Generation number: 2
- Number of stages: no change
- Housing type: S...Standard
  X...special housing
- Shaft design: G...Solid shaft without key is a special design (for more information see chapter 8.2 Interface on the output drive or 9. Pricing)
- Bearing design: S...Standard
- Backlash - New for PE to show the equality of the type codes of the planetary gearboxes. No option only S for standard
- Gear ratio: no change
- Motor adapter: ME....EasyAdapt
  MEL...EasyAdapt Large for large motor shafts

7. Technical Data

7.1 General Information

As already explained in chapter 1.1, the intention for the revision of the PE series was to apply the new modularity of the P/PH G3 to the PE series. In other words, to use as many components as possible in the PE series that are already used in the P/PH G3. Therefore, the development focused on standardising the interface from the gearbox to the motor adapter or to the motor and to use the gearing parts of the PE series also as input stages of the two-stage gearboxes of the P/PH G3 series. For this multiple use of the gearing parts, the PE2 and PE3 sizes had to be reinforced, which had a very positive effect on the torque increases.

Another focus had to be placed on the manufacturing costs, as the margins for the current series are much too low. Numerous concessions from the sales department were very helpful. The three most important ones are mentioned here.

- Elimination of the smooth output shaft as standard
- Torque reduction for all two-stage versions with i=4 in the output.
  Here, instead of a 4-stage, a 3-stage planetary system could be used.
- i=70 gets the actually worse i=10 gearing in the output. This saves sun gear variants.

We have prepared very extensive comparison documents. We will gladly provide you with these as described in chapter 3.2.

7.2 Projection

The factor fB_{ZB} that is applied to the load changes in cycle operation is now adapted to the P/PH Generation 3 series.

With PE Generation 1, a factor fB_{ZB} of 1.2 to 1.8 had to be applied for >1000 LW/h until now (see following table)

Cyclic operation	fB_{ZB} [2]
≤ 1000 load changes/hour (LW/h)	1.00
2000 load changes/hour (LW/h)	1.20
3000 load changes/hour (LW/h)	1.40
4000 load changes/hour (LW/h)	1.60
≥ 5000 load changes/hour (LW/h)	1.80

With PE Generation 2, a factor fB_{ZB} of 1.15 only has to be applied for >1000 LW/h (see following table)

Cyclic operation	fB_{ZB}
≤ 1000 load changes/hour (LW/h)	1.00
> 1000 load changes/hour (LW/h)	1.15

This increases the permissible acceleration torque by up to 56%.

This increase is not shown in the following comparisons.

