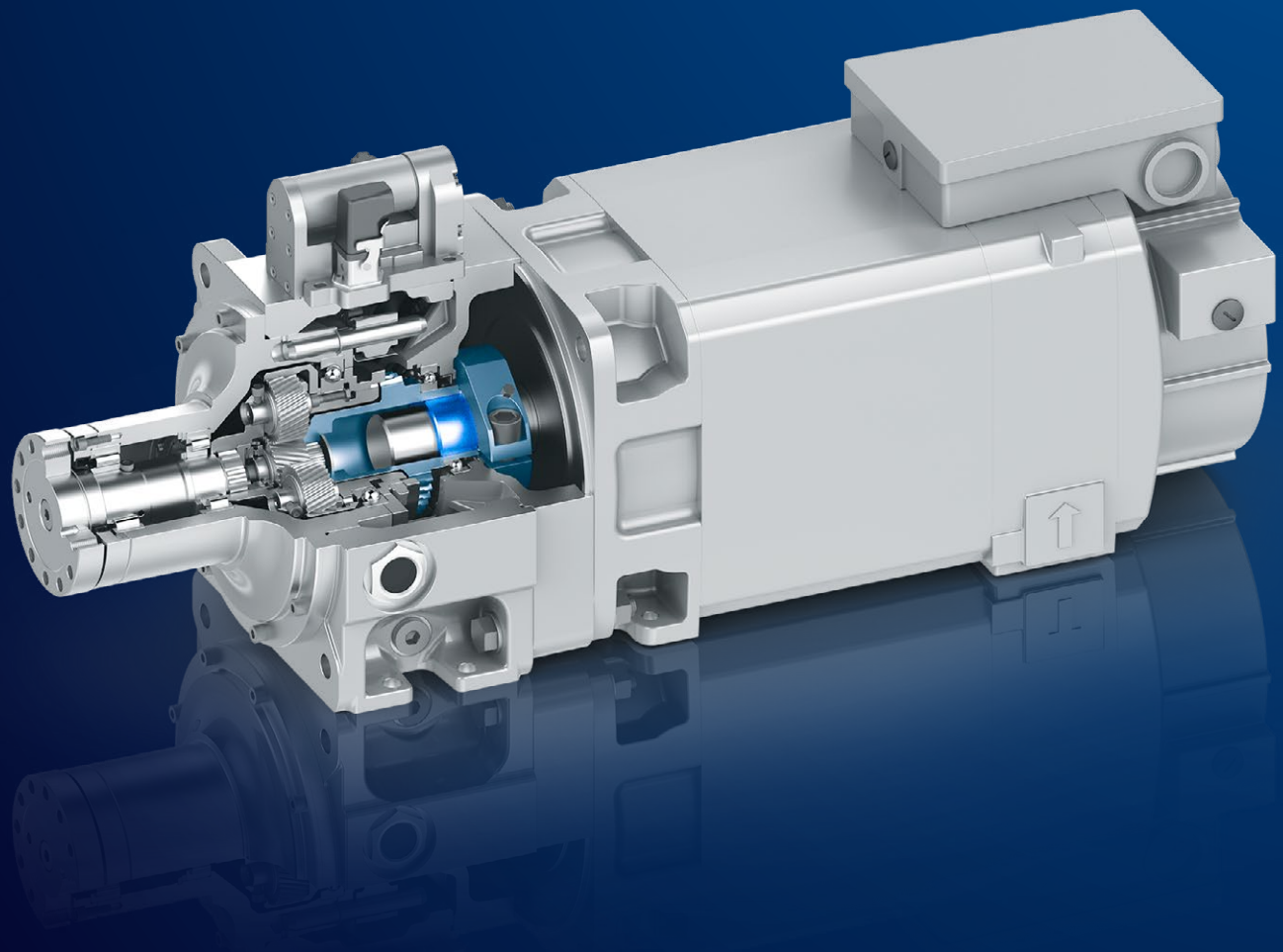
Power and Dynamics

Two-Speed Gearbox for Machine Tools

Duoplan 2K



Content

The expert for the industry

Our enthusiasm for innovative products and processes and our uncompromising pursuit of quality have made us a global leader in driveline and chassis technology as well as active and passive safety technology. We are contributing towards a sustainable future by producing advanced technology solutions with the goal of improving mobility, increasing the efficiency of our products and systems, and conserving resources. Our customers in the automotive and industrial sectors welcome our determined focus on products and services, which provide great customer value.

Our world revolves around your drive

In more than three decades, ZF has evolved into an expert for developing and manufacturing tailor-made driveline technology for industrial machinery. Renowned manufacturers trust in our competence and product quality.

ZF Friedrichshafen AG with its Marine & Special Driveline Technology business unit offers already since decades a wide range of industrial drives, brakes, and clutches for mechanical engineering applications as well as customized drive solutions. The focus of development and production activities is on servo gearboxes for automation technology, two-stage manual drives for machine tools, as well as customized drives, for instance for printing machines or robotics applications.The range of innovative products covers low-play servo gearboxes (Servoplan), robust two-stage gearboxes (Duoplan), as well as hysteresis applications that transfer torque without contact (Tiratron).
Even under continuously high machine loads, ZF industrial drives work in a highly reliable and precise manner. Their size is so small and their weight so low that they can be smoothly integrated into the respective manufacturing concept. Low-scale maintenance efforts and longevity guarantee high availability.

Experience that counts

Tens of years of intensive cooperation and development work with renowned machine manufacturers world-wide have made us what we are today. Know-how, product quality, and precision combine to create a perfect, flexible unit. Thanks to our experience, we know all about the requirements in mechanical engineering and work closely with our customers to offer tailor-made drive solutions.
Furthermore, our engineers constantly interact with the ZF Research and Development Center and utilize state-of-the-art technologies to continue to find even more innovative solutions for mechanical engineering and plant engineering. The internal company processes at ZF demonstrate a high level of quality that is recognized within the automotive industry. Competence and process quality that benefit our customers.

Worldwide service

ZF considers itself not only a manufacturer, but also a reliable partner who supports its customers throughout the lifecycle of their machines – worldwide. With our own comprehensive service network and full range of aftersales services. From prompt original-manufacturer parts supplies via technical service, up to consultancy and training. Quickly, directly, reliably. In short, ZF links powerful top-quality products with excellent services to provide a unique offer.

Perfect solutions for machine tools

Today, a machine tool must be universally applicable in order to process different materials. The two-speed Duoplan manual gearboxes live up to these demands. The Duoplan two-speed gearbox is mainly used in machine tool main-spindle drives, test-benches and applications where high torque is needed.

By way of example, the gearbox can be used in turning machines (horizontal B3/B5), machining centers (vertical V1/V3) thanks to its variable installation position. The gearbox is also suitable for use in many systems in which torque increase and/or speed reduction is required. Machine tools are designed to be universal so that they can process different materials. This requires both high cutting speeds for soft materials as well as high cutting forces for hard materials requirements which a two-speed gearbox can fulfill, since it can either retain high motor speeds (i = 1:1) or multiply the motor torque (e.g. ratio i = 4.00) and reduce the speeds, both by the same factor.

One solution for every demand

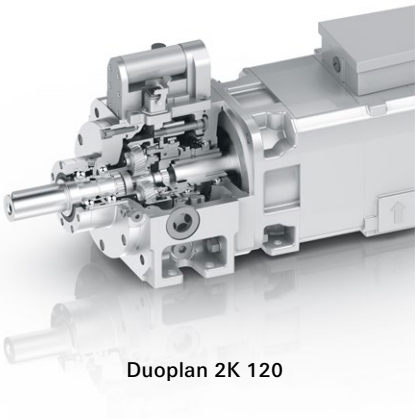
Precision gearboxes of the Duoplan model range cover all common performance, torque, and motor classes of industrial machine drives. This allows the performance range of machine tools to be used in an optimal and energy-efficient way.

The Duoplan model range offers more than ten different gearbox variants for diverse applications and installation positions. They can be used to operate motors with an axle height from 100 to 280 millimeters; the range of the transferred nominal power is between 19 and 120 kW, and the range of the nominal input torque is between 120 and 2,100 Nm. With this extensive spectrum of gearboxes, engineering companies and production facilities benefit from further increases in efficiency and improved cost-effectiveness because an optimally adjusted motor/gearbox unit also reduces energy consumption.

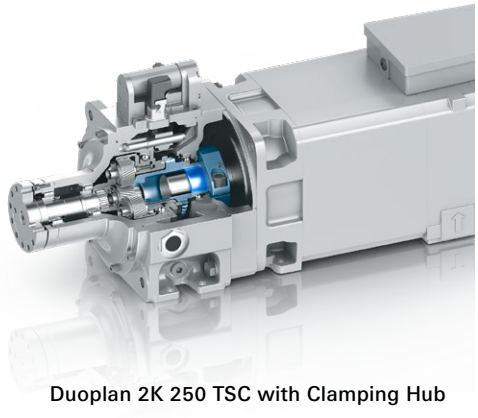
A range of output housing variants cater to different spindle drive designs: E.g. Duoplan Standard with wide bearing base for belt drives with high cantilever forces, Duoplan INLINE with short output housing and angular contact bearings for direct drive and Duoplan TSC (Through-Spindle-Cooling) to facilitate the transfer of cutting liquids like emulsions, hydraulic oils and air-oil mixtures with up to 70 bars of pressure at a flow rate of 20 l/min through the gearbox and spindle, directly to the tool.

Further features of the two-speed manual gearbox include the smaller space requirements thanks to the planetary design, low running noise, and direct installation on all kinds of main spindle motors. Concentricity and center distance changes are compensated for by the floating sun gear, whereby the planetary gearset is much less sensitive to tolerances. Low circumferential backlash, high efficiency, and easy assembly are additional benefits.

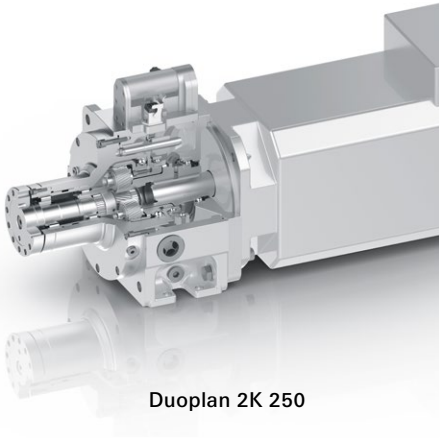
Flexible for any application. The Duoplan gearbox family, a perfect solution for every use case.



