



HIGH PRECISION REDUCTION GEARS

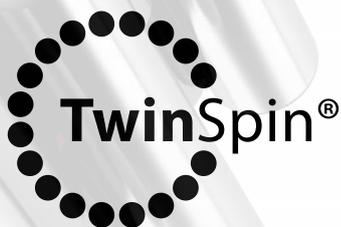


HIGH PRECISION ACTUATORS





HIGH PRECISION REDUCTION GEARS



G series

G series



T series

T series



E series

E series



H series

H series



M series

M series

HIGH PRECISION ACTUATORS



DS series

DS



DSH series

DSH



DSM series

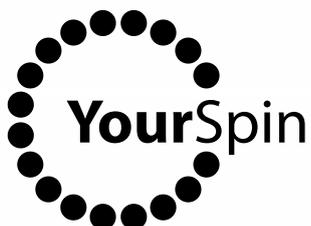
DSM



DSF series

DSF

SPECIAL SOLUTION



Customized gears

Gears

Customized actuators

Actuators

TwinSpin® - HIGH PRECISION REDUCTION GEARS
DriveSpin® - HIGH PRECISION ACTUATORS

The SPINEA catalogue, as well as further catalogues and publications are available on our website www.spinea.com in the DOWNLOADS section. You can also find helpful information on our multimedia USB, which includes technical documentation. In addition, it also includes an interactive presentation of the TwinSpin® operating principle and 2D/3D technical drawings. Please contact the SPINEA sales department or your sales representative for your free copy.

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Company Address:
SPINEA, s.r.o.
Okrajová 33
080 05 Prešov
Slovakia, EU

Plant Address:
SPINEA, s.r.o.
Ku Magašu 702/3
080 01 Haniska - Prešov
Slovakia, EU

Sales Department:
Tel: +421 51 770 01 56
E-mail: info@spinea.com
sales@spinea.com
Web: www.spinea.com



Company Address:
SPINEA Technologies s.r.o.
Volgogradská 13
080 01 Prešov
Slovakia, EU

Web: www.spinea-technologies.com

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NEW EDITION

Trademark note:
Trademark TwinSpin® registered in: EU member states.
Trademark DriveSpin® registered in: SK, DK, GB, IL, IN, JP, KR, SE, TR, US, AT, BX, CH, CN, CZ, DE, FR, PL, RU





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SPINEA

EXCELLENCE IN MOTION

SPINEA, s.r.o. is a modern Slovak engineering company, engaged in the development, manufacturing and sales of high-precision reduction gears, sold under the trademark TwinSpin®. An invention of a Slovak engineer was the impulse for the company establishment in 1994. The TwinSpin® high precision reduction gears are serially manufactured, based on the grant of an international patent. The TwinSpin® gears belong to a category of hi-tech products and represent a unique technical solution, which integrates radial-axial bearings with a high precision reduction gear into a single compact unit. The products of the company are suitable for applications, which require high reduction-gear ratio, high kinematic precision, zero-backlash motion, high torque capacity, high rigidity, compact design in a limited installation space as well as low weight. They are widely used in automation and industrial robotics, in the field of machine tools manufacturing, in navigation and camera equipment, medical systems and in many other fields.



SPINEA

TECHNOLOGIES

SPINEA Technologies, s.r.o. is a young research and development technology company, which is engaged in continuous development in the field of electrical actuators based on the G and TS-I bearing reducer platform, as well as development of customer-oriented mechatronic units. The company was founded at the end of 2012 through separation of the electric drives department from the parent company SPINEA s.r.o., while the impulse was to bring unique technologies, methods, and solutions for the industrial market, followed by their implementation into the production process.



1. TwinSpin® - General information

The TwinSpin® (TS) high precision reduction gears are based on a new reduction mechanism and a new design of the radial-axial output bearing. As a result, they represent a new generation of power transmission systems. The notion "TwinSpin®" indicates the full integration of a high precision trochoidal reduction gear and a radial-axial bearing in a single unit. This new transmission concept allows the use of the reduction gears directly in robot joints, rotary tables and wheel gears in various transport systems. The TwinSpin® high precision reduction gears are designed for applications requiring a high reduction ratio, high kinematic accuracy, low lost motion, high moment capacity and high stiffness of a compact design with limited installation space and low mass.

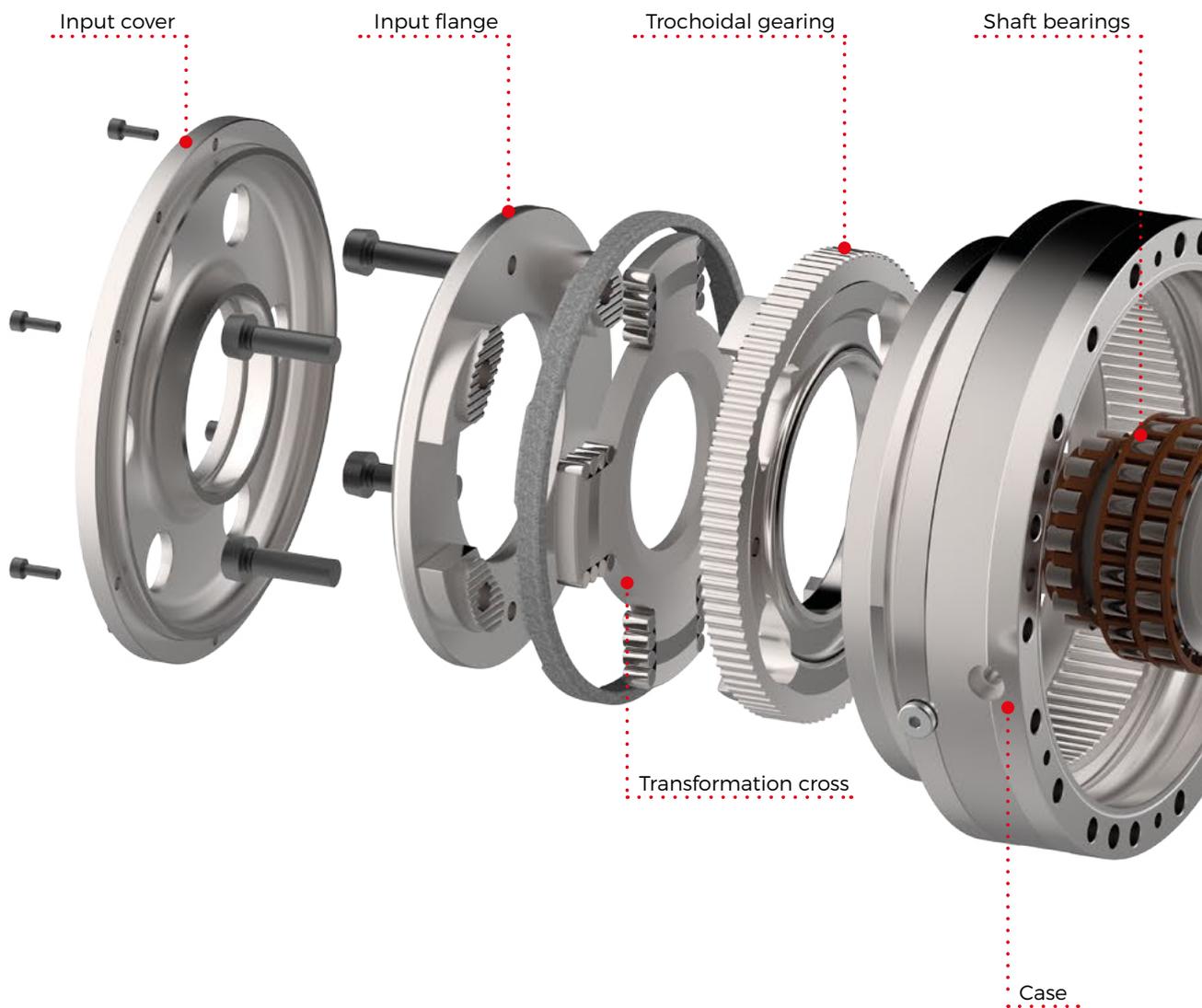
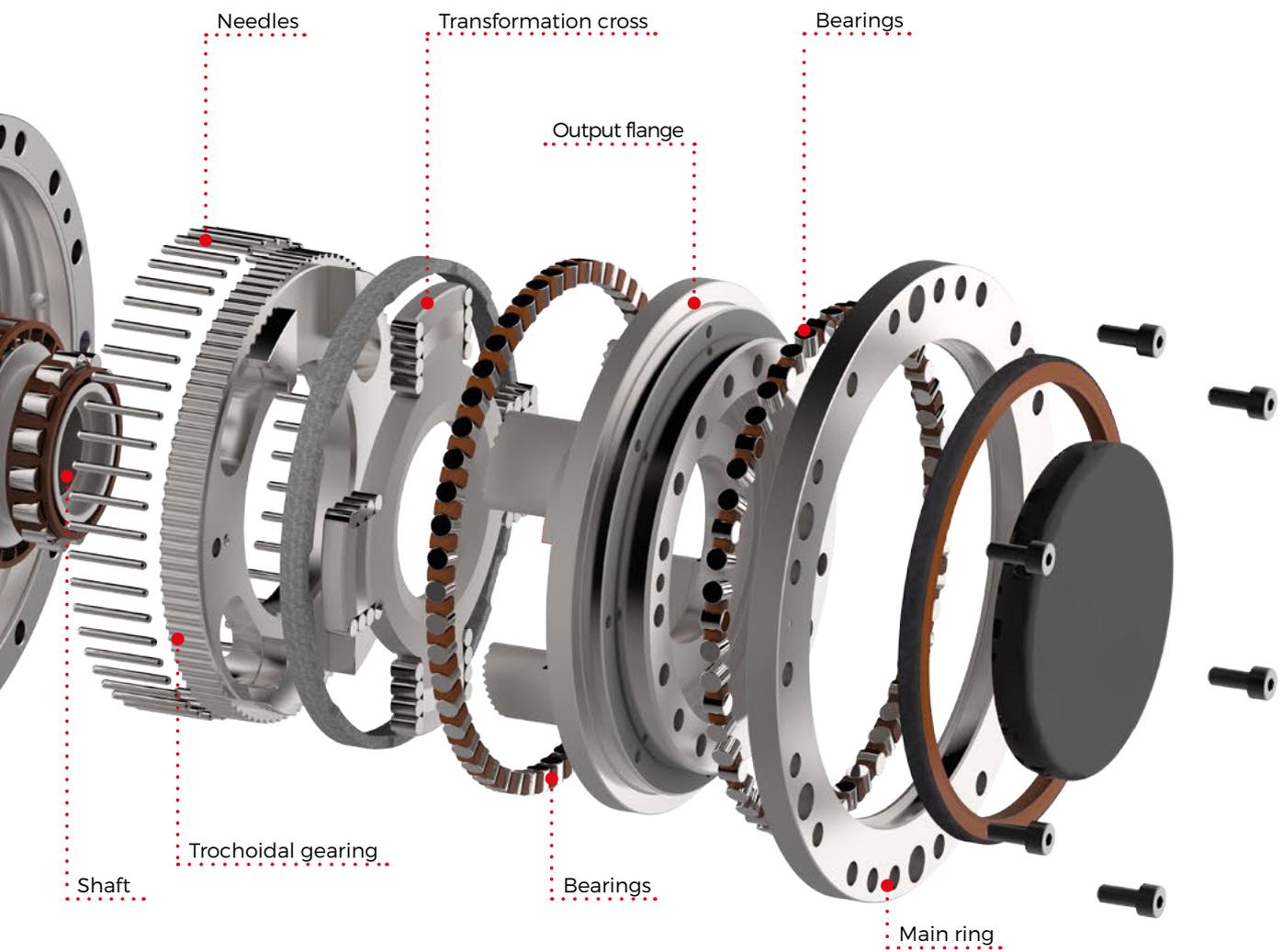