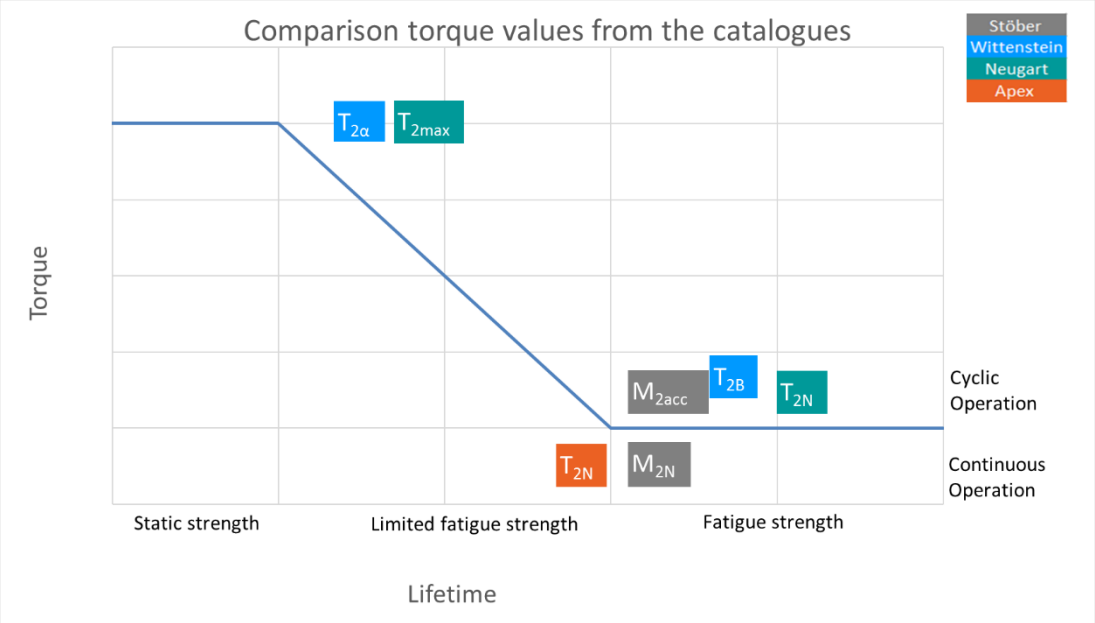
7.3 Comparison G1 and G2

Comparison diagrams G1 vs. G2 per series and size
(Ex.: "Compare PE2 G1-G2_Diagrams.pdf")

- Acceleration torques
- Rated torques
- Emergency stop torques
- Continuous operating speeds
- Cycle operating speeds
- Torsional stiffnesses

All further comparisons can be found in the link provided in chapter 1.

7.4 Competitive Comparison

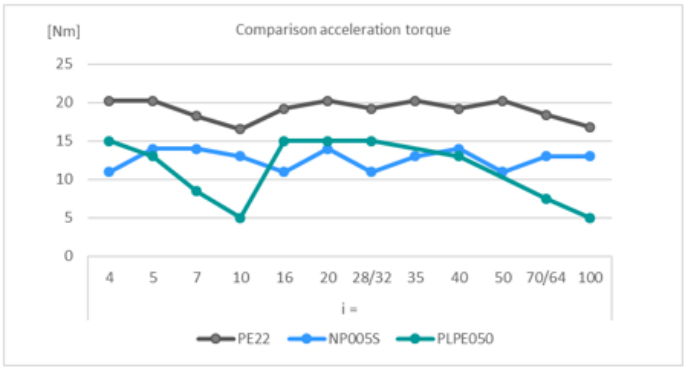


The torque data of the Economy gearboxes cannot be easily compared with the competition. This is due to the different design rules that the competitors hide in the small print of their catalogue.

We have therefore tried to show in a chart where which value of our three biggest competitors can be found. The result of this comparison is that only Wittenstein and Neugart have a comparative value for our acceleration moment and therefore we have only included this in the competitive comparison. The T2B value from Apex is not a usable acceleration torque and can therefore not be included.

Example PE22

Comparison acceleration torque [Nm]				
		Stöber M2acc	Wittenstein T2B	Neugart T2N
		PE22	NP005S	PLPE050
i =	4	20	11	15
	5	20	14	13
	7	18	14	9
	10	17	13	5
	16	19	11	15
	20	20	14	15
	25	20	14	13
	28/32	19	11	15
	35	20	13	14
	40	19	14	13
	50	20	11	10
	70/64	18	13	8
	100	17	13	5



All further comparisons and values for torques and stiffness can be found in the link provided in chapter 1.

7.5 Ratios

The ratios i= 12 and 15 are no longer available in the catalogue; they continue to be available to existing customers as a non-catalogue variant. Customers are to be converted to the standard ratio i=10 and i=16 in the medium term.

7.6 Bearing

- Output and planetary gear bearings remain unchanged from PE generation 1.
- For two-stage gearbox variants, a smaller size is used as the driving stage. Exception: size PE2, as there is no smaller size available here.

7.7 Toothing

The gearing forms the heart of a gearbox. STÖBER has been developing and producing gearboxes for over 70 years. Thanks to constant innovative technological developments and investments in state-of-the-art production facilities, we are now at the forefront of technology. In the development of the PE Generation 2 Economy planetary gearboxes, we were once again able to apply this high level of expertise, and thus develop a top product that is second to none.