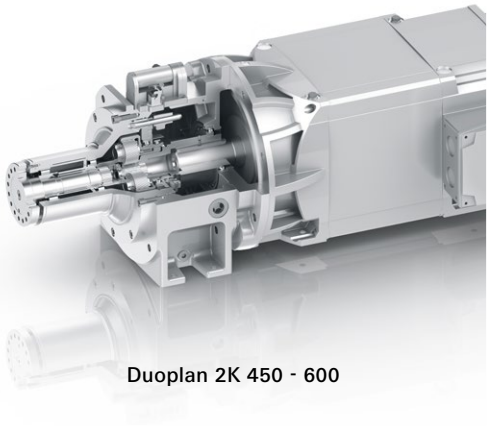
Duoplan 2K 120



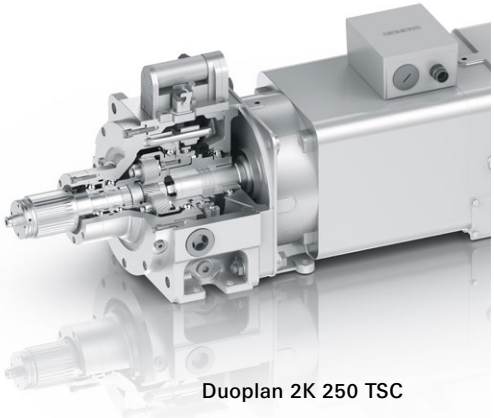
Duoplan 2K 250 TSC with Clamping Hub



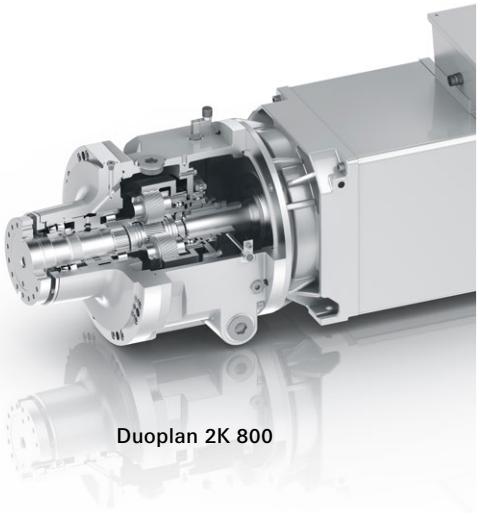
Duoplan 2K 250



Duoplan 2K 450 - 600



Duoplan 2K 250 TSC



Duoplan 2K 800

Duoplan – Technical data

Performance values		i	2K 120 2K 121	2K 250	2K 300	2K 450	2K 600
Nominal data							
Motor center height			100/112	132	160	160/180	180
Nominal power	[kW]		19	39	47	47	63
Nominal speed	[min^{-1}]		1 500	1 500	1 500	1 000	1 000
Nominal input torque (continuous operation S1)	[Nm]		120	250	300/250**	450	600
Output torque	[Nm]	**1.00**	120	250	300	450	600
	[Nm]	**3.07**	–	768	921	–	–
	[Nm]	**3.16**	379	–	–	–	–
	[Nm]	**3.17**	–	–	–	1 426	1 902
	[Nm]	**4.00**	480	1 000	1 200	1 800	2 400
	[Nm]	**4.91**	589	–	–	–	–
	[Nm]	**5.00**	–	–	–	2 250	3 000
	[Nm]	**5.50**	–	1 375	1 375	–	–
Maximum data							
Maximum torque in Nm (intermitted loading S6 cycle duration 10 min, ED. max. 60%)							
Input	[Nm]		140	400	400	630	840
Output	[Nm]	**1.00**	140	400	400	630	840
(max. acceleration torque)	[Nm]	**3.07**	–	1 228	1 228	–	–
	[Nm]	**3.16**	442	–	–	–	–
	[Nm]	**3.17**	–	–	–	1 997	2 662
	[Nm]	**4.00**	560	1 600	1 600	2 520	3 360
	[Nm]	**4.91**	687	–	–	–	–
	[Nm]	**5.00**	–	–	–	3 150	4 200
	[Nm]	**5.50**	–	2 200	2 200	–	–
Maximum permitted input speed							
• in reduction	[min^{-1}]	**≠1**	8 000	6 300	6 300	5 000	5 000
• for direct drive	[min^{-1}]	**1** [2)]	12 000 [3)]	10 000 [3)4)]	10 000 [3)4)]	8 000	5 000
Maximum vibration value	[mm/s]		2.0	1.4	1.4	≤ 2.0	≤ 2.5
Reduced vibration value	[mm/s]		1.2	1.0	1.0		
Maximum vibration value INLINE	[mm/s]		1.0	1.0	1.0		
Reduced vibration value INLINE	[mm/s]		0.7	0.7	0.7		
At reference speed	[min^{-1}]		6 000	5 000	5 000	4 000	4 000
Max. axial force in reduction ratio[5)]	[N]	**3.07**	–	3 090	3 710		
	[N]	**4.00**	–	3 964	4 756	5 439	7 253
	[N]	**5.00**	–	–		7 139	9 519
	[N]	**5.50**	–	5 288	5 288	–	–
Mass moment of inertia [1)]	[J in kgcm^2]	**1.00**	110	270	270	736	736
Input	[J in kgcm^2]	**4.00**	9	36	36	197	197
Operating data							
Weight (standard)	[ca. kg]		42/52	68	86	155	165
Electrical connection for shift unit							
Power consumption	[W]		84	84	84	84	84
Supply voltage (at shift unit)	[V]		24±10%	24±10%	24±10%	24±10%	24±10%
Current supply at 24 V	[A]		5.0	5.0	5.0	5.0	5.0

Operator is free to define bearing load and lifetime.
See installation drawings or page 15-16 for bearing data.
[1)] Mass moments of inertia for other ratios and for smooth motor shaft on request
[2)] Admissible with oil cooler, otherwise n_{max} for reduction ratio
[3)] Max. speed only permitted with oil connection at port K+ T (see pages 18-20 for oil recirculation systems connections)
[4)] Max. speed only permitted with integrated oil channel versions
[5)] Note the permissible axial power on the motor shaft
* On request
** i = 5.5 = reduced input torque

Duoplan – Technical data

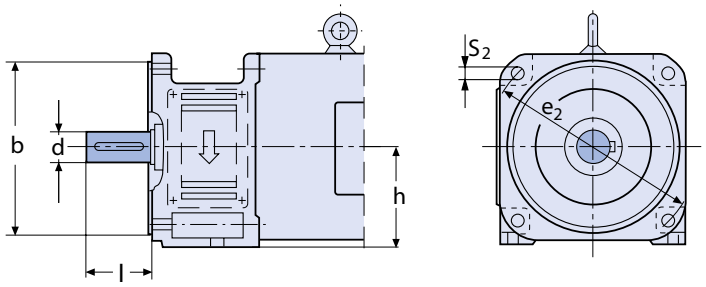
Performance values		i	2K 800 801/802	2K 1000 1001/1002	2K 2100
Nominal data					
Motor center height			180/200/225	180/200/225	225/280
Nominal power	[kW]		84	100	120
Nominal speed	[rpm]		1 000	1 000	500
Nominal input torque (continuous operation S1)	[Nm]		800	960	2 100
Output torque	[Nm]	1.00	800	960	2 100
	[Nm]	3.19	2 552	–	–
	[Nm]	4.00	3 200	3 840	8 400
Maximum data					
Maximum torque in Nm (intermitted loading S6 cycle duration 10 min, ED. max. 60%)					
Input	[Nm]		900	1 100	*
Output	[Nm]	1.00	900	1 100	–
(max. acceleration torque)	[Nm]	3.19	2 871	–	–
	[Nm]	4.00	3 600	4 400	–
Maximum permitted input speed					
• in reduction	[rpm]	≠1	5 000	5 000	3 500
• for direct drive	[rpm]	1	5 000	5 000	3 000
Maximum vibration value	[mm/s]		3.0	3.0	5.0
At reference speed	[rpm]		4 000	4 000	2 500
Mass moment of inertia [1)]	[J in kgcm^2]	1.00	1 956	1 956	*
Input	[J in kgcm^2]	4.00	110	110	*
Operating data					
Weight (standard)	[approx. kg]		175	175	180
Electrical connection for shift unit					
Power consumption	[W]		84	84	85
Supply voltage (at shift unit)	[V]		24±10%	24±10%	24±10%
Current supply at 24 V	[A]		5.0	5.0	5.0

Operator is free to define bearing load and lifetime.
See installation drawings or page 14-15 for bearing data.
[1)] Mass moments of inertia for other ratios on request
* on request

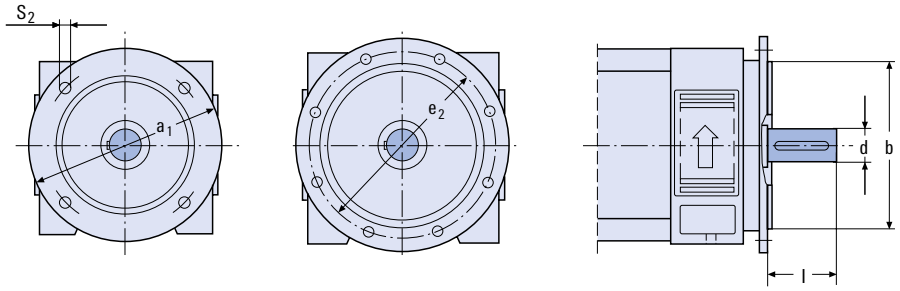
Standard motor connection dimensions

Duoplan	2K 120	2K 121	2K 250	2K 300	2K 450 2K 600	2K 800 2K 1000	2K 801 2K 1001	2K 802 2K 1002	2K 2100	2K 2100
Motor center height	100	112	132	160	160/180	180	200	225	225	280
Standard motor connection dimension										
h	100	112	132	160	160/180	180	200	225	225	280
d	38	48	42	55	55/60	65	65	75	75	90
l	80±0.1	110±0.1	110-0.2	110-0.2	110-0.2 140-0.2	140-0.2	140±0.2	140±0.2	140±0.2	170±0.2
b	180 *	230 *	250	300	300	300	350	450	450	550
e_2	215	265	300	350	350	400	400	500	500	600
a_1	–	–	–		400	450	450	550	550	660
s_2	14	15	18	18	18	18	19	19	19	24

* Other motor frame sizes on request



2K 120 / 2K 121 / 2K 250 / 2K 300 / 2K 450 / 2K 600

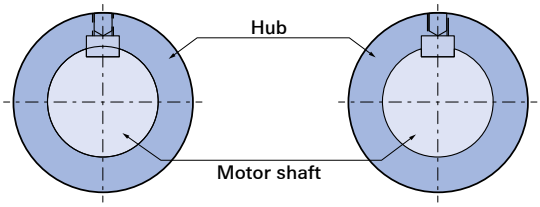


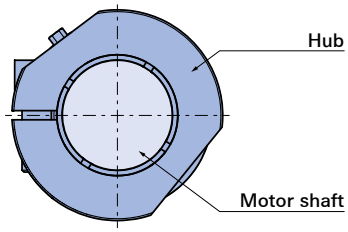
2K 800 / 2K 801 / 2K 802 /
2K 1000 / 2K 1001 / 2K 1002 / 2K 2100

Motor output shafts with standard fitted key, or clamping hub for smooth motor shaft

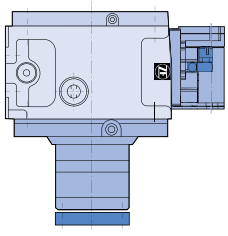
Gearbox sizes Duoplan	Shaft diameter [mm]	Fitted key b x h [mm]	Fitted key length [mm]	Clamping hub
2K 120 / 2K 121	38	10x8	70	x
	32	10x8	70	--
	42	12x8	90	x
	48	14x9	90	x
2K 250	42	12x8	90	x
	48	14x9	90	x
	55	16x10	90	x
2K 300	55	16x10	90	x
	48	14x9	90	x
	42	12x8	90	x
	60	18x11	125	x
2K 450	60	18x11	125	–
	55	16x10	90	–
2K 600	65	18x11	125	–
2K 800 / 2K 801 / 2K 1000 / 2K 1001	60/65	18x11	125	–
2K 802 / 2K 1002 / 2K 2100	75	20x12	125	–
	80	22x14	150	–

- See DIN ISO 21940-32.
- For half-key balancing the key type B is standard.
- For a full-key balanced motorshaft both types can be used.
- Application with smooth motorshaft without keyway on request.
- If a Siemens motor is used, only the full-key balanced shaft is possible.

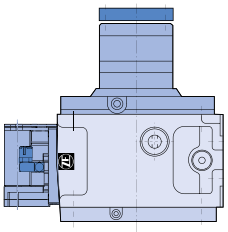




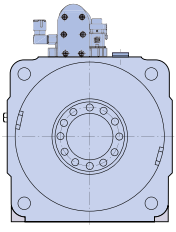
Installation position

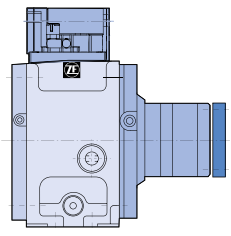


Vertical V1

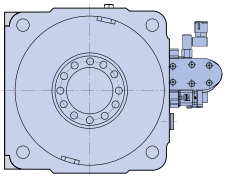


Vertical V3



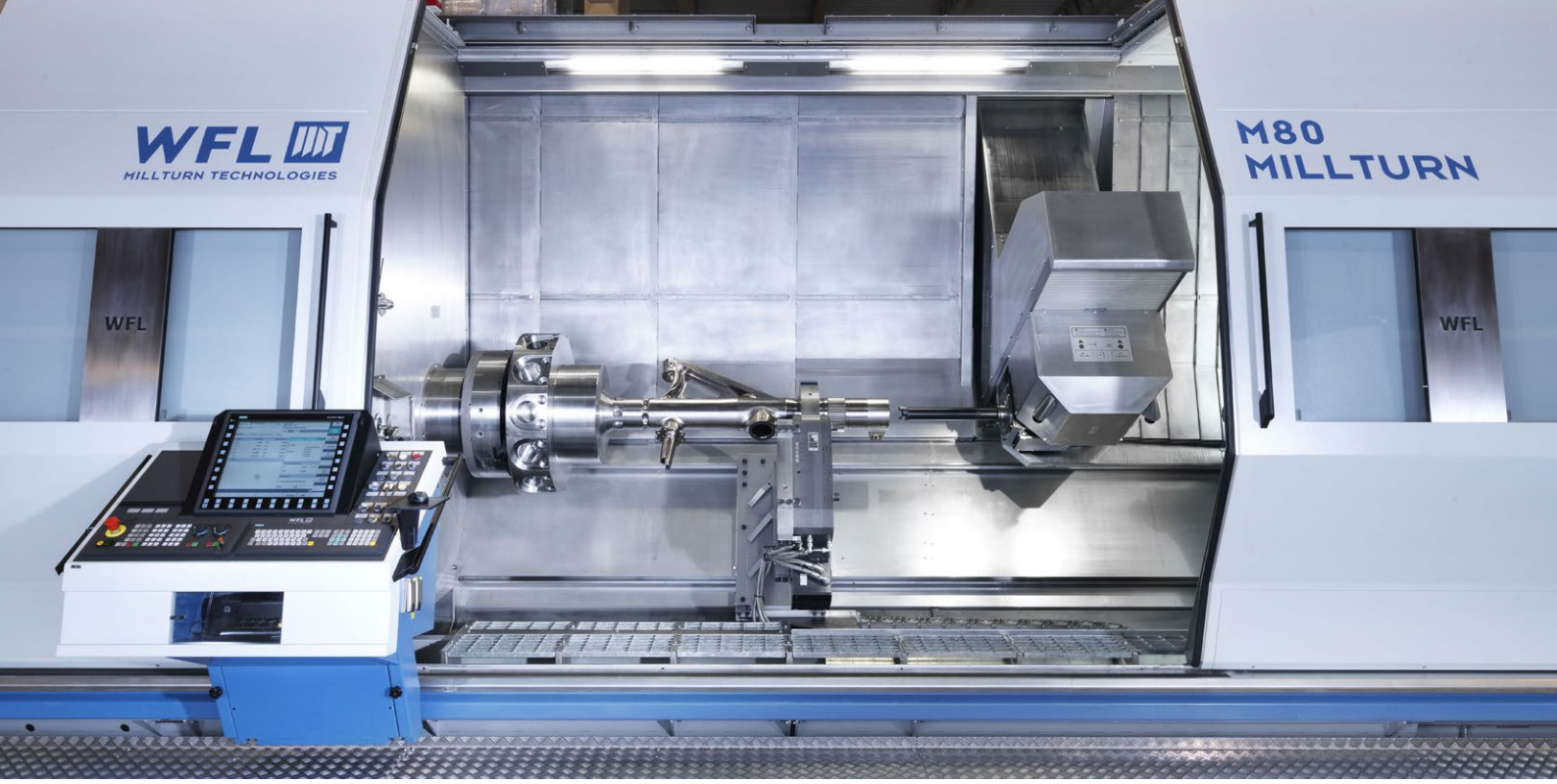


Horizontal B5



Horizontal B5
Shift unit on right side
(view from output)