Fig. 1.a: TwinSpin® reduction gears components



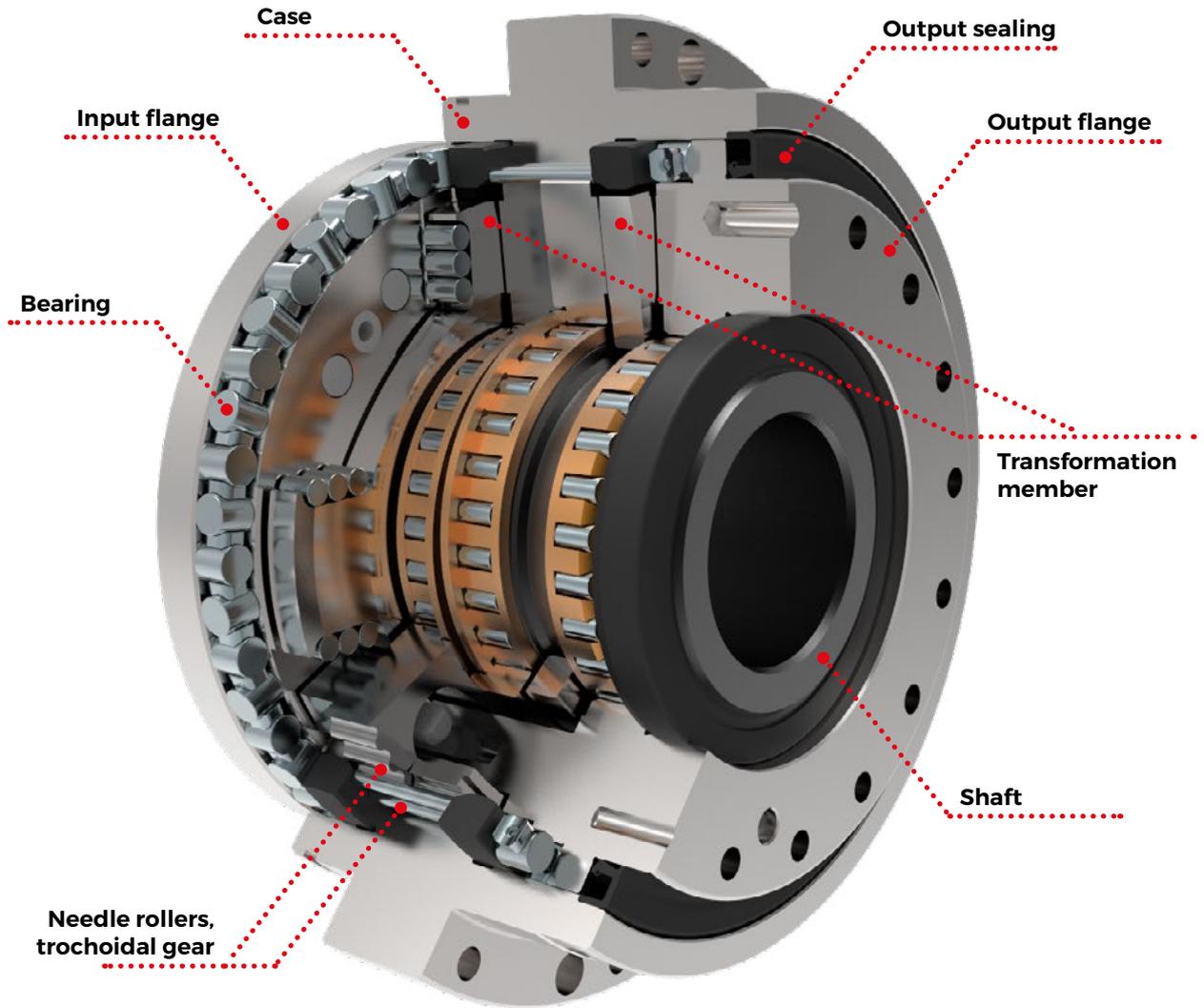


Fig. 1.b: TwinSpin® cross section

Output sealing

On the output flange side, it prevents internal contamination and lubricant leakage from the reduction gear.

Case

Incorporates the high capacity precision radial-axial output bearings integrated in the reduction gear.

Flanges

Input and output flanges are fixed together by fitted bolts, and rotate at reduced speed in the radial-axial output bearing relative to the case.

Shaft

High-speed member of the reduction mechanism carried by roller bearings in the flanges. Bearing raceways are ground directly on the shaft and the flanges. The shaft eccentrics rotationally support the trochoidal gears via roller bearings.

Trochoidal gearing

Their trochoidal profile with almost 50% simultaneous meshing ensures transmission of high torque and backlash-free performance of the reduction gear.

Transformation member

Transforms the planetary motion of the trochoidal gears to the rotary motion of a pair of flanges.


 $\alpha=0^\circ$

The input shaft of the reduction gear is in zero point.


 $\alpha=90^\circ$

Rotation of the input shaft by 90° causes the revolution of the cycloidal gear (1/4 of spacing of the cycloidal tooth). Direction of the cycloidal gear rotation is opposite with regard to the rotation of input shaft.


 $\alpha=180^\circ$

Rotation of the input shaft by 180° causes the revolution of the cycloidal gear (2/4 of spacing of the cycloidal tooth).