Sun and planetary gears are used from the single-drive stage of the P/PH Generation 3. Since more torque is required for the PE2 and PE3 sizes, as the driving-in stage before P3 and P4, this can now be used as a significant torque increase.

Optimised gear width:

In the current generation, 2-stage gearboxes use the same size in the input as in the output. This gearing is oversized. In Generation 2, the gearbox size in the input drive was changed to a smaller size to meet the requirements in order to optimise the overall length and the efficiency of the gearbox.

Gear materials, hardening processes, quality and machining:

State-of-the-art materials and case hardening processes have been used for the planetary and sun gears. These gears are finished to a high quality using high-end gear grinding machines from the most renowned manufacturers.

A new gearing process, power skiving, was used to produce the internal gear teeth. With this process, the internal gear teeth can be produced in one clamping with the bearing seats and in a significantly higher quality (1 - 2 classes). Due to the complete machining on one machine, reclamping errors are avoided and the component does not have to be re-aligned. This eliminates concentricity errors. For the housings of the Economy planetary gearboxes PE, however, the focus of this process is more on the economic than on the qualitative aspects. The result is an excellent price-performance ratio.

With power skiving, the speeds of the workpiece and tool are synchronised. The superimposed feed motion causes the tool cutting edge to peel the tooth gaps out of the housing material.

Video on the new manufacturing process 

The ring gear teeth are machined directly into the housing. For the PE series, a high-strength nodular graphite cast iron (GGG70) with a minimum tensile strength of 700N/mm² is used.

8. Geometry data

The mechanical interfaces on the output are compatible with PE Generation 1.

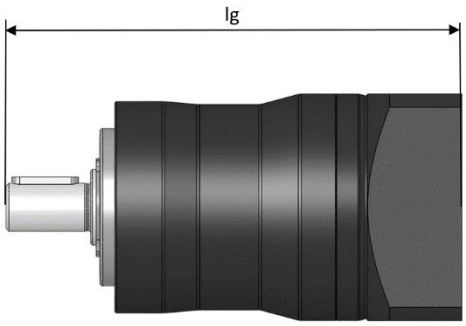
In general, however, we recommend a dimensions check based on the new 3D models due to the changed input stage.

You will receive this

- together with the quotation from our order department
- by configuring your product with the STÖBER Configurator https://configurator.stoeber.de/en-US/?shop=SAT

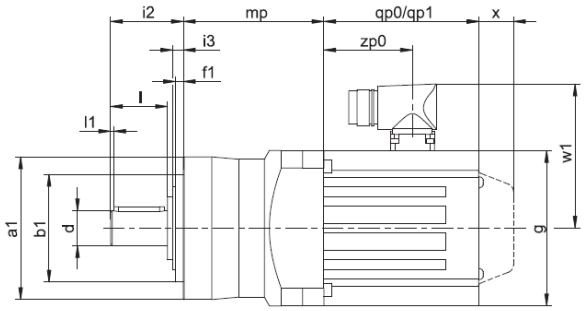
8.1 Overall length

- Motor adapter gearbox



Size	G1 ME L [mm]	G2 ME L [mm]	Reduction [mm]
PE211 – PE221	109,0	109,5	0,5
PE212 – PE222	136,5	141,5	5,0
PE311 – PE321	153,5	150,5	-3,0
PE312 – PE322	186,0	168,0	-18,0
PE411 – PE421	173,0	167,0	-6,0
PE412 – PE422	211,0	204,0	-7,0
PE511 – PE521	223,5	222,0	-1,5
PE512 – PE522	269,0	251,0	-18