B5 clockwise rotation for:
2K 120 / 2K 250 / 2K 300 / 2K 450 / 2K 600



Output / Motor interface

Output

There is a choice of two different output variants. The standard long bearing base output flange version is used for beltdrives, allowing high cantilever forces. For the 2K 300 an extended output version is optional for even higher belt forces. Further options include short output housings as Duoplan INLINE for space saving direct drives. This version is supplied as a standard with angular contact bearings. Duoplan TSC (Through-Spindle-Cooling) allows cutting liquids like emulsions, hydraulic oils and air-oil mixtures with up to 70 bars of pressure at a flow rate of 20 l/min through the gearbox and spindle, directly to the tool.

Motor connection

The hubs are generally fitted with a keyway for power gearbox. It should be noted that the hub must be balanced in the same way as the motor. There are two types of balancing: Half-key and full-key. In the case of full-key balancing, the motor shaft is balanced with a fitted key, the hub without. The length of the fitted key is unimportant in this instance.

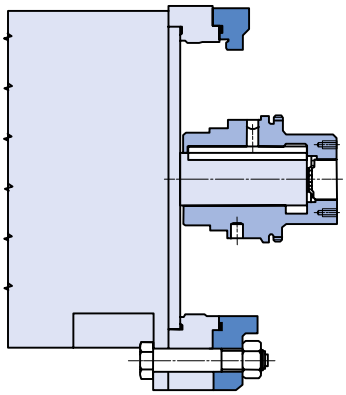
In the case of half-key balance, however, the keyway is filled out with a balance compensator. The shape, length, and position of the keyway must be adapted. For this reason, it is necessary to provide ZF with details of the motor – including the relevant dimensions and balancing type – when ordering.

Clamping hubs without fitted keys are used for smooth motor shafts. If the motor connection dimensions do not permit direct mounting to the Duoplan, an adapter plate or adapter ring is required. These adapter parts can be included in the supply on request, depending to motor manufacturer.

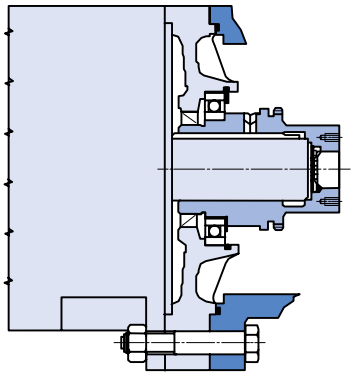
Note

For motor-gearbox units that are fixed in the machine with the gearbox output housing/flange only, no preload support on motor B-side is permitted.

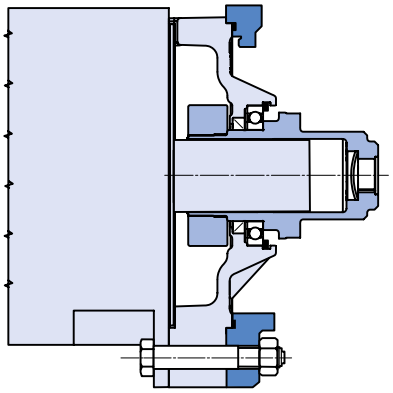
Possible connections



Open Design
(with/without adapter ring)



Closed Design
(with hub bearing and shaft seal)



Closed Design
(With clamping hub,with hub bearing
and shaft seal)

Gearbox interface

Open design

The open version gearbox is without adapter plate. Sealing with motor shaft seal.

Closed design (with hub bearing and shaft seal)

There is a version with ball bearing available for certain motors. The hub in this version is also fixed by the bearing to prevent axial hub movement, rsp. present axial forces from the helical gearing onto the motor shaft (see technical data page 7). Assembly onto spindle motor is made easier due to a fixed hub position as supplied by the factory.

Closed design (with clamping hub, with hub bearing and shaft seal)

Easy and quick to assemble. Different adapter rings can be obtained for easy adaptation to different motor shafts.

Adapter ring

The adapter ring allows adaptation to different dimensions. A shaft seal is required on the motor shaft.

Input flange (2K 250 / 2K 300 / 2K 800 / 2K 1000 / 2K 2100)

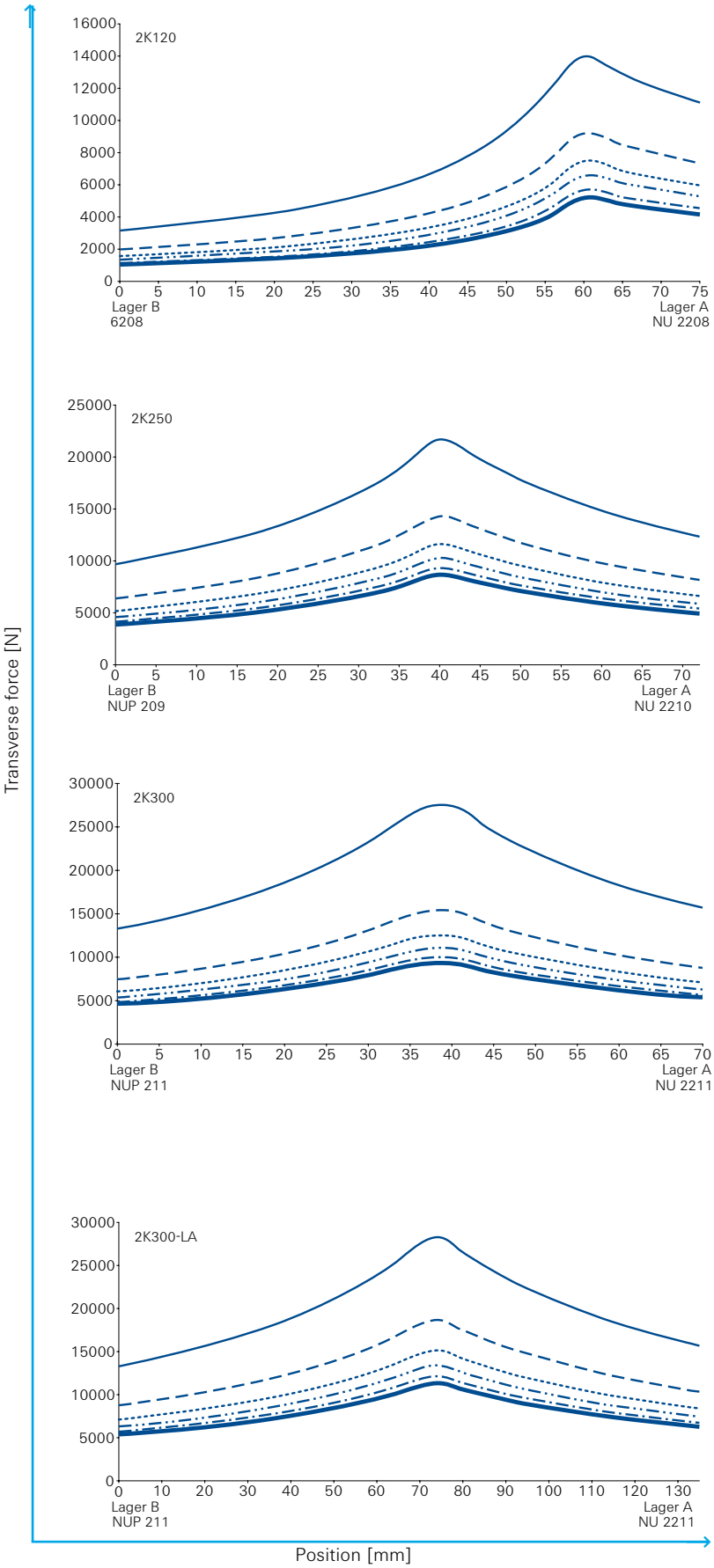
Besides the classic motor-gearbox-adaptation (motor shaft, key way, hub) we offer – on request – a gearbox with input flange to mount a pulley, clutch or similar (as shown on page 22).

Output bearings

The output bearings vary depending on the type and level of load on the output shaft. Cylindrical roller bearings are used to cope with high radial forces, e.g. in belt pulley drives. In contrast, angular-contact ball bearings are suitable for coaxial drives, low radial backlash or axial forces. The flexible design of the output housings and shafts allows a range of selection.

Versions and lifetime calculation based on XY-method

The medium lateral force must be between the output bearings



2K 120 / 2K 121

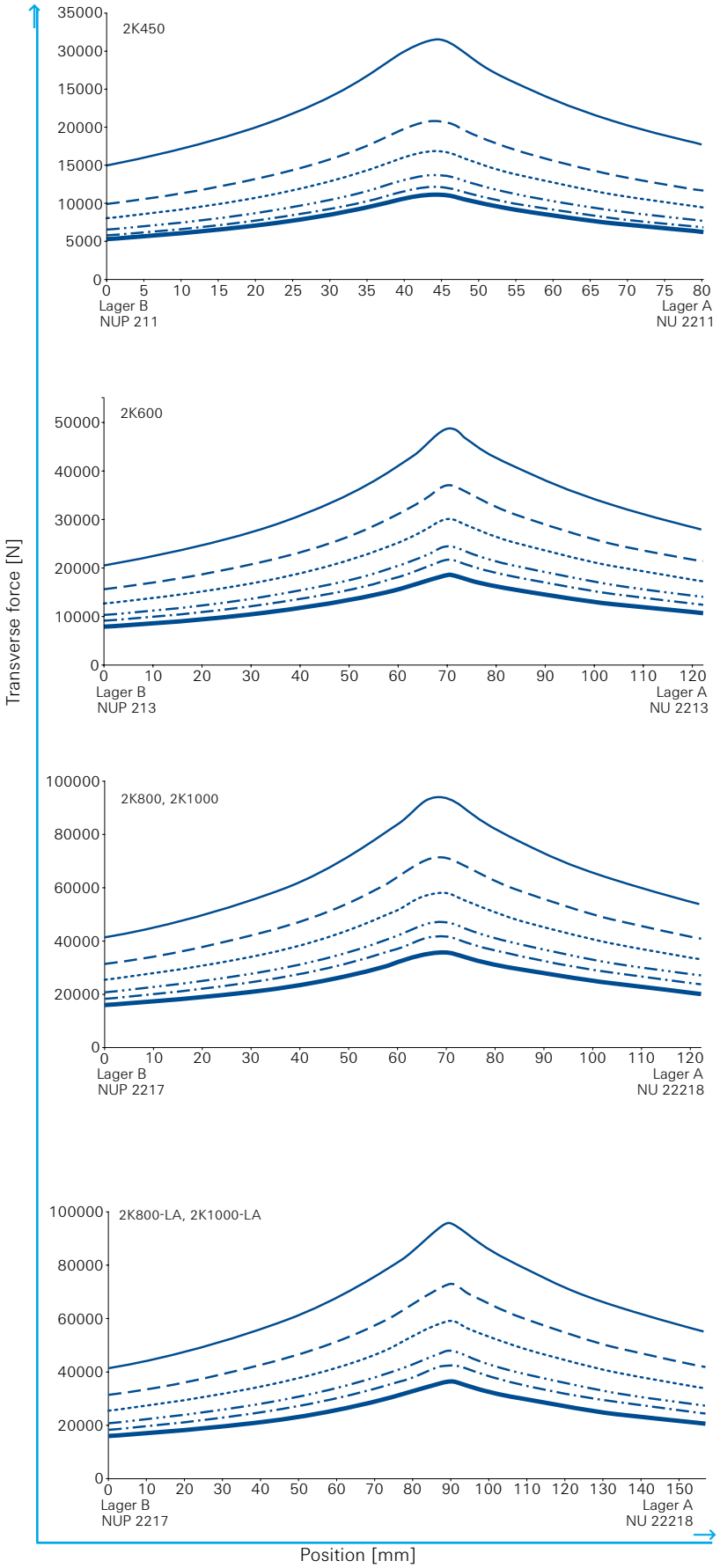
- nab/out = 375 rpm
- nab/out = 1 500 rpm
- nab/out = 3 500 rpm
- nab/out = 4 000 rpm
- nab/out = 7 500 rpm
- nab/out = 10 000 rpm