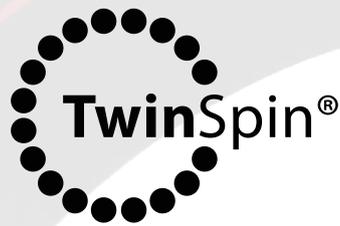

 $\alpha=270^\circ$

Rotation of the input shaft by 270° causes the revolution of the cycloidal gear (3/4 of spacing of the cycloidal tooth).


 $\alpha=360^\circ$

Rotation of the input shaft by 360° causes the revolution of the cycloidal gear (4/4 of spacing of the cycloidal tooth).

Fig. 1.1: Operating principle



Advantages

The TwinSpin® high precision reduction gears meet the requirements of even the most demanding customers across all industrial fields. With optimal price-performance ratio they reliably ensure parameters such as high precision, compactness, high tilting as well as torsional stiffness, low weight, low vibrations or wide range of gear ratios.

Exceptional precision

With the utilization of our own patented design the reduction gears represent an unrivalled precise solution, while at the same time keeping a wide range of dimensions and gear ratios.

High overload capacity, long lifetime

The reduction gears are characterized by easy implementation and excellent tilting and torsional stiffness parameters. At the same time they keep a trouble-free operation with exceptionally low noise and vibrations at a wide range of application environment temperature ranges. They rely on high resistance and overload capacity of the gearbox with integrated radial-axial bearings. Subsequently, your initial investment will project into maintenance cost saving, during entire utilization time.

Uniquely balanced design

TwinSpin® represents an integration of high load carrying reduction gear with a unique reduction mechanism and high load carrying output bearings into one compact unit. Small dimensions and first-class technical parameters lead to high utility value in an optimal performance, dimension and price ratio.

Technical support

Our expertly prepared team of specialists is at your disposal in order to solve any issues. The use of first-rate materials and the manufacturing process are guaranteed by ISO 9000 certificates, and are a fundamental prerequisite of the correct and reliable functioning of our products.

G series



T series



E series



H series



M series



2. TwinSpin® series

Tab. 2.a: Overview of the high precision reduction gear versions

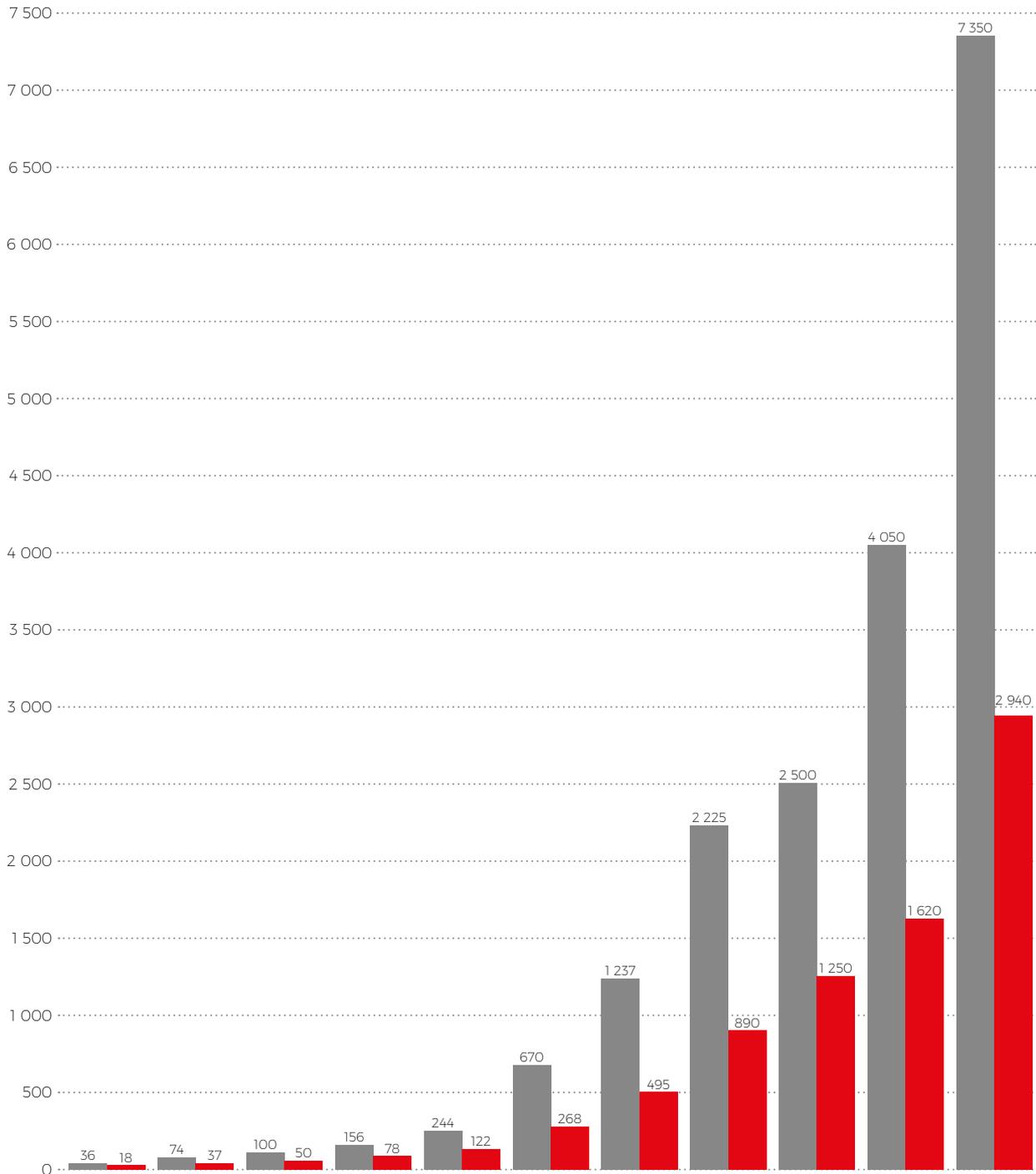
Series	Rated output torque	Tilting stiffness	Torsional stiffness	Motor assembly	Radial-axial run-out	No-load starting torque	Lost motion
T	⊕ ⊕ ⊕ ⊕	⊕ ⊕ ⊕ ⊕	⊕ ⊕ ⊕ ⊕	⊕ ⊕ ⊕ ⊕	⊕ ⊕ ⊕ ⊕	⊕ ⊕ ⊕	⊕ ⊕ ⊕ ⊕
E	⊕ ⊕ ⊕ ⊕	⊕ ⊕ ⊕ ⊕	⊕ ⊕ ⊕ ⊕	⊕ ⊕ ⊕ ⊕	⊕ ⊕ ⊕ ⊕	⊕ ⊕ ⊕	⊕ ⊕ ⊕ ⊕
H	⊕ ⊕ ⊕ ⊕	⊕ ⊕ ⊕ ⊕	⊕ ⊕ ⊕ ⊕	⊕ ⊕ ⊕	⊕ ⊕ ⊕ ⊕	⊕	⊕ ⊕ ⊕ ⊕
M	⊕ ⊕ ⊕ ⊕	⊕ ⊕ ⊕	⊕ ⊕ ⊕ ⊕	⊕ ⊕ ⊕ ⊕	⊕ ⊕ ⊕ ⊕	⊕ ⊕ ⊕ ⊕	⊕ ⊕ ⊕ ⊕

Tab. 2.b: Reduction gears sizes, series and models overview

Series	Size	TS 50	TS 60	TS 70	TS 80	TS 110	TS 140	TS 170	TS 200	TS 220	TS 240	TS 300
TB			●	●	●	●	●					
TC								●	●		●	●
E				●	●	●	●	●	●	●		
H				●			●	●	●	●		
M		●										

Acceleration and braking torque [Nm]

Rated output torque [Nm]



Size	TS 50	TS 60	TS 70	TS 80	TS 110	TS 140	TS 170	TS 200	TS 220	TS 240	TS 300
Reduction ratio	47, 63	35, 47, 63, 75	41, 57, 75	37, 63, 85	33, 67, 89, 119	33, 57, 69, 87, 115, 139	33, 59, 69, 83, 105, 125, 141	63, 83, 125, 169	55, 125	37, 87, 121, 153	63, 125, 191

Robotics

6-axis robots, scara robots, portal robots, gantry robots



ABB product

Automation and service robotics

Service robotics, general automation, assembly equipment, rotary tables, welding positioners