- Direct mounting

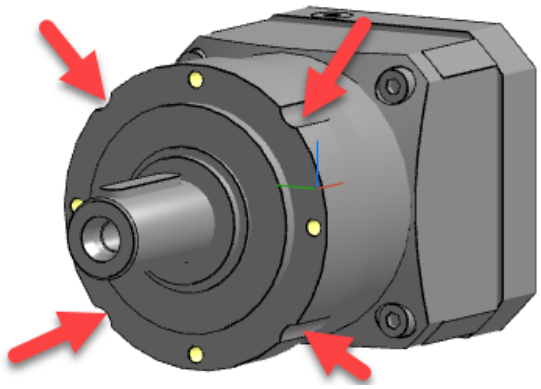


Size	i2+mp		Reduction
	G1	G2	[mm]
PE211 - PE221 EZ3	97	97,5	0,5
PE311 - PE321 EZ3	122	122,5	0,5
PE311 - PE321 EZ4	118,5	119	0,5
PE312 - PE322 EZ3	154,5	156	1,5
PE411 - PE421 EZ4	134	135	1
PE411 - PE421 EZ5	136,5	137,5	1
PE412 - PE422 EZ3	-	175	-
PE412 - PE422 EZ4	172	171,5	-0,5
PE511 - PE521 EZ5	175,5	180	4,5
PE511 - PE521 EZ7	181,5	183	1,5
PE512 - PE522 EZ4	-	222	-
PE512 - PE522 EZ5	221	221,5	0,5

8.2 Interface at the output

The mechanical interfaces on the output are compatible with Generation 1.

- Standard output shaft with feather key
- The smooth output shaft without feather key is a special version.
  Existing customers can be converted at no extra cost on request.
  For new customers/new applications a gross additional price of 88,-€ has to be charged, regardless of the size. Minimum lot size 10 pieces. A supplementary application (ROAD) must be submitted.
- Millings on the PE5 of generation 2 are omitted.



On the PE5 of Generation 1, 4 cut-outs had to be made on the housing to enable the screw connection between the gearbox housing and the motor adapter. Since the screw connection on the G2 is now made from the motor side, these milled no longer necessary.

8.3 Interface at the input

The input drive interface is now adapted to the P/PH G3 series.

- The square dimensions in direct mounting remain unchanged
- The standardisation of the motor adapters has resulted in changes to the square dimensions of the motor adapters.

Size	Motor shaft d_{max} x l_{max} [mm]	G1	Square dimension a6 [mm]	G2	Square dimension a6 [mm]
PE2	14x30	PE211_ME PE212_ME	55 55	PE221_ME PE222_ME	55 55
PE3	19x40	PE311_ME PE312_ME	75 75	PE321_ME PE322_ME	75 55
PE4	24x42	PE411_ME PE412_ME	100 100	PE421_ME PE422_ME	100 75
PE5	32x50	PE511_ME PE512_ME	120 120	PE521_ME PE522_ME	120 100

- Here is also an overview of the possible mountable motor shaft diameters

Size	ME d_{MW} [mm]	MEL d_{MW} [mm]	Size	ME d_{MW} [mm]	MEL d_{MW} [mm]
PE211 PE212	≤ 14 ≤ 14	≤ 19 ≤ 19	PE221 PE222	≤ 14 ≤ 14	≤ 19 -
PE311 PE312	≤ 19 ≤ 19	≤ 24 ≤ 24	PE321 PE322	≤ 19 ≤ 14	≤ 24 -
PE411 PE412	≤ 24 ≤ 24	≤ 32 ≤ 32	PE421 PE422	≤ 24 ≤ 19	≤ 32 ≤ 24
PE511 PE512	≤ 32 ≤ 32	≤ 38 ≤ 38	PE521 PE522	≤ 32 ≤ 24	≤ 38 ≤ 32

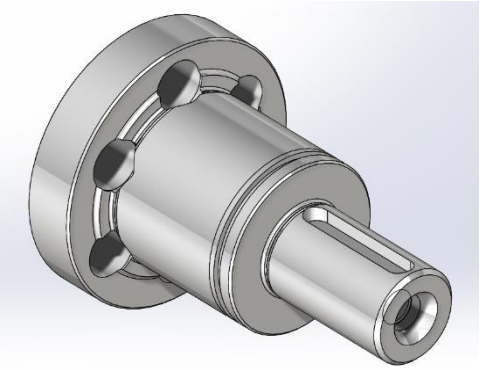
8.4 Housing

The focus was on reducing the number of variants. Due to the omission of the MEI variants and the use of the blanks of the driving-in stage of the P/PH series for the 2-stage version, the number of blanks is reduced to 5. In comparison, 18 blanks are required in Generation 1.