2K 250 / 2K 300 / 2K 300 long

- nab/out = 375 rpm
- nab/out = 1 500 rpm
- nab/out = 3 000 rpm
- nab/out = 4 500 rpm
- nab/out = 6 300 rpm
- nab/out = 8 000 rpm

Permitted cantilever forces

For standard bearing
service life = 36 000 h
Note:
Take into account the motor manufacturer's permitted cantilever forces



2K 450

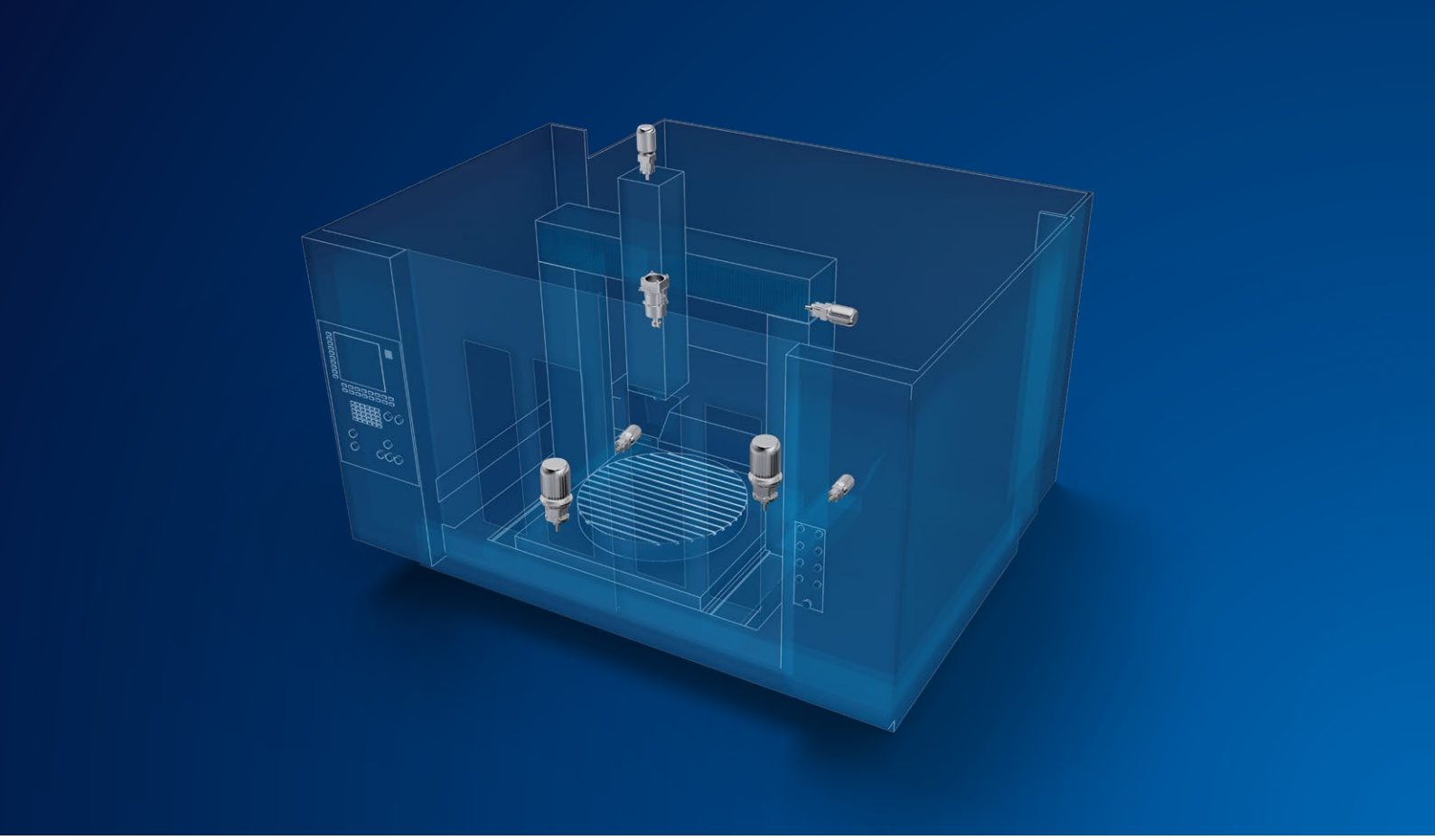
nab/out =	250 rpm
nab/out =	1 000 rpm
nab/out =	2 000 rpm
nab/out =	4 000 rpm
nab/out =	6 000 rpm
nab/out =	8 000 rpm

2K 600 / 2K 800 / 2K 800 long
2K 1000 / 2K 1000 long

nab/out =	200 rpm
nab/out =	500 rpm
nab/out =	1 000 rpm
nab/out =	2 000 rpm
nab/out =	3 000 rpm
nab/out =	5 000 rpm

Permitted cantilever forces

For standard bearing
service life = 36 000 h
Note:
Take into account the motor manufacturer's permitted cantilever forces



Duoplan – high performance guaranteed

Duoplan gearboxes function as the core component of any machine tool and provide a powerful drive solution.

Torsional backlash

- Three backlash classes in reduction mode are available: The circumferential backlash classes of the gearbox sizes can be found from page 28 onward.

Workpiece processing with constant cutting force

- Class 3*: Normal torsional backlash < 30 arcmin.
- Only for turning machine drives involving workpiece processing with constant cutting force.
- For turning machine drives when cutting is uninterrupted while the workpiece is being processed or in the case of predominant facing involving cutting speed adjustment.
- For boring mills, milling machines and machining centres.

Extreme milling work

- Class 2: Reduced torsional backlash < 20 arcmin.
- For milling machines and machining centres used to execute extreme milling work, e.g. tool side milling cutters with very coarse index/division (interrupt cutting), workpieces made from tough material, milling of ribbed workpieces.

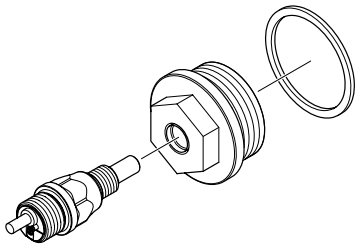
Highly-dynamic machine tools

- Class 1: Especially reduced torsional backlash < 15 arcmin.
- As class 2: Except in lightweight highly-dynamic machine tools incorporating components with high internal elasticity; designed to prevent resonance vibration.

Lubrication

Splash type lubrication

The standard gearbox version B5 has splash type lubrication. Splash type lubrication is suitable for intermittent operation. In this instance, frequent gear changes, varying speeds and idle time (e.g. due to retooling) are a prerequisite.



For applications with immersion lubrication, we recommend using an oil sensor to occasionally check the oil level before machine startup. (Oil sensor order number 4161 298 045)

Recirculating lubrication

The 2K 120 / 2K 121 / 2K 250 / 2K 300 / 2K 450 / 2K 600 gearboxes (vertical V1 and V3 installation positions) require recirculating lubrication. In this instance, the type of recirculating lubrication depends on the operating temperature levels required. The 2K 800 / 2K 801 / 2K 802 / 2K 1000 / 2K 1001 / 2K 1002 and 2K 2100 gearboxes must always be operated with recirculating lubrication (refer also to installation drawings / operating instructions).

Figures on page18-20 show the possible oil inlet and outlet positions on the gearbox. Please refer to the relevant installation drawings for detailed dimensions.

Standard recirculating lubrication in V1/B5 with oil tank installation

The oil inlet is attached in place of the oil drain plug. The oil flow rate is approx. 1.5 l/min. (only for 2K 120 / 2K 121 / 2K 250 / 2K 300); approx. 2.0 l/min. (only for 2K 450 / 2K 600); approx. 2.5 l/min. (only for 2K 800 / 2K 1000). In the case of V3 vertical installation position, the lubrication oil can be supplied in either radial direction or centrally.
The tank of the pump unit must be ventilated. Oil back pressure in the return pipe to the gearbox must be avoided (Ø min. 20 mm). The tank capacity should be at least ten times the recirculating oil quantity. A 60 µm filter and a pressure limitation valve should also be used as a safeguard.

Recirculating lubrication with heat exchanger

A heat exchanger is installed in the recirculating lubrication system to assure additional temperature reduction. For best cooling results without any influence on lubrication, various connection parts for different installation positions and operating modes are provided. In order to achieve an optimal temperature development of the gearbox and to enable the max. speeds, an integrated oil channel version is offered (oil port connection see pages 18-20, ordering code see pages 28-33). In addition, it is possible to operate the 2K 250 / 300 without oil level (dry sump lubrication).

Lubrication

		2K 120 2K 121	2K 250	2K 300	2K 450	2K 600
Operating data						
Oil fill volume in dm^3	Horizontal B5	1.0/1.4	1.5	2.8	5.1	5.4
Approx. oil fill in dm^3 (oil level in middle of oil sight glass is most accurate reading)	Vertical (V1/V3)	recirculating lubrication				
Oil grade for						
• Splash lubrication		HLP 68 as per ISO VG 68				
• Recirculating lubrication		HLP 46 as per ISO VG 46				
• Recirculating lubrication with heat exchanger		HLP 32 as per ISO VG 32				
• Recirculating lubrication with DSL*		HLP 22 as per ISO VG 22 For V1 and V3 installation positions oil recirculating system is mandatory				
Oil change interval		5000 h				
Oil temperature		Max. 120° C permitted depending on application, installation position, lubrication and cooling				

* DSL = Dry Sump Lubrication for 2K250 / 2K300

		2K 800 801 / 802	2K 1000 1001 / 1002	2K 2100
Operating data				
Oil fill volume in dm^3	Horizontal B5	recirculating lubrication		
Approx. oil fill in dm^3 (oil level in middle of oil sight glass is most accurate reading)	Vertical (V1/V3)	recirculating lubrication		
Oil grade for				
• Splash lubrication		HLP 46 as per ISO VG 46		
• Recirculating lubrication with heat exchanger		HLP 32 as per ISO VG 32		
Oil change interval		5000 h		
Oil temperature		Max. 120° C permitted depending on application, installation position, lubrication and cooling		

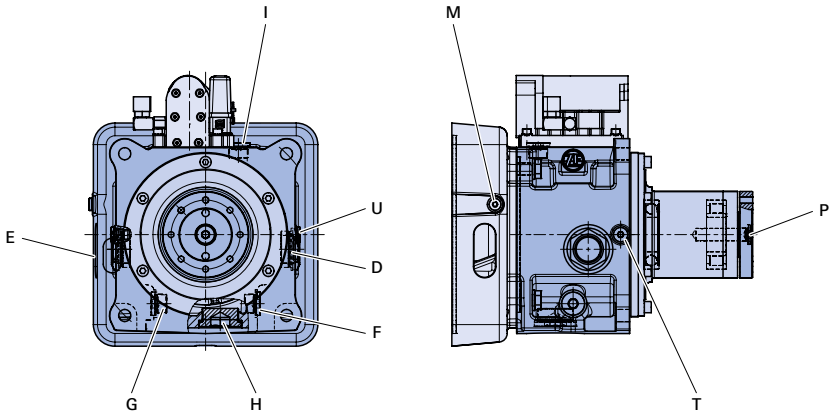
Connections for recirculating lubrication

2K 120 / 2K 121

Installation position	Oil inlet*	Max. pressure	Oil outlet*
V1, B5 (closed version)	M (0.5 l /min) T and/or U (1.0 l /min)	0.5 bar 0.5 bar	D/E
V1 (open version)	T and/or U (1.5 l /min)	0.5 bar	D/E
B5 (open version)	G or F (1.5 l /min)	1.5 bar	D/E
B5 turned, right*	I or F (1.5 l /min)	1.5 bar	H
V3	P (1.5 l /min) or T and/or U (1.5 l /min)	1.5 bar 0.5 bar	D

* View toward gearbox output:
D/G = Mainly counter clockwise rotation
E/F = Mainly clockwise rotation

Note:
For applications using max. speeds of 12,000 rpm, it is mandatory to use port T and/or U with 1.5 dm^3/min. In addition an oil recirculating system using an oil chiller with > 0.3 kW capacity and oil volume >15 liter is necessary.