Machine tools

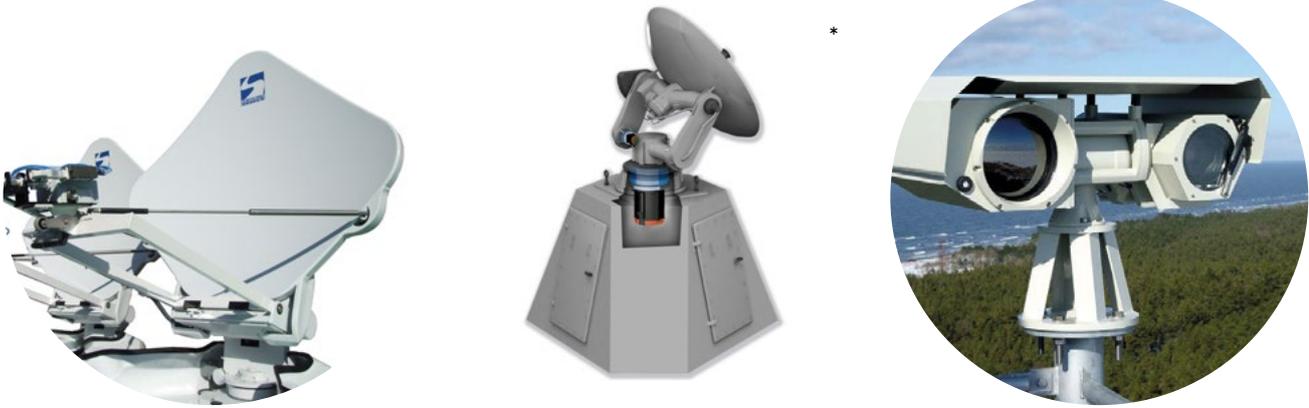
Turning and milling machines, grinding machines, bending machines, cutting machines (waterjet, laser, plasma, etc.) tool changers, pallet changers, rotary tables, cutting heads, woodworking machines, marble and stone machines, rotary transfer machines, woodworking machines



*Illustration image

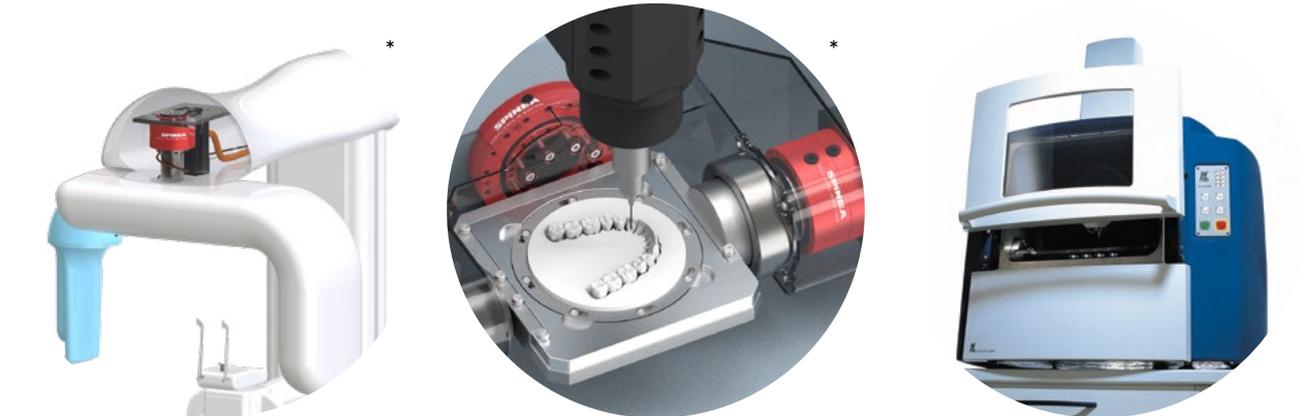
Navigation and security

Radars, navigation equipment, surveillance optoelectronics systems, security and defense equipment, simulation systems



Medical equipment

Surgical robots, radiosurgery devices, medical and rehabilitation devices, scanners, dental milling machines, other medical equipment

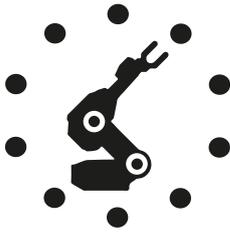


Other applications

Inspection, measuring and testing equipment, textile machines, packaging machines, semiconductor manufacturing, remote camera systems (film industry), calibration systems, rotary positioners in science projects

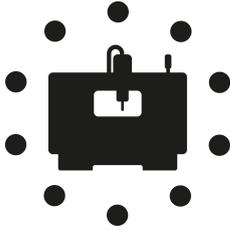


*Illustration image



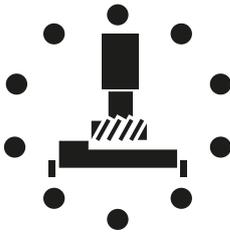
Robotics

6-axis robots, scara robots, portal robots, gantry robots



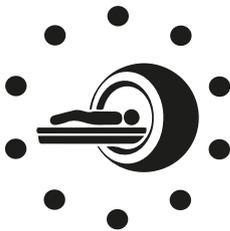
Automation and service robotics

Service robotics, general automation, assembly equipment



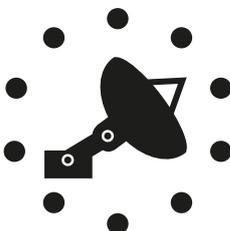
Machine tools

Turning and milling machines, grinding machines, bending machines, cutting machines, tool changers



Medical equipment

Medical and rehabilitation devices, scanners, dental milling machines, other medical equipment



Navigation and security

Radars, navigation equipment, surveillance and camera systems, security and defense equipment



Other applications

Measuring equipment, woodworking machines, textile machines, packaging machines, semiconductor manufacturing

KUKA



COMAU



ABB



KABAN

DMG

MicroStep®

FERMAT



WAFIOS

**ESTUN
ROBOTICS**

HWACHEON

TOSHULIN

Wittmann

MÄGERLE

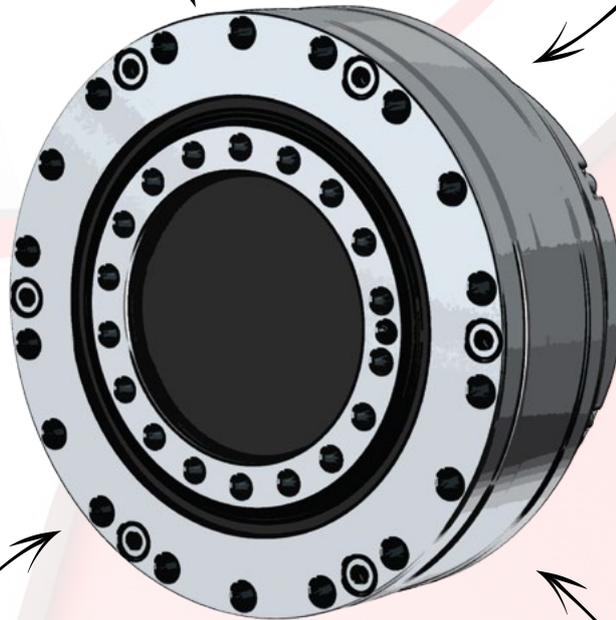
TRUMPF





Friction under control

High precision output bearing



Robust design and overload capacity

High torque density



G series

EXCELLENCE IN PERFORMANCE

2.1 G SERIES



Advantages

- high tilting stiffness
- low friction
- high precision output bearing
- high torque density
- reduced lost motion settings
- high torque overload capacity

The **G series** a new generation of TwinSpin® high precision reduction gears with a new design of the main bearing and improved performance for the most demanding applications. G series brings increase in torque to weight ratio in comparison with the previous generation. Innovative design of main bearing reaches unprecedented tilting stiffness, high precision of the output bearing and modularity of design which allows customised solutions. Further improvements introduced with G series brings further friction reduction in transmission mechanism, lower hysteresis and low settings of Lost Motion, especially in small sizes. Finally with G series new sizes of reducers are introduced in standard and hollowshaft design to broaden portfolio and application range of TwinSpin® reducers.

Tab. 2.1a: G series features

Case	Through holes in case
Input flange connection	The shaft sealing / adapter flange is offered in the following versions: a) motor connection flange b) sealed input cover c) without a flange
Input shaft design	The input shaft is offered in the following versions: a) shaft with a keyway b) according to a special request
Installation and operation characteristics	A wider range of modular configurations

Tab. 2.1b: G series ordering specifications

TS - 225 - 55 - G - P24					
Name	Size	Ratio	Series version	Shaft version	
				P (DIN 6885)	S
TS	75	41, 63 , 75	G	9	•
	85	33 , 63 , 79	G	11	•
	95	43, 73, 95	G	14	•
	115	43 , 69, 123	G	14	•
	155	53, 109 , 133	G	19	•
	185	57 , 67 , 117 , 139	G	24	•
	225	55 , 69, 137	G	24	•

Note: An example of an ordering code of a modified TwinSpin® G series reduction gear with a motor flange:
 TS225 - 55 - G - P24 - M235 - P231. The markings M235 and P231 for a specific modification are defined by the manufacturer.