Due to the new design of the 2-stage version, the input is one size smaller than the output, comparable to the P/PH series.

The material remains EN-GJS-700 as before.

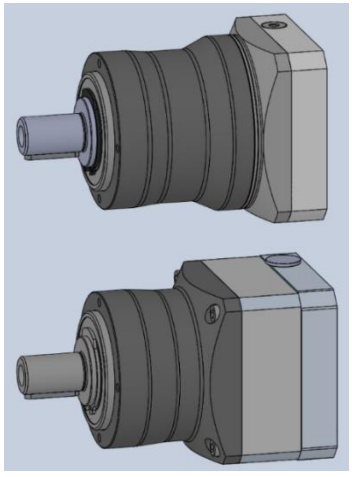
8.5 Planetary carrier



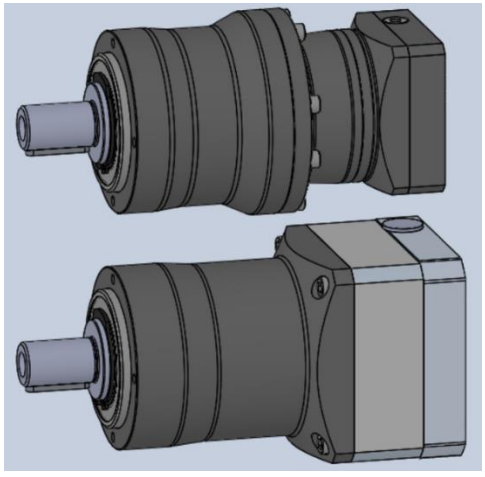
To reduce the variety of parts, the following specification applies:

- Standard version only with feather key
- Smooth solid shaft without feather key only as a special version (ROAD required). Minimum lot size 10 pieces with a flat-rate gross additional price for all sizes of amount of 88,-€.
- Drive-in planetary carriers only with uniform bore
- As before, the planet carriers have bores for two ratios each, with the exception of i=3.

8.6 Design



Comparison of G2 (top) and G1 in 1-stage version

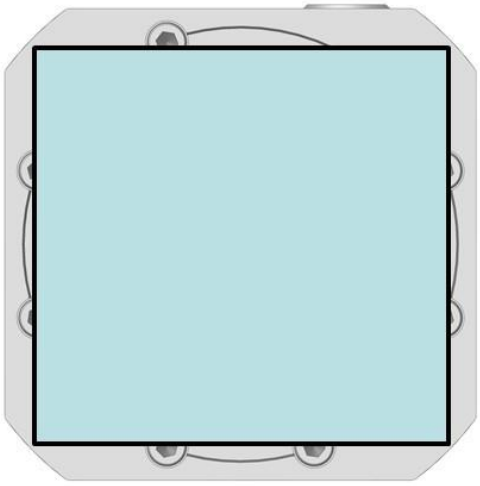


Comparison of G2 (top) and G1 in 2-stage version

8.7 Motor Adapter

The intended coupling variants are ME and MEL from the P/PH series. The geometrically suitable MF(L) coupling is not intended for mounting.

The screw connection is always made from the motor side, identical in construction to the P/PH series. With small motor flanges, the countersinks for the screw heads are visible.



To seal the affected attachments, a lasered stainless steel sheet with a thickness of s=0.5mm is offered as an option. This must be ordered as a separate item.

All available sheets can be viewed in a document on our intranet page.

https://stoebergermany.sharepoint.com/sites/System_DE/SitePages/en/Getriebe.aspx

9. Pricing

The gross sales prices remain unchanged.