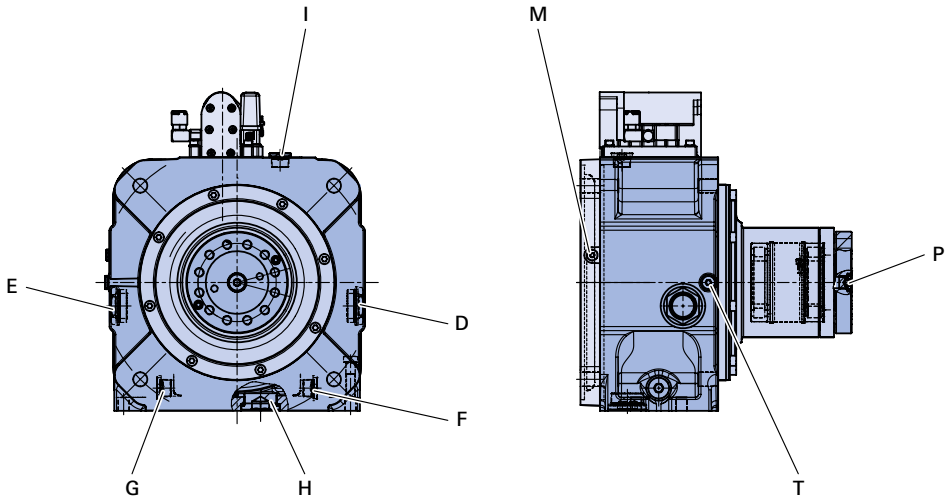


Connections for recirculating lubrication

	2K 250 / 2K 300			2K 450 / 2K 600		
Installation position	**Oil inlet***	**Max. pressure**	**Oil outlet***	**Oil inlet***	**Max. pressure**	**Oil outlet***
V1, B5 (closed version)	M (0.5 l /min) T (1.0 l /min)	0.5 bar 0.5 bar	D/E	M (0.5 l /min) T (1.5 l /min)	0.5 bar 0.5 bar	D/E
V1, V3 (open version)	T (1.5 l /min)	0.5 bar	D/E	T (2.0 l /min)	0.5 bar	D/E
B5 (open version)	G or F (1.5 l /min)	1.5 bar	D/E	G (2.0 l /min) or F (2.0 l /min)	1.5 bar 1.5 bar	D/E
B5 turned, right* (open version)	I or F (1.5 l min)	1.5 bar	H	I or F (2.0 l /min)	1.5 bar	H
V3	P (1.5 l /min) T (1.5 l /min)	1.5 bar 0.5 bar	H	T (2.0 l /min)	1.5 bar	H

* View toward gearbox output:
D/G = Mainly anti-clockwise rotation
E/F = Mainly clockwise rotation
In V1/V3 recirculation lubrication necessary for 2K 250 / 300

Note:
For applications using max. speeds of 10,000 rpm port T is mandatory with integrated oil channel versions
In addition an oil recirculating system using an oil chiller > 0.3 kW and oil volume >15 litres is necessary.
The integrate oil channel version is available for 2K 250 / 300 (see note page 29-30).
This permits a gearbox operation without oil level, however a safety check of oil supply needs to be included in the oil system. A safeguard for the oil circulation amount is required however. See operating instructions for connections and delivery quantities. Essential for the oil circulation amount is always the amount which flows through the oil return.

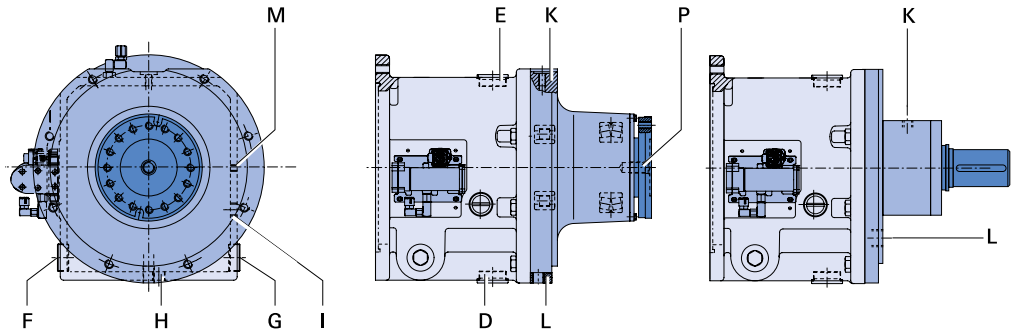


Connections for recirculating lubrication

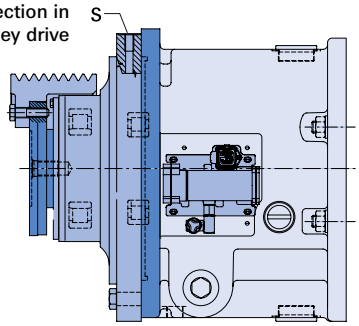
Installation position	2K 800 / 2K 801 / 2K 802 2K 1000 / 2K 1001 / 2K 1002 Oil inlet*	Max. pressure	Oil outlet*	2K 2100 Oil inlet*	Max. pressure	Oil outlet*
B5	M (0.5 l /min) K (2.5 l /min)	3 bar 5 bar	G or F or D	M (min. 3.0 l /min)	3 bar	E or F
V1	M (0.5 l /min) K (2.5 l/min)	3 bar 5 bar	D or E or L (with suction)	M (min. 3.0 l /min)	3 bar	D or E
V3	M (0.5 l /min) K (2.5 l/min) or M (0.5 l /min) P (2.5 l/min)	3 bar 5 bar 3 bar 5 bar	H und I (with suction) or G or F			

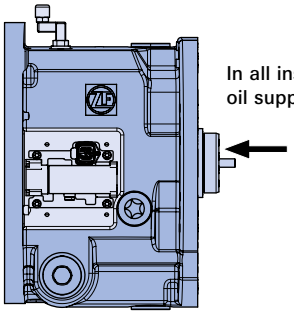
* View toward gearbox output
* Recirculating lubrication for all installation positions mandatory

2K 800 / 2K 801 / 2K 802 / 2K 1000 / 2K 1001 / 2K 1002



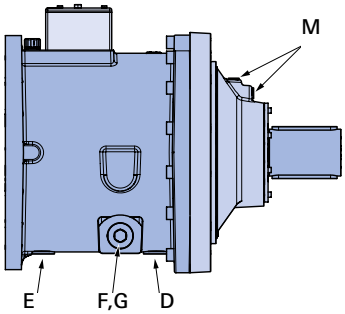
Oil feed for additional connection in case of pulley drive (0.5-1 l/min)

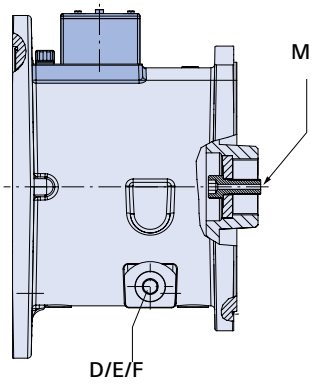




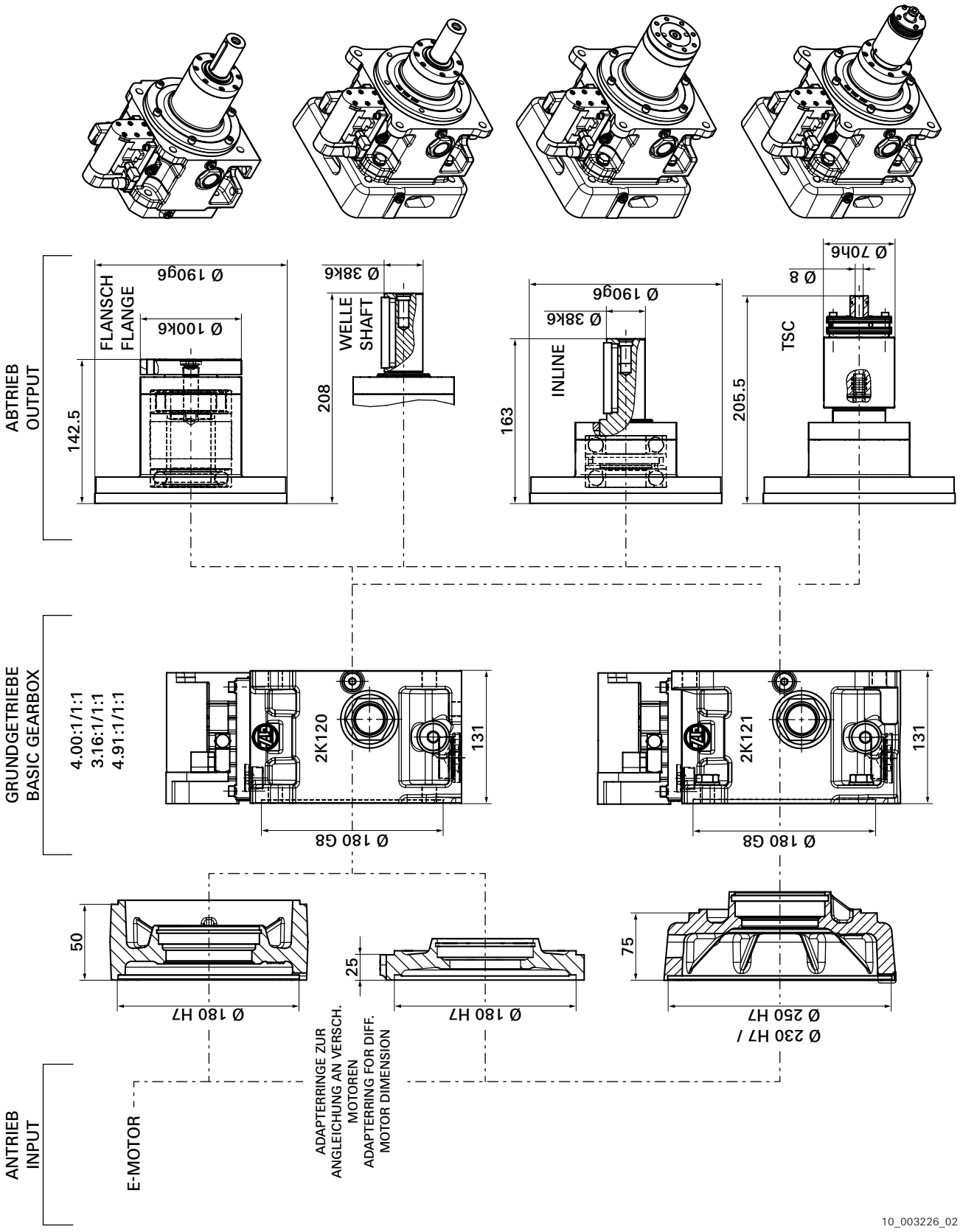
In all installation positions oil supply 2.5l/min