Shaft version


P

Shaft with a keyway


S

Special shaft

Note: Drawings shows maximum possible size of key-way applicable in each size of TwinSpin® reducer.

Tab. 2.1c: G series rating table

Size	Reduction ratio	Rated output torque	Max. acceleration / deceleration torque	Maximum permissible torque at emergency / E-stop	Rated input speed	Maximum input speed 10)	Lost motion	Hysteresis	Angular transmission error 1) 7)	No-load starting torque (max) 9)
	i	T_r [Nm]	T_{acc} [Nm]	T_{em} [Nm]	n_r [rpm]	n_{max} [rpm]				
TS 75	41	35	70	175	2 000	4 800	<1	<1	72	0.15
	63					5 000				0.1
	75					5 400				0.1
TS 85	33	75	150	375	2 000	4 400	<1	<1	72	0.25
	63					4 800				0.2
	79					5 000				0.2
TS 95	43	85	170	425	2 000	4 000	<1	<1	72	0.35
	73					4 500				0.3
	95					4 800				0.3
TS 115	43	173	346	865	2 000	4 200	<1	<1	60	0.5
	69					4 300				0.45
	123					4 800				0.4
TS 155	53	460	1 150	2 300	2 000	3 400	<1	<1	40	0.8
	109					3 800				0.6
	133					4 200				0.6
TS 185	57	780	1 950	3 900	2 000	3 500	<1	<1	30	1.4
	67					3 700				1.4
	117					4 300				1.2
	139					4 400				1.2
TS 225	55	1 270	3 175	6 350	2 000	3 200	<1	<1	30	1.8
	69					3 400				1.5
	137					4 000				1.4

RIGHT TO CHANGE WITHOUT PRIOR NOTICE RESERVED

- 1) Mean statistical value. For further information see chapter Torsional stiffness, Tilting stiffness.
- 2) Load at output speed 15 rpm and $L_{10} = 12\,000$ hrs.
- 3) Moment M_c value for $F_a = 0$. If $F_a \neq 0$, see chapter 3.5.
- 4) Axial force $F_{a,max}$ value for $M_c = 0$. If $M_c \neq 0$ see chapter 3.5.
- 6) The parameter depends on the version of the high precision reduction gear.
- 7) The parameter depends on the version of the high precision reduction gear, ratio and lost motion.
- 8) The values of the parameters are informative. The exact value depends on the specific version of the high precision reduction gear.
- 9) Temperatures of the high precision reduction gear lower than 20°C will cause higher no-load starting or back driving torque.
- 10) Instantaneous speed peak that may occur within the working cycle.

Tab. 2.1c: G series rating table - continued

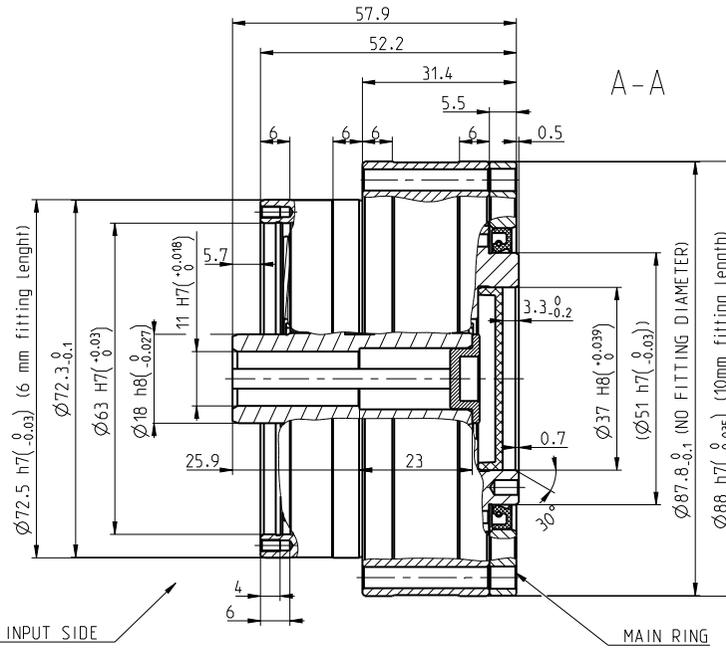
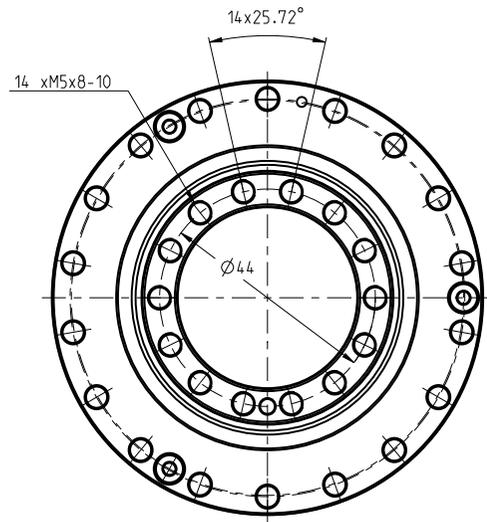
Size	Reduction ratio	Max. backdriving torque 9)	Torsional stiffness 50-100% T_r 1)	Moment stiffness 1)	Rated moment 2) 3)	Allowable moment	Allowable radial force 2)	Allowable axial force 2) 4)	Input inertia 8)	Weight 8)
	i	[Nm]	k_t [Nm/arcmin]	M_t [Nm/arcmin]	M_c [Nm]	M_{cmax} [Nm]	F_r [kN]	$F_{a,max}$ [kN]	I [10^{-4} kgm ²]	m [kg]
TS 75	41	5	8.1	70	95	190	1.8	6.4	0.019	0.95
	63	8	8.2							
	75	10	8.4							
TS 85	33	5	9.5	90	168	336	2.2	6.8	0.034	1.7
	63	15	10.8							
	79	20	10.8							
TS 95	43	20	15	120	205	410	3.5	11.1	0.14	1.9
	73	27	15.3							
	95	38	15.5							
TS 115	43	18	31	220	275	550	4	12.5	0.29	3.2
	69	30	31							
	123	42	32							
TS 155	53	50	85	900	820	1 640	8.3	26.1	0.96	8.3
	109	80	88							
	133	115	90							
TS 185	57	85	147	1 300	1 700	3 400	13.9	43	1.98	12.8
	67	90	148							
	117	120	150							
	139	135	152							
TS 225	55	60	258	2 300	2 190	4 380	15.2	47.4	3.2	22.4
	69	80	300							
	137	230	308							

IMPORTANT NOTES:

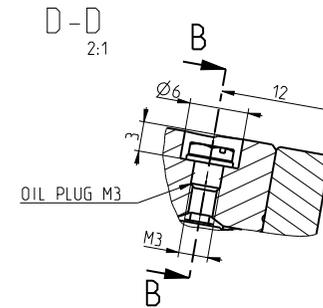
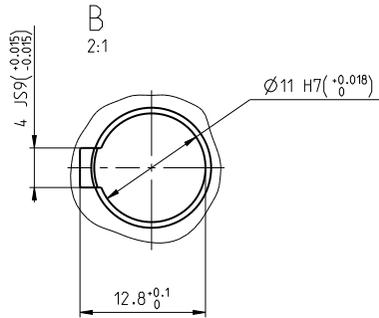
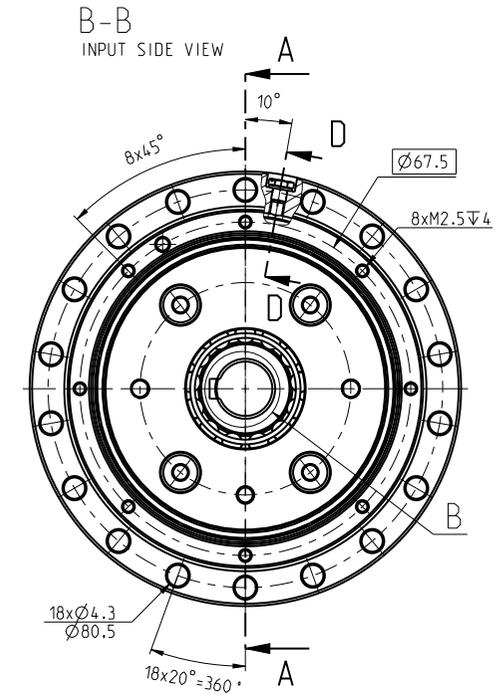
- Load values in the table are valid for the nominal life of $L_{10} = 6\,000$ [Hrs].
- High precision reduction gears are preferred for intermittent cycles (S3-S8); the output speed in applications is inverted-variable.
- The continuous mode cycle (S1) is needed to be consulted with the manufacturer.
- If the output speed in application is less than 0.1 rpm please consult with the manufacturer.
- The values in the table refer to the nominal operating temperature.
- Please note the temperature on the gear case that should not exceed significantly 60°C degrees.