For the motor adapter gearboxes, the next smaller motor adapter is now used for the two-stage gearboxes. This results in a price reduction for two versions and a minimal price increase for one version. (see table below)

	Gear unit G1	Adapter ME	Total	Gear unit G2	Adapter ME	Total	Difference
PE2 1-stufig	228 €	171 €	399 €	228 €	171 €	399 €	0 €
PE2 2-stufig	395 €	171 €	566 €	395 €	171 €	566 €	0 €
PE3 1-stufig	243 €	190 €	433 €	243 €	190 €	433 €	0 €
PE3 2-stufig	438 €	**190 €**	628 €	438 €	**171 €**	609 €	-19 €
PE4 1-stufig	274 €	187 €	461 €	274 €	187 €	461 €	0 €
PE4 2-stufig	485 €	**187 €**	672 €	485 €	**190 €**	675 €	3 €
PE5 1-stufig	386 €	226 €	612 €	386 €	226 €	612 €	0 €
PE5 2-stufig	649 €	**226 €**	875 €	649 €	**187 €**	836 €	-39 €

The price list (PDF) will only be available in the next few weeks.

10. Media

10.1 Catalogue

The publication dates of the catalogues below refer to the German editions. The foreign language versions always appear 4 weeks later.

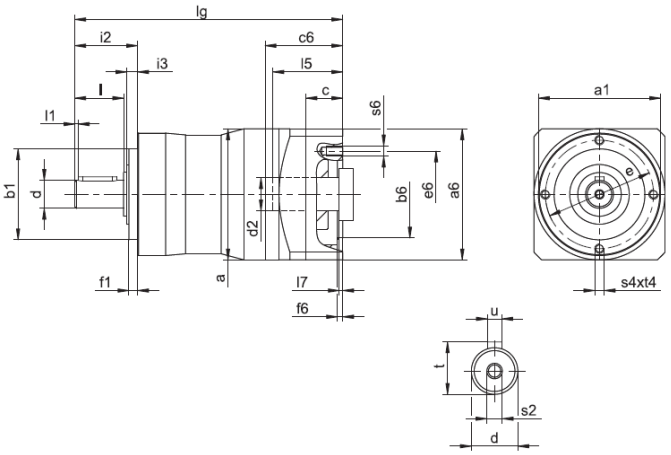
Servo gear units	Synchron.-EZ	Rack and Pinion	Lean Motor
01.04.2021	01.04.2021	01.06.2021	01.07.2021

- Only the largest possible coupling is shown in the catalogue. This makes the selection lists in the catalogue clearer and the catalogue is not unnecessarily inflated.

  Smaller possible coupling sizes can be selected in the STÖBER configurator. The smaller mass moments of inertia associated with the smaller couplings can also be determined here. To do this, the gearbox must be configured and the technical data sheet downloaded.

  It is easier in SERVOsoft. Here, the gearboxes with all coupling sizes can be selected. The corresponding mass moments of inertia are taken over directly in the drive dimensioning and used for the calculation.

- The complete length dimension of the adapter gear is now indicated with "lg".



- Only one motor connection flange per size is shown in the catalogue.

  The other motor connection flanges can be found in the STÖBER Configurator.

Beispielmaße Motoranschluss + Gesamtlänge

Typ	Øb6	Øe6	Ød2max	l5	□a6	c	c6	f6	l7	lg	s6
PE221_ME	40^{H7}	63	14	30	55	15	32,0	3,5	3,0	109,5	M5
PE222_ME	40^{H7}	63	14	30	55	15	32,0	3,5	3,0	141,5	M5
PE321_ME	60^{H7}	75	19	41	75	18	41,5	3,5	4,0	150,5	M5
PE322_ME	40^{H7}	63	14	30	55	15	32,0	3,5	3,0	168,0	M5
PE421_ME	95^{H7}	115	24	41	100	21	42,5	4,0	3,5	167,0	M8
PE422_ME	60^{H7}	75	19	41	75	18	41,5	3,5	4,0	204,0	M5
PE521_ME	110^{H7}	130	32	51	120	24	54,0	4,0	4,5	222,0	M8
PE522_ME	95^{H7}	115	24	41	100	21	42,5	4,0	3,5	251,0	M8