2K 2100

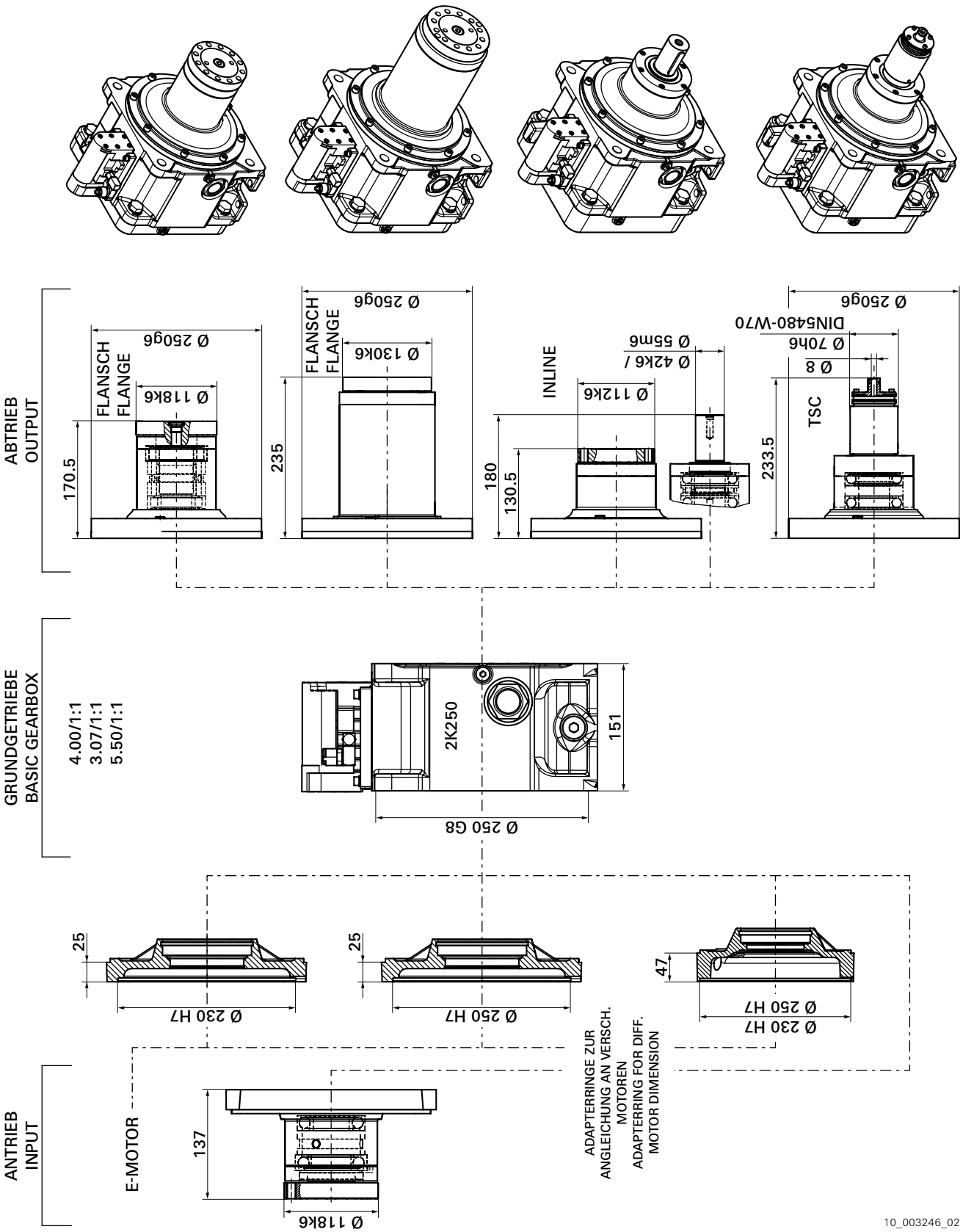




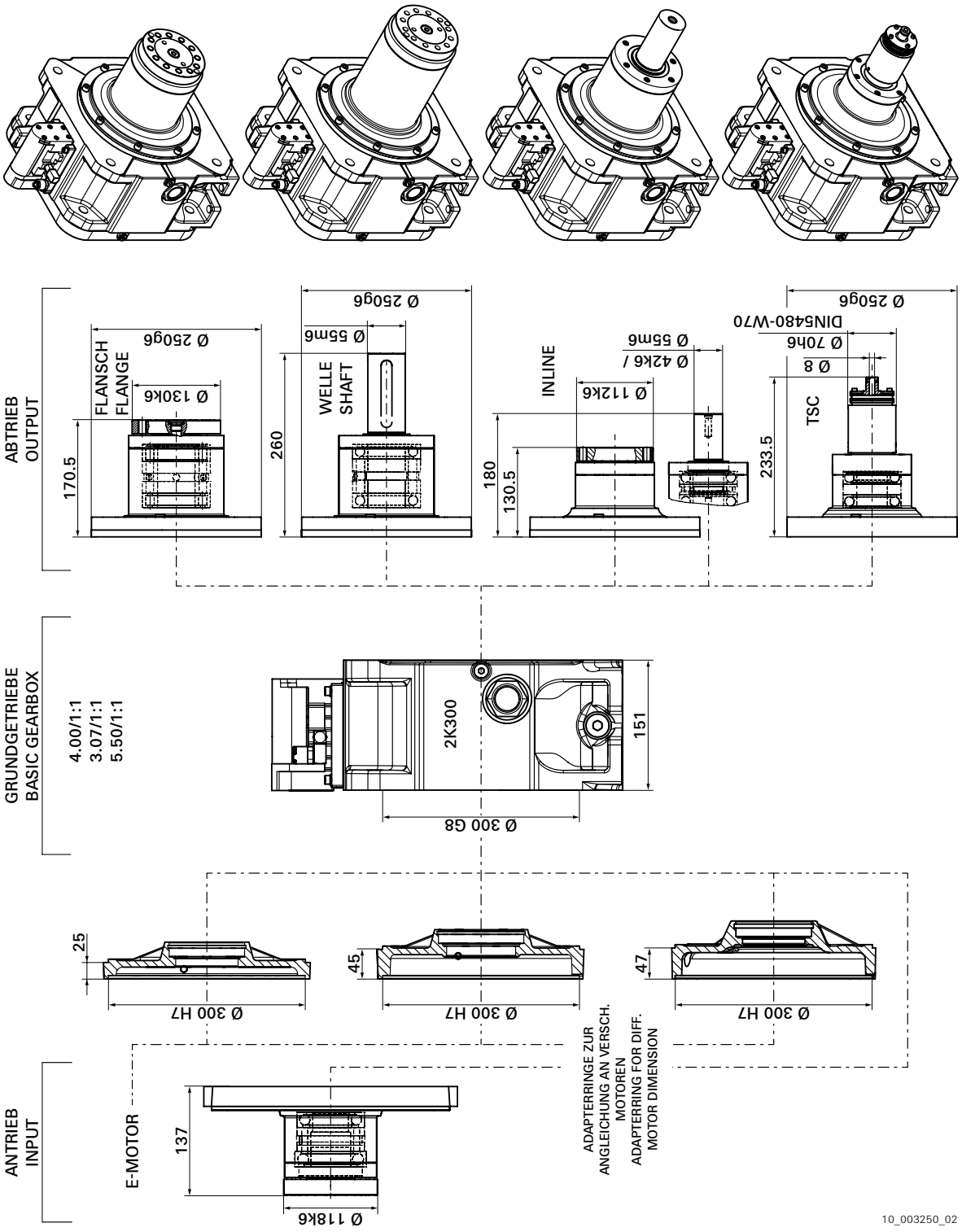
Gearbox selection 2K 120 / 2K 121



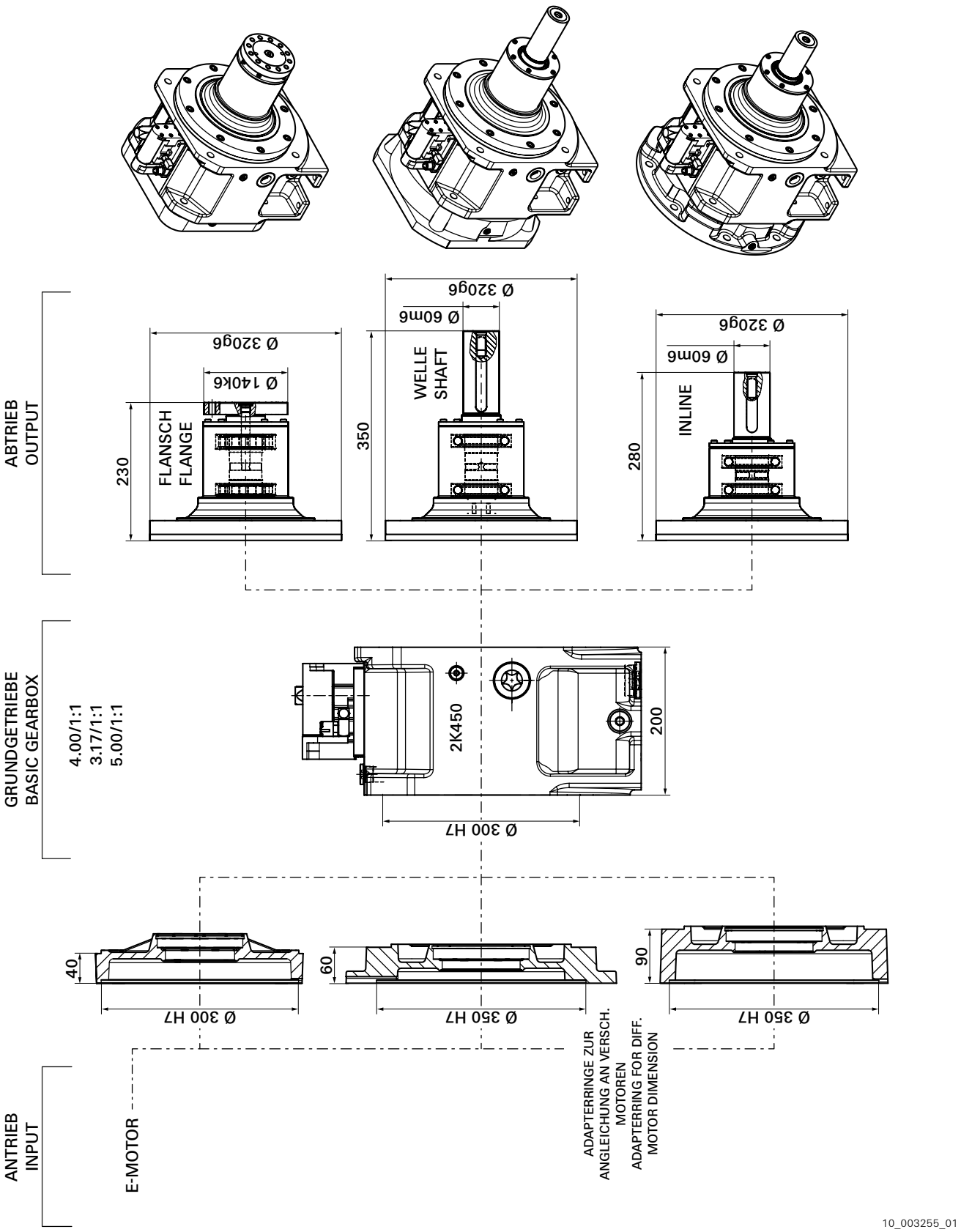
Gearbox selection 2K 250



Gearbox selection 2K 300

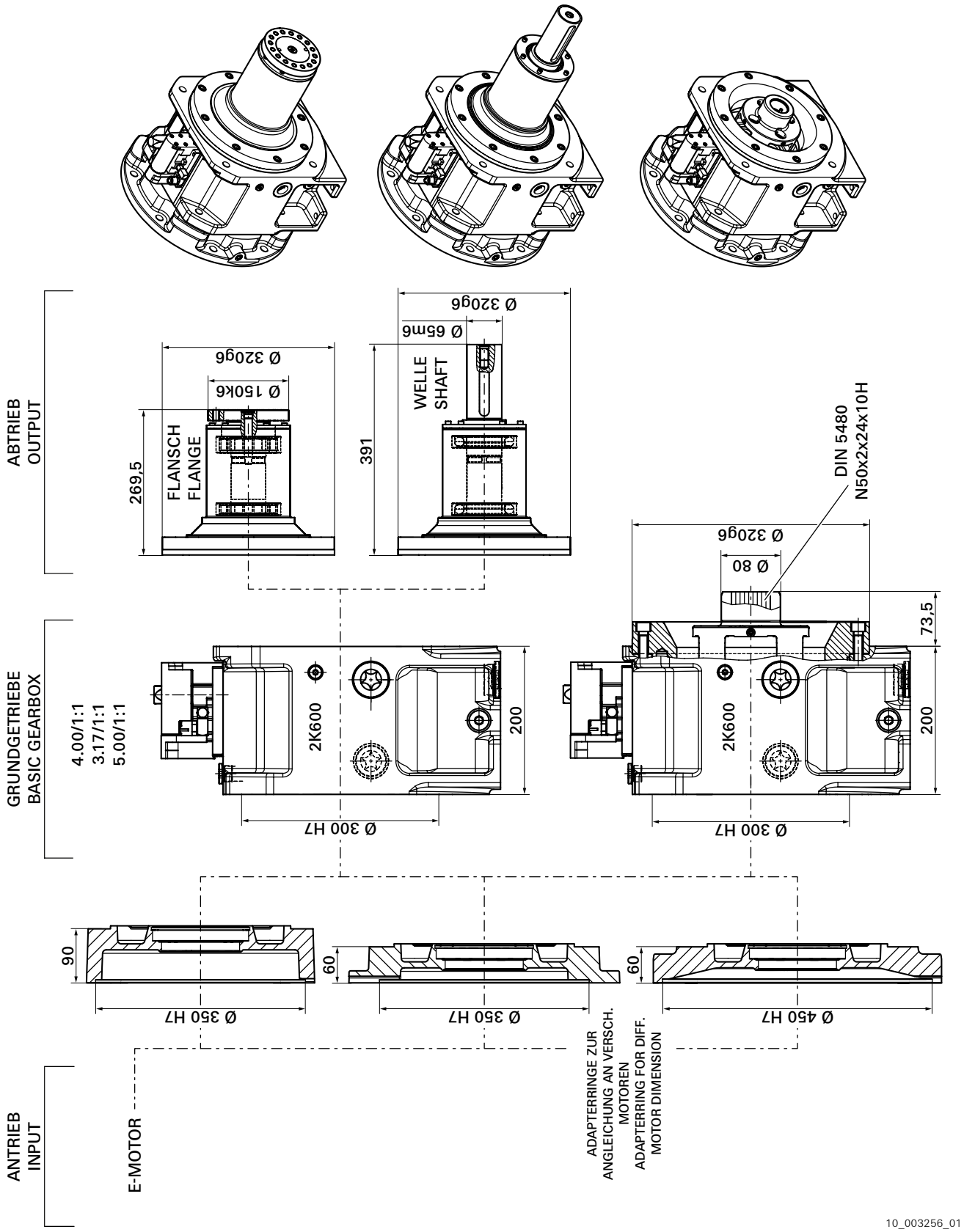


Gearbox selection 2K 450

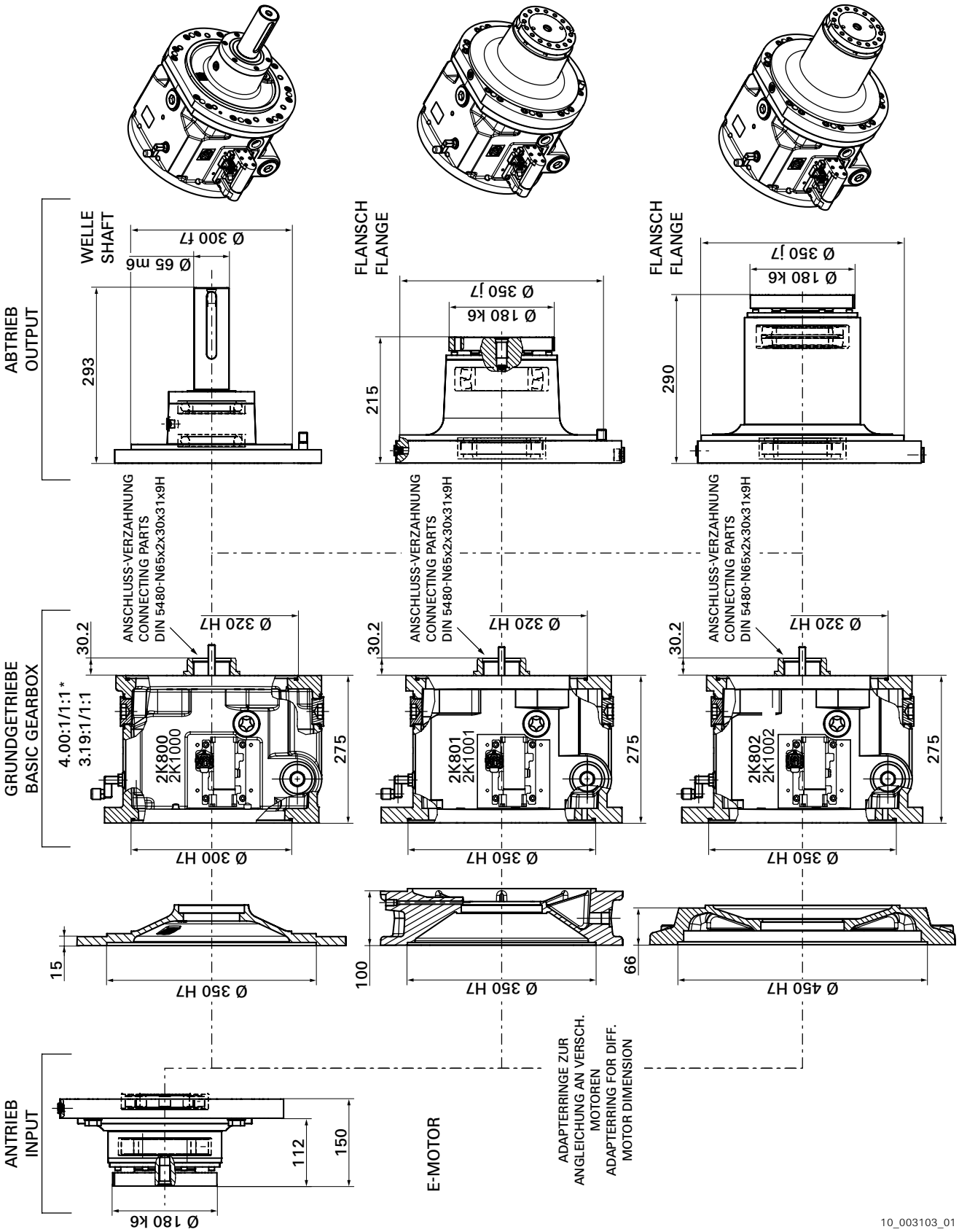


10_003255_01

Gearbox selection 2K 600

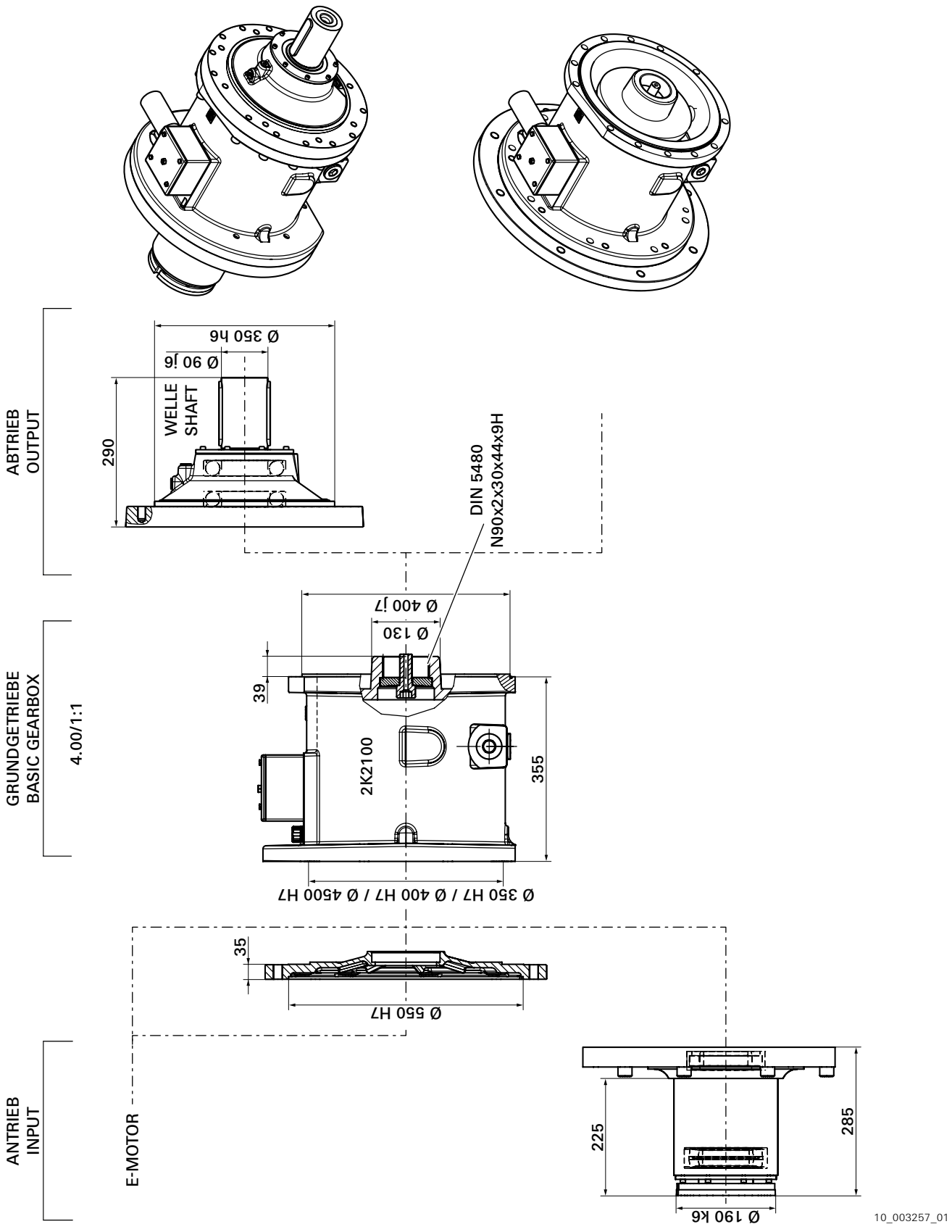


Gearbox selection 2K 800, 2K 1000



* 2K1000 / 1001 / 1002

Gearbox selection 2K 2100



ZF-Duoplan 2K 120 / 2K 121 Standard, Inline, TSC – Order number

Note:
Standard = Bold type
Option = Normal type

1) RWDR = Radial shaft seal
* motor-specific, on request

2	L	G					-						-		0	
1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15

Two-speed gearbox

Motor balancing

Without keyway, with clamping hub	1
Full-key	**4**
Half-key*	5

Gearbox interface (see page12)

Open without hub	0
Open with hub	2
Closed with hub and hub bearing and RWDR[1] *	**3**
Open with hub and adapter ring *	5

ZF gearbox type for motor frame size / ratio

100/i_1 = 4.00	**12**
100/i_1 = 3.16	13
100/i_1 = 4.91	09
112/i_1 = 4.00	**11**
112/i_1 = 3.16	14
100/i_1 = 4.91	08

Output bearings

Cylindrical roller / ball bearings	**3**
Angular-contact ball bearings	4

Gearbox output

a_1 = 38 mm	B
a_1 = 100 mm	**C**
a_1 = 38 mm, smooth, without keyway	L
a_1 = 38 mm, INLINE	P
a_1 = 38 mm, INLINE, smooth, without keyway	G
a_1 = 70 x 70 mm, INLINE, TSC	U
a_1 = 70 x 70 mm, DIN 5480, INLINE, TSC	W

Installation position

V1 / B5 / B5 (clockwise rotation)	**C**
V3 central lube oil supply in output shaft / radial lube oil supply in bearing housing	B

Motor shaft diameter and length “d x l”

Without hub	0
32 mm x 80mm (not with clamping hub)	2
38 mm x 80 mm	**3**
42 mm x 110 mm	4
48 mm x 110 mm	9

Torsional backlash on gearbox output

Normal backlash max. 30 arcmin	**1**
Reduced backlash max. 20 arcmin	3
Minimal reduced backlash max. 15 arcmin	4

Reduced vibration

S

Rotary union for output shaft

T

Duoplan 2K 250 Standard, Inline, TSC – Order number

Note:
Standard = Bold type
Option = Normal type

1) RWDR = Radial shaft seal
* motor-specific, on request

2	L	G					-						-			
1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15

Two-speed gearbox

Motor balancing
Without keyway, with clamping hub 1