The ratios highlighted in bold are recommended by SPINEA as optimal versions in terms of price and delivery.

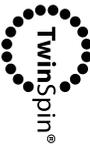
TS 85 - i - G - P11



UNSEALED FROM INPUT SIDE



1. Main ring must be fixed in operation with 18pcs of screw M4, st 12.9, tilghtening torque 5 Nm
 2. Unsealed space, see assembly manual in catalogue TS G
- RECOMENDATION FOR SEALING MOTOR FLANGE:
 Recommended tolerance for fitting diameter ($\varnothing 63$ $^{+0.03/-0.06}$)

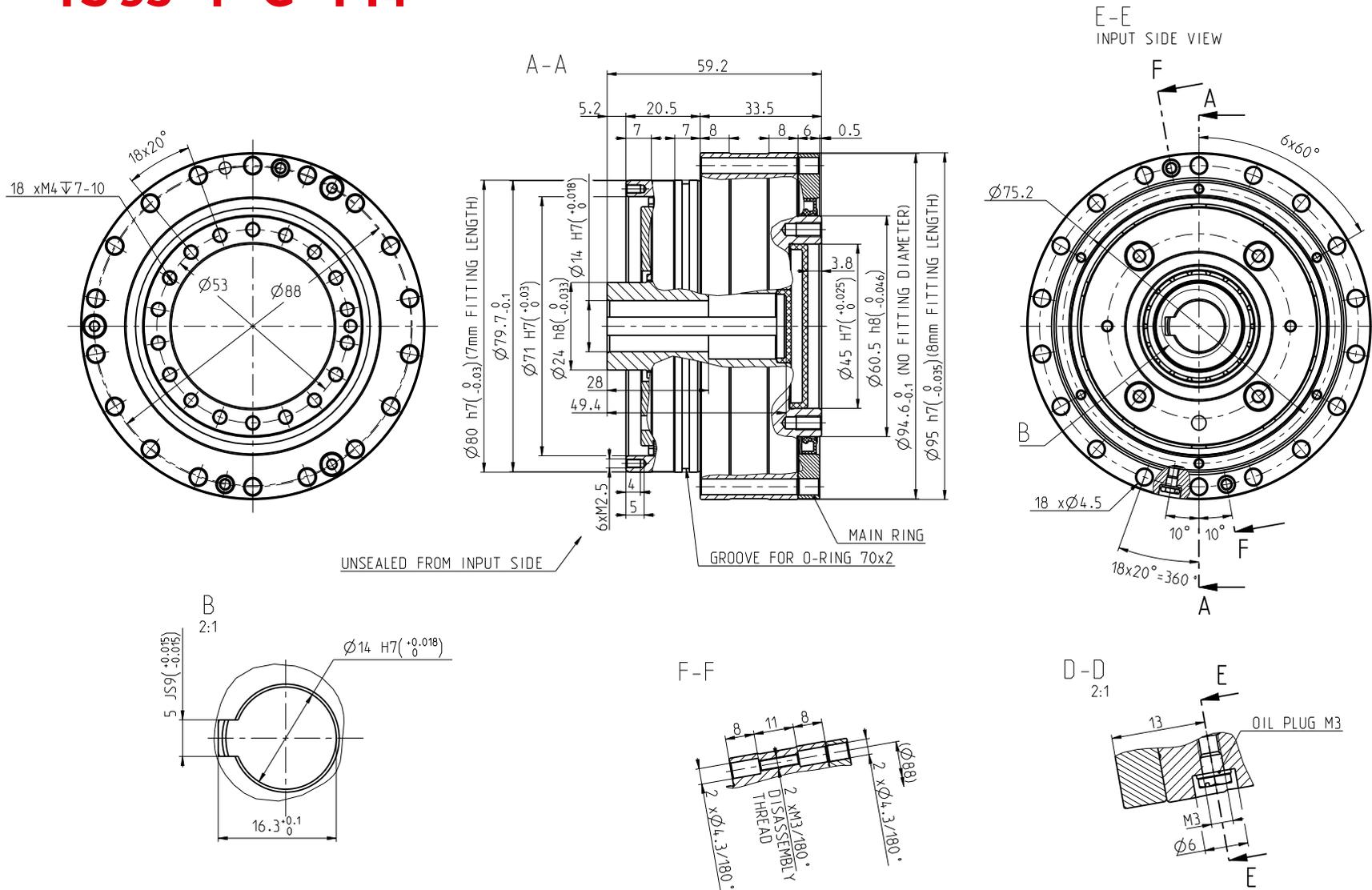


TS 85 - i - G - P11

Drawings

G series

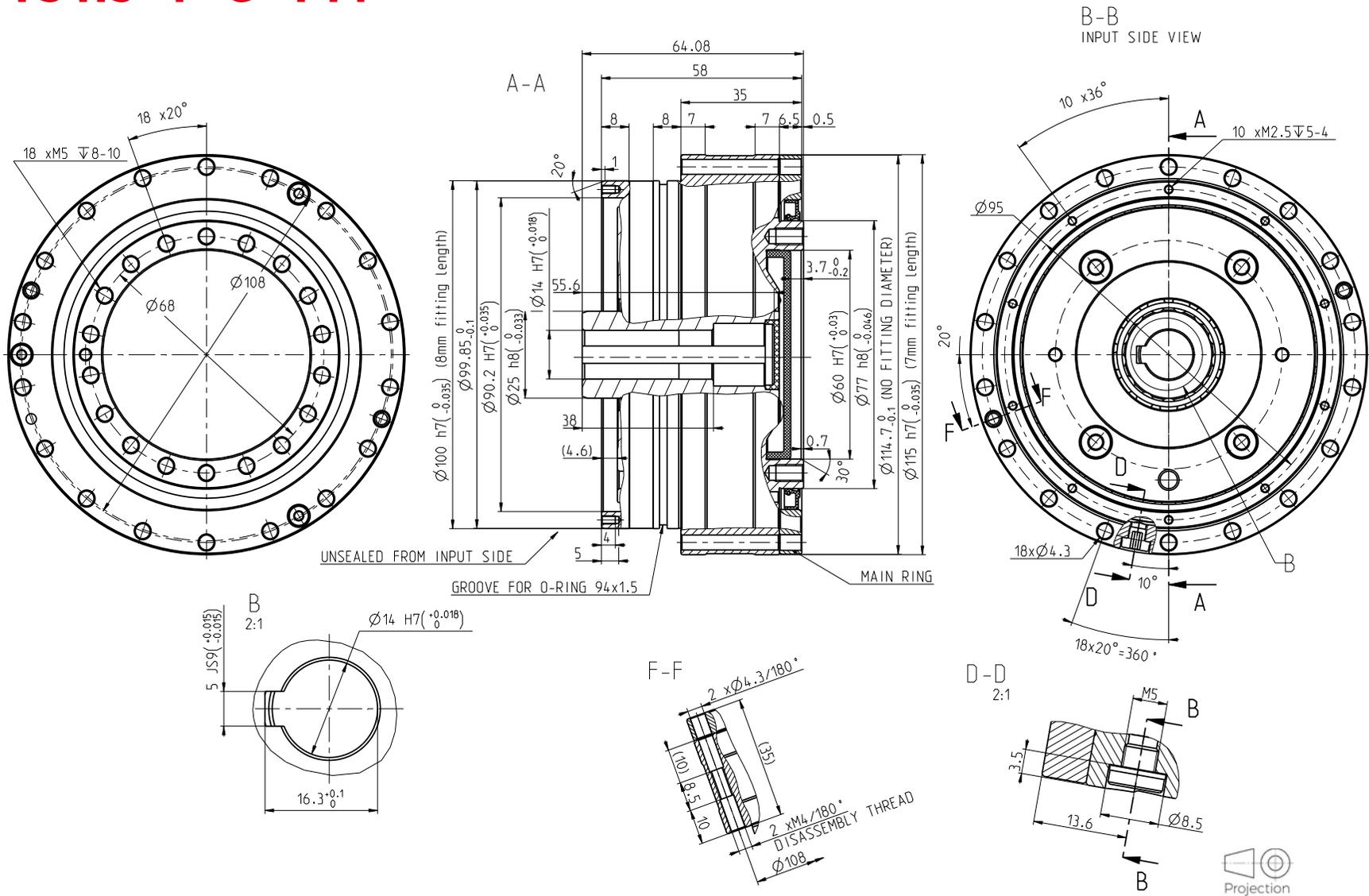
TS 95 - i - G - P14



1. Main ring must be fixed in operation with 18pcs of screw M4, st 12.9, tilghtening torque 5 Nm
 2. Unsealed space, see assembly manual in catalogue TS G
- RECOMENDATION FOR SEALING MOTOR FLANGE:
Recommended tolerance for fitting diameter ($\varnothing 71 \begin{smallmatrix} -0.03 \\ -0.06 \end{smallmatrix}$)