In der obigen Tabelle finden Sie Beispiel-Motoranschlussmaße für den Motoradapter ME. **Beachten Sie, dass sich die Maße c6, l5 und lg entsprechend verlängern, wenn das Maß c, abhängig vom verwendeten Motor, länger wird.**

Weitere Motoranschlussmaße für den Motoradapter ME und MEL finden Sie in unserem STÖBER Configurator unter http://configurator.stoeber.de. Hier können Sie sich direkt ein 3D-Modell Ihres Antriebs herunterladen.

10.2 Internet / Intranet

- Homepage & STÖBER Configurator
  The homepage and the configurator are changed to G2 for sales release.
- Drawing catalogue internal
  Before the introduction in the STÖBER Configurator all Generation 2 gearboxes are available at http://satcad.stoeber.de/.
  After the introduction of G2 in the STÖBER Configurator, all Generation 1 gearboxes are still available at http://satcad.stoeber.de/.

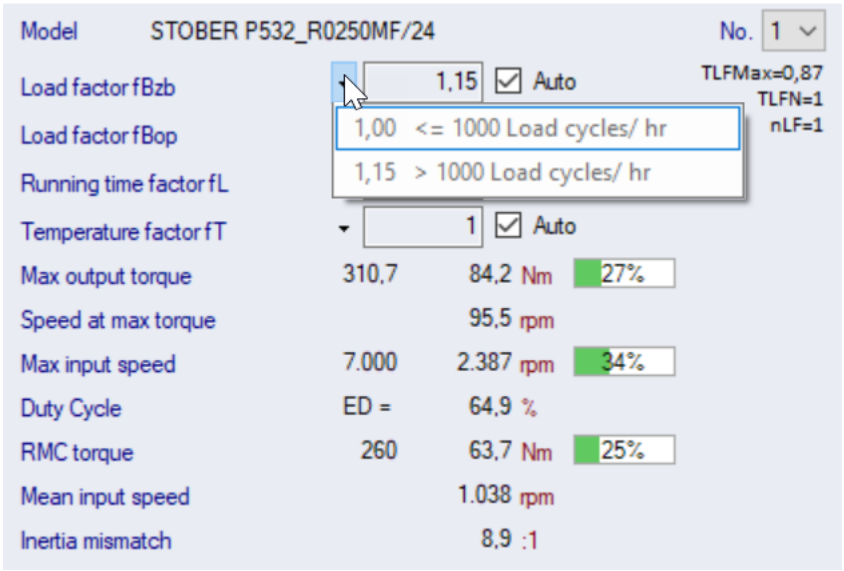
11. Calculation programs

11.1 SERVOSoft

- The new shock factor fB_{zb} from the Generation 3 planetary gearboxes is now also applied to the PE Generation 2.
  With more than 1000 load changes per hour, only a note about the system check was issued until now.

T2: Gearbox	For the selected PE gearbox, an additional safety factor has to be applied to the nominal torque M2N, which is currently not implemented in SERVOsoft. Please apply this factor manually, when <=1000 cycles/h fB=1,0 / >1000 <= 5000 fB=1+0,0002(cycles/h-1000) / >= 5000 fB=1,8

  In the future, the same factors will be used as for the Generation 3 planetary gearboxes. They are automatically taken into account in the program.



- The gear motors, rack drives and adapter gearboxes will be renewed in G2. In addition, the G1 adapter gearboxes will still be present.
- G1 will be removed after discontinuation on 01.08.2022.
  From 01.04.2021, G1 will be set to "soon phase out" status.

11.2 GETBER

GETBER is a calculation program that we use internally to calculate safety and bearing life.

The design department and product management have access to this calculation tool. Upon customer request via the field service, we will also use GETBER for the PE G2.

When introduced, all generation PE G2 gearboxes will be available with ME adapters.

Service life calculations as before on request from SPG.

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