Full-key **4**
Half-key* 5

Gearbox interface (see page 12)
Open without hub 0
Open with hub 2
Closed with hub and hub bearing and RWDR[1] * **3**
Open with hub and adapter ring * 5
Input flange D = 118 (2K 250 standard) 9

Gearbox type
$132/i_1 = 4.00$ Ø 230 **05**
$132/i_1 = 3.07$ Ø 230 06
$132/i_1 = 5.50$ Ø 230 (not TSC) 07
$132/i_1 = 4.00$ Ø 250 **15**
$132/i_1 = 3.07$ Ø 250 16
$132/i_1 = 5.50$ Ø 250 (not TSC) 17

Output bearings
Cylindrical roller / ball bearings **3**
Angular-contact ball bearings 4
Spindle ball bearings 6

Gearbox output
$a_1 = 118$ mm **F**
$a_1 = 130$ mm J
$a_1 = 130$ mm, wide bearing base R
$a_1 = 42$ mm K
$a_1 = 42$ mm, smooth, without keyway L
$a_1 = 42$ mm, INLINE P
$a_1 = 42$ mm, INLINE, smooth, without keyway G
$a_1 = 55$ mm M
$a_1 = 55$ mm, smooth, without keyway N
$a_1 = 55$ mm, INLINE A
$a_1 = 55$ mm, INLINE, smooth, without keyway H
$a_1 = 70 \times 70$ mm, INLINE, TSC U
$a_1 = 70 \times 70$ mm, DIN 5480, INLINE, TSC W
$a_1 = 112$ mm, INLINE T

Installation position
B5 / V1 / B5 (clockwise rotation) **C**
V3 central lube oil supply in output shaft / radial lube oil supply in bearing housing B

Motor shaft diameter and length "d x l"
Without hub 0
42 mm x 110 mm 1
48 mm x 110 mm **2**
55 mm x 110 mm 3
60 mm x 140 mm 4

Torsional backlash on gearbox output
Normal backlash max. 30 arcmin **1**
Reduced backlash max. 20 arcmin 3
Minimal reduced backlash max. 15 arcmin 4

Neutral shift position N

Reduced vibration S

Integrated oil channel version for max. speeds and dry sump lubrication M

Rotary union for output shaft T

Duoplan 2K 300 Standard, Inline, TSC – Order number

Note:
Standard = Bold type
Option = Normal type

1) RWDR = Radial shaft seal
* motor-specific, on request

2	L	G					-						-			
1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15

Two-speed gearbox

Motor balancing

Without keyway, with clamping hub	1
Full-key	**4**
Half-key*	5

Gearbox interface (see page 12)

Open without hub with clamping hub	0
Open with hub	2
Closed with hub and hub bearing and RWDR[1] *	**3**
Open with hub and adapter ring *	5
Input flange D = 118	9

Gearbox type

160/i_1 = 4.00	**20**
160/i_1 = 3.07	21
160/i_1 = 5.50 (not for TSC)	22

Output bearings

Cylindrical roller / ball bearings	**3**
Angular-contact ball bearings	4
Spindle ball bearings	6