TS 115 - i - G - P14



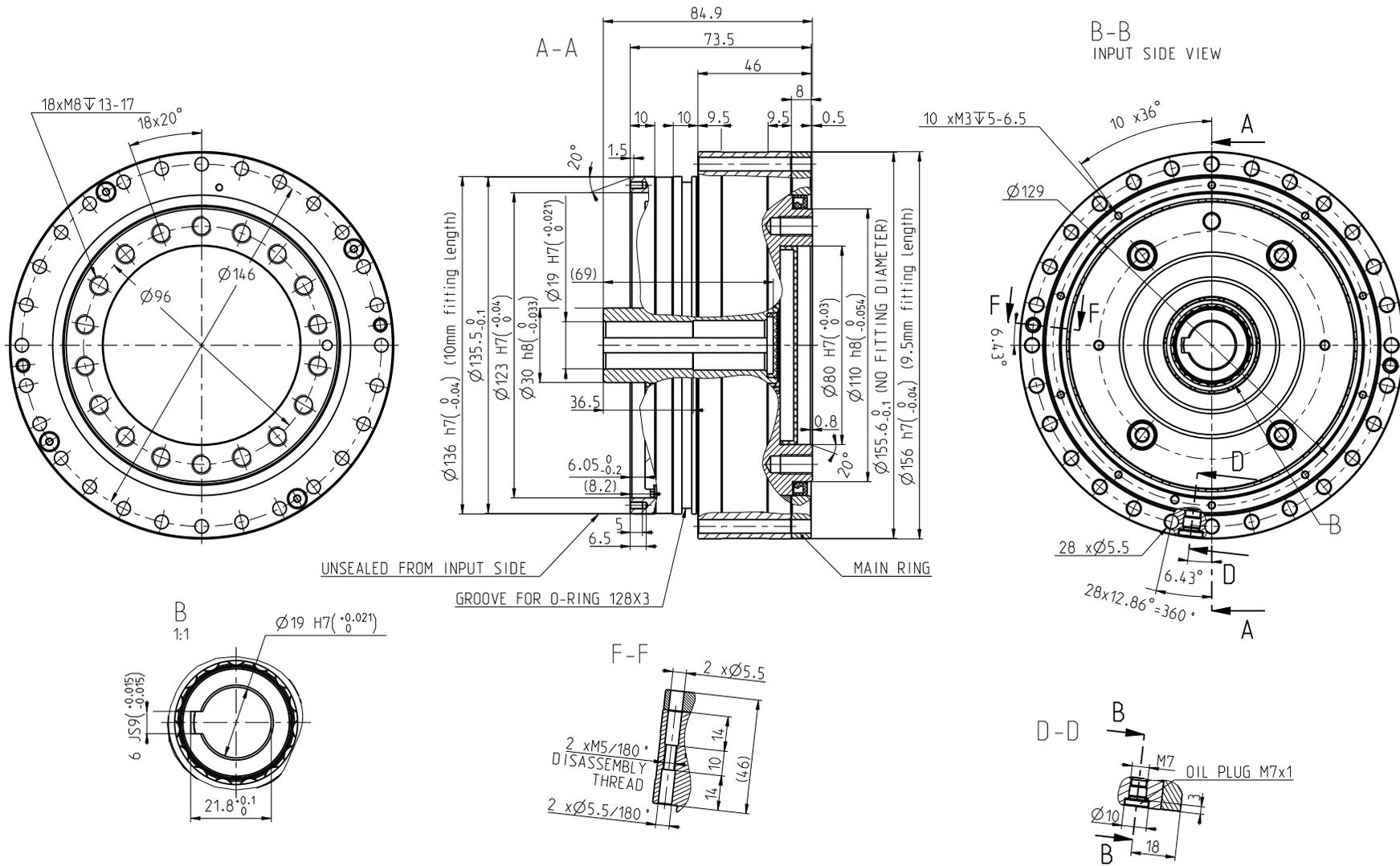
1. Main ring must be fixed in operation with 18pcs of screw M4, st 12.9, tilghtening torque 5 Nm
 2. Unsealed space, see assembly manual in catalogue TS G
- RECOMENDATION FOR SEALING MOTOR FLANGE:
Recommended tolerance for fitting diameter ($\phi 90.2 \begin{smallmatrix} -0.05 \\ 0.06 \end{smallmatrix}$)

TS 115 - i - G - P14

Drawings

G series

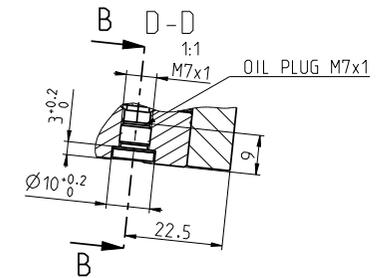
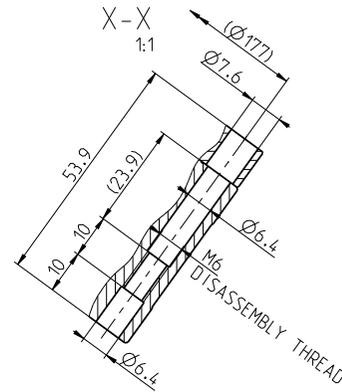
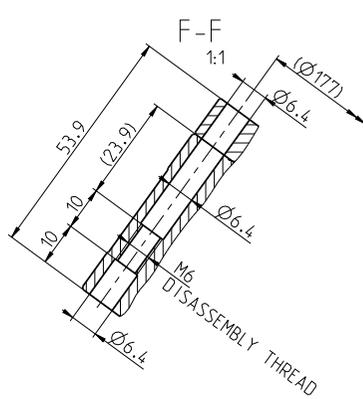
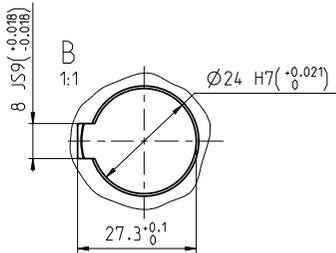
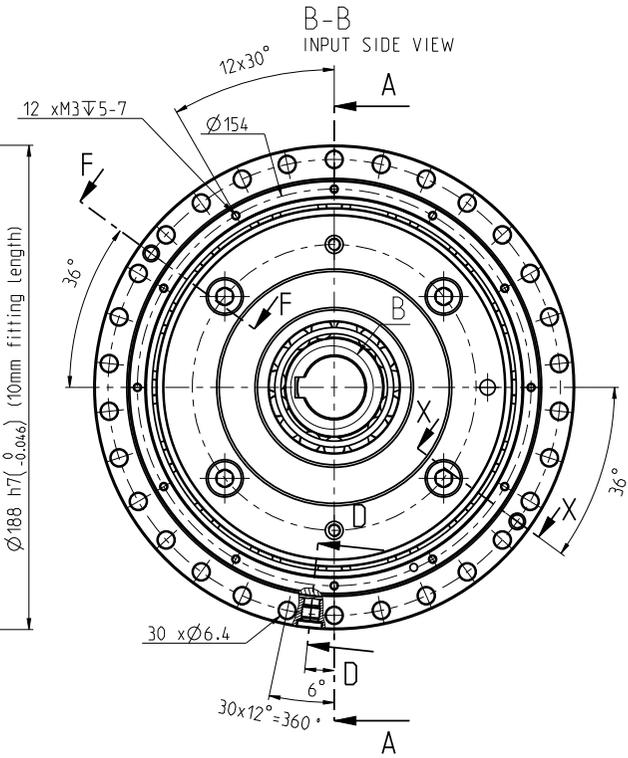
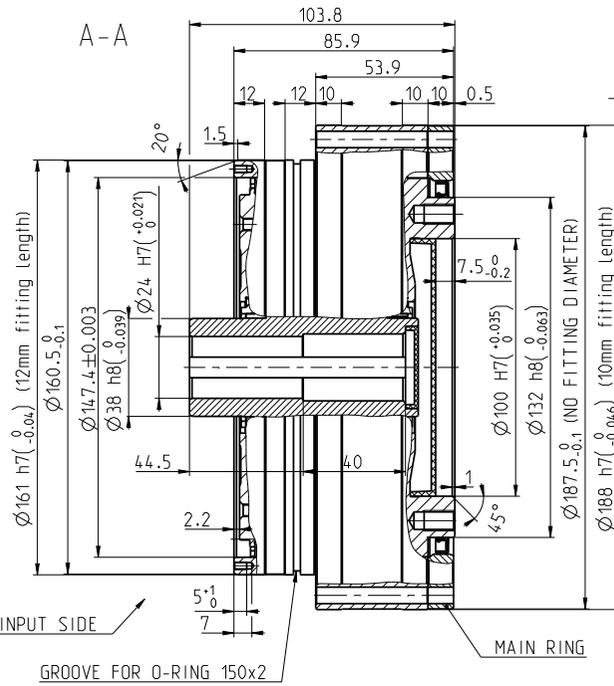
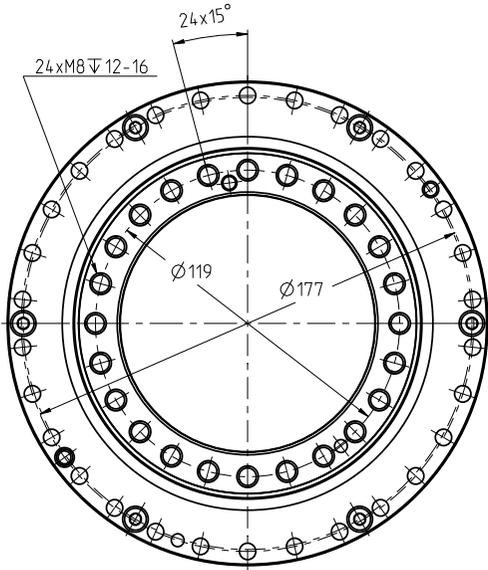
TS 155 - i - G - P19