Gearbox output

a_1 = 118 mm	F
a_1 = 130 mm	**J**
a_1 = 130 mm, wide bearing base	R
a_1 = 42 mm	K
a_1 = 42 mm, smooth, without keyway	L
a_1 = 42 mm, INLINE	P
a_1 = 42 mm, INLINE, smooth, without keyway	G
a_1 = 55 mm	M
a_1 = 55 mm, smooth, without keyway	N
a_1 = 55 mm, INLINE	A
a_1 = 55 mm, INLINE, smooth, without keyway	H
a_1 = 70 x 70 mm, INLINE, TSC	U
a_1 = 70 x 70 mm, DIN 5480, INLINE, TSC	W
a_1 = 112 mm, INLINE	T

Installation position

B5 / V1 / B5 (clockwise rotation)	**C**
V3 central lube oil supply in output shaft / radial lube oil supply in bearing housing	B

Motor shaft diameter and length “d x l”

Without hub	0
55 mm x 110 mm	**1**
48 mm x 110 mm	2
42 mm x 110 mm	3
60 mm x 140 mm	4

Torsional backlash on gearbox output

Normal backlash max. 30 arcmin	**1**
Reduced backlash max. 20 arcmin	3
Minimal reduced backlash max. 15 arcmin	4

Reduced vibration

S

Integrated oil channel version for max. speeds and dry sump lubrication (for B5 please order V1 version)

M

Rotary union for output shaft

T

Cooling flange in combination with ordering „M“

K

Neutral shift position

N

Duoplan 2K 450 / 2K 600 Standard, Inline – Order number

Note:
Standard = Bold type
Option = Normal type

1) RWDR = Radial shaft seal
* motor-specific, on request

2	L	G					-						-		0	0
1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15

Two-speed gearbox

Motor balancing

Full-key	**4**
Half-key*	5

Gearbox interface (see page 12)

Open without hub	0
Open with hub	2
Closed with hub and hub bearing and RWDR[1] *	**3**

Gearbox type

160/i_1 = 4.00	**Spigot Ø 300 mm**	**30**
160/i_1 = 5.00	Spigot Ø 300 mm	31
160/i_1 = 3.172	Spigot Ø 300 mm	32
180/i_1 = 4.00	**Spigot Ø 300 mm**	**40**
180/i_1 = 5.00	Spigot Ø 300 mm	41
180/i_1 = 3.172	Spigot Ø 300 mm	44
200/i_1 = 4.00	**Spigot Ø 350 mm**	**42**
200/i_1 = 5.00	Spigot Ø 350 mm	43
200/i_1 = 3.172	Spigot Ø 350 mm	45
225/i_1 = 4.00	**Spigot Ø 450 mm**	**46**
225/i_1 = 5.00	Spigot Ø 450 mm	47
225/i_1 = 3.172	Spigot Ø 450 mm	48

Output bearings

Without output	0
Cylindrical roller ball bearings	**3**
Angular-contact ball bearings	4

Gearbox output

Without, driving spline N50	N
a_1 = 140 mm (only for 2K 450)	**F**
a_1 = 150 mm (only for 2K 600)	**J**
a_1 = 60 mm (only for 2K 450)	K
a_1 = 60 mm, smooth, without keyway (only for 2K 450)	L
a_1 = 60 mm, INLINE (only for 2K 450)	P
a_1 = 60 mm, INLINE (only for 2K 450), smooth, without keyway	G
a_1 = 65 mm (only for 2K 600)	M
a_1 = 65 mm, smooth, without keyway (only for 2K 600)	H

Installation position

B5 / V1	**C**
V3	**B**

Motor shaft diameter and length "d x l"

Without hub	0
60 mm x 140 mm (2K 450)	**1**
65 mm x 140 mm (2K 600)	**2**
70 mm x 140 mm	3
75 mm x 140 mm	4
80 mm x 170 mm	5
55 mm x 110 mm	6

Torsional backlash on gearbox output

Normal backlash max. 30 arcmin	**1**
Reduced backlash max. 20 arcmin	3

Neutral shift position

N

Duoplan 2K 800 / 2K 801 / 2K 802 Standard – Order number

Note:
Standard = Bold type
Option = Normal type

1) RWDR = Radial shaft seal
* motor-specific, on request

2	L	G					-						-		0	0
1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15

Two-speed gearbox

Motor balancing

Full-key	**4**
Half-key*	5

Gearbox interface (see page 12)

Open without hub	0
Open with hub	**2**
Closed with hub and RWDR[1] *	4
Open with hub and adapter ring *	5
Input flange (Ø = 180 k6)	9

Gearbox type

180/i_1 = 4.00	**Spigot Ø 300 mm**	**50**
180/i_1 = 3.19	Spigot Ø 300 mm	51
200/i_1 = 4.00	**Spigot Ø 350 mm**	**60**
200/i_1 = 3.19	Spigot Ø 350 mm	61
225/i_1 = 4.00	**Spigot Ø 450 mm**	**70**
225/i_1 = 3.19	Spigot Ø 450 mm	71

Holding brake

without holding brake	**1**

Gearbox output

Without, driving spline N65	N
Without, driving spline N80**	Y
a_1 = 65 mm	H
a_1 = 65 mm, smooth without keyway	L
a_1 = 180 mm	**J**
a_1 = 180 mm, wide bearing base	R

Installation position

V1 / B5	**C**
V3	B

Motor shaft diameter and length “d x l”

Without hub	0
60 mm x 140 mm	**1**
65 mm x 140 mm	**2**
75 mm x 140 mm	**3**
80 mm x 170 mm	4
70 mm x 140 mm	5

Torsional backlash on gearbox output

Normal backlash max. 40 arcmin	**1**

Neutral shift position

N

** On request

Duoplan 2K 1000 / 2K 1001 / 2K 1002 Standard – Order number

Note:
Standard = Bold type
Option = Normal type

1) RWDR = Radial shaft seal
* motor-specific, on request

2	L	G					-						-		0	0
1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15

Two-speed gearbox

Motor balancing (4)

Full-key	**4**
Half-key*	5

Gearbox interface (see page 12) (5)

Open without hub	0
Open with hub	**2**
Closed with hub and RWDR[1] *	4
Open with hub and adapter ring *	5
Input flange (Ø = 180 k6)	9

Gearbox type (6, 7)

180/i_1 = 4.00	**Spigot Ø 300 mm**	**90**
200/i_1 = 4.00	**Spigot Ø 350 mm**	**92**
225/i_1 = 4.00	**Spigot Ø 450 mm**	**94**

Holding brake (8)

Without holding brake	**1**

Gearbox output (9)

Without, driving spline N65	N
Without, driving spline N80**	Y
a_1 = 65 mm	H
a_1 = 65 mm, smooth without keyway	L
a_1 = 180 mm	**J**
a_1 = 180 mm, wide bearing base	R

Installation position (10)

V1 / B5	**C**
V3	B

Motor shaft diameter and length “d x l” (11)

Without hub	0
60 mm x 140 mm	**1**
65 mm x 140 mm	**2**
75 mm x 140 mm	**3**
80 mm x 170 mm	4
70 mm x 140 mm	5

Torsional backlash on gearbox output (12)

Normal backlash max. 40 arcmin	**1**

Neutral shift position (13)

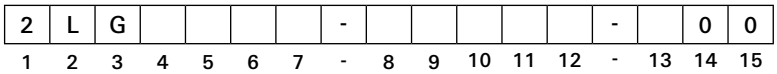
N

** On request

Duoplan 2K 2100 Standard – Order number

Note:
Standard = Bold type
Option = Normal type

1) RWDR = Radial shaft seal
* motor-specific, on request



Two-speed gearbox

Motor balancing
Full-key **4**
Half-key* 5

Gearbox interface (see page 12)
Open without hub 0
Open with hub **2**
Closed with hub and hub bearing and RWDR[1] * 4
Open with hub and adapter ring * 5
Input flange (Ø = 190 k6) for installation position V1/ B5 9

Gearbox type
Spigot Ø 450 mm, FF500 **80**
Spigot Ø 400 mm, special motor 82
Spigot Ø 350 mm, FF400 84
Spigot Ø 550 mm, FF600 86
Spigot Ø 680 mm, FF740 88

Holding brake
Without holding brake **1**

Gearbox output
Without output, driving spline N90 **N**
STW, i = 3.196 on request S
a_1 = Ø 90 x 140, keyway 2 x 25 x 14 x 125 H
a_1 = Ø 90 x 140, smooth G

Installation position
V1 / B5 **C**
V3 central lube oil supply in output shaft B

Motor shaft diameter “d”
Without hub 0
75 mm x 140 **1**
80 mm x 170 2
90 mm x 170 3
95 mm x 170 4

Torsional backlash on gearbox output
Normal backlash max. 40 arcmin **1**

Neutral shift position
N

Request for quotation?

Please fill out the questionnaire below and send to:
Fax +49 7541 77-903610 or
Email industrial-drives@zf.com

Sender:

1. Motor (enclose motor data form)

Motor brand

Type

Size

Nominal power (kW)

Max. torque (Nm)

Motor operating speed n_1 to n_2 (rpm) at constant power

Max. speed (rpm)

Motor shaft diameter d (mm)

Motor shaft length l (mm)

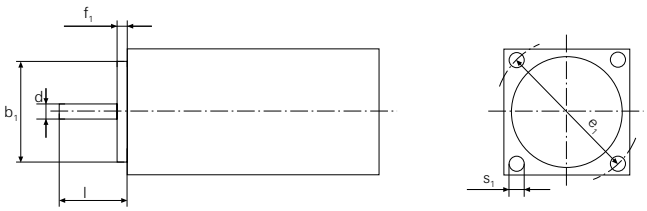
Pilot diameter b_1 (mm)

Pilot width f_1 (mm)

Pcd e_1 (mm)

Hole diameter s_1 (mm)

Fitting key l x b x h (mm)



☐ Motor shaft with keyway

☐ Motor shaft without keyway

☐ Motor shaft with shaft seal

☐ Motor shaft without shaft seal

☐ Full-key balanced motor shaft

☐ Half-key balanced motor shaft

2. Duoplan type

☐ 2K 120	☐ 2K 300	☐ 2K 800	☐ 2K 1000	☐ 2K 2100
☐ 2K 121	☐ 2K 450	☐ 2K 801	☐ 2K 1001	
☐ 2K 250	☐ 2K 600	☐ 2K 802	☐ 2K 1002	

	Standard	Option
Gearbox interface	☐ Open	☐ With adapter plate, hub bearing and shaft seal ☐ With adapter plate and shaft seal ☐ With adapter ring ☐ With input flange (2K 250 / 300 / 800 / 1000 / 2100)
Ratio i_1	☐ 4.00 Standard ☐ 3.1 (2K 120 / 121 / 250 / 450 / 600 / 800 / 1000)	☐ 5.0 (2K 450 / 600) ☐ 5.5 (2K 250 / 300) ☐ 4.91 (2K 120 / 121)
Installation position	☐ B5 ☐ B5 clockwise rotation ☐ V1	☐ V3
Output bearings	☐ Cylindrical roller bearings ☐ Cylindrical roller bearings/ roller bearings (2K 120 / 121)	☐ Angular-contact ball bearings ☐ Self aligning- and cylinder ball bearings (2K 800 / 801 / 802 / 1000 / 1001 / 1002)
Lubrication system	☐ Splash type lubrication ☐ Integrated oil channel system ☐ Dry sump lubrication	
Gearbox output	☐ Gearbox with output flange ☐ 100 mm (2K 120 / 121) ☐ 118 mm (2K 250 / 300) ☐ 130 mm (2K 300 / 250) ☐ 140 mm (2K 450) ☐ 150 mm (2K 600) ☐ 180 mm (2K 800 / 801 / 802 1000 / 1001 / 1002) ☐ Rotary union for output shaft	☐ Gearbox with output shaft ☐ 38 mm (2K 120 / 121) ☐ 38 mm (2K 120 / 121 INLINE) ☐ 42 mm (2K 250 / 300) ☐ 42 mm (2K 250 / 300 INLINE) ☐ 55 mm (2K 300 / 250) ☐ 60 mm (2K 450) ☐ 65 mm (2K 600 / 800 / 801 / 802 / 1000 / 1001 / 1002) ☐ 70 mm DIN 5480 (2K 120 TSC / 121 TSC / 250 TSC / 300 TSC) ☐ 90 mm (2K 2100) ☐ Gearboxes for direct mounting without output (2K 600 / 800 / 801 / 802 / 1000 / 1001 / 1002 / 2100)
Torsional backlash at gearbox output	☐ < 30 min ☐ < 40 min	☐ < 20 min ☐ < 15 min

Quantity per year _____

Order-No. _____

Application _____

Subject to technical change without notice. For installation investigation purposes, please request installation drawings; only the data contained therein is binding.

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ZF Group
Industrial Technology
Marine & Special Driveline Technology
88038 Friedrichshafen
Germany

Phone +49 7541 77-3610
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