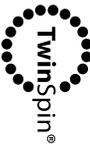
1. Main ring must be fixed in operation with 28pcs of screw M5, st 12.9, tilghtening torque 8 Nm
 2. Unsealed space, see assembly manual in catalogue TS G
- RECOMENDATION FOR SEALING MOTOR FLANGE:
Recommended tolerance for fitting diameter ($\phi 123$ $\begin{smallmatrix} -0.03 \\ -0.06 \end{smallmatrix}$)



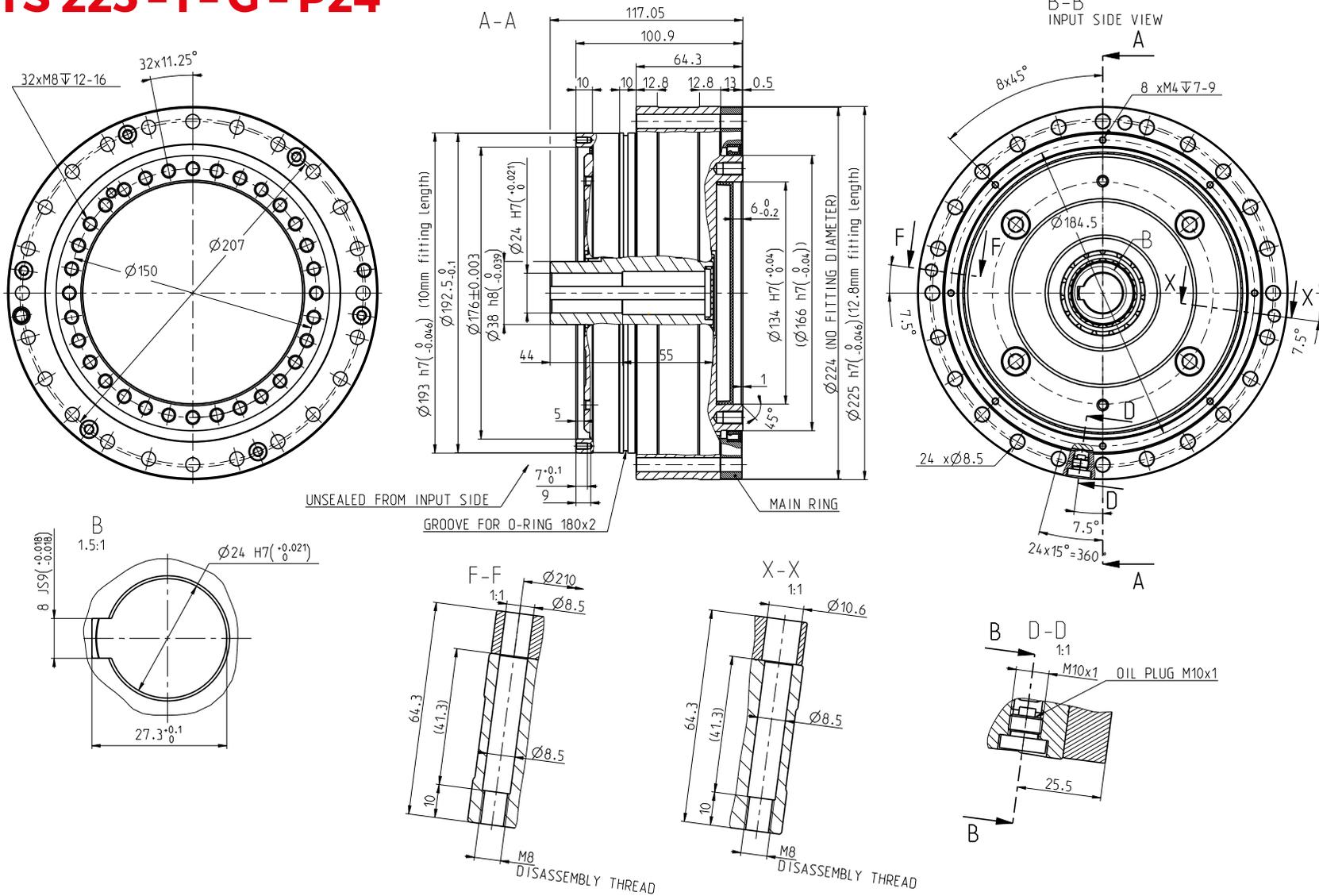
TS 185 - i - G - P24



1. Main ring must be fixed in operation with 30pcs of screw M6, st 12.9, tightening torque 17 Nm
 2. Unsealed space, see assembly manual in catalogue TS G
- RECOMENDATION FOR SEALING MOTOR FLANGE:
Recommended tolerance for fitting diameter (Ø147.4 $\begin{smallmatrix} -0.03 \\ -0.06 \end{smallmatrix}$)



TS 225 - i - G - P24

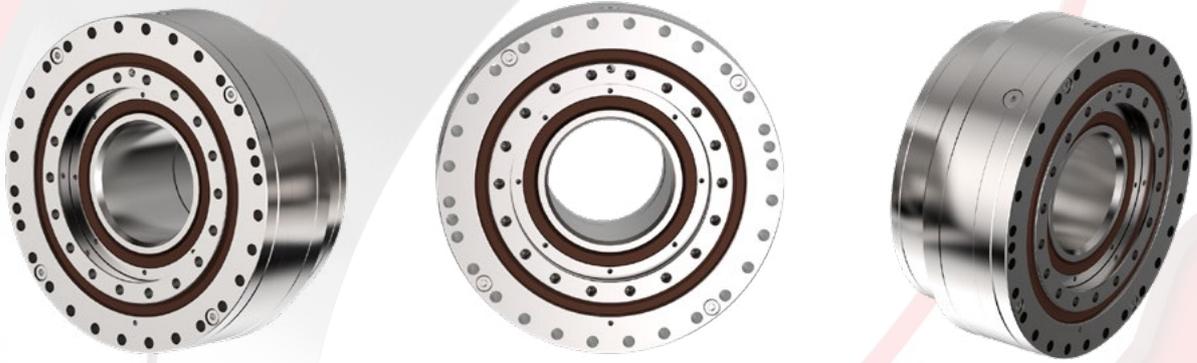


1. Main ring must be fixed in operation with 24pcs of screw M8, st 12.9, tightening torque 42 Nm
 2. Unsealed space, see assembly manual in catalogue TS G
- RECOMENDATION FOR SEALING MOTOR FLANGE:
Recommended tolerance for fitting diameter ($\phi 176$ $\begin{smallmatrix} -0.03 \\ -0.06 \end{smallmatrix}$)





2.2 GH SERIES



Tab. 2.1d: GH series rating table

Size	Reduction ratio	Rated output torque	Max. acceleration / deceleration torque	Maximum permissible torque at emergency / E-stop	Rated input speed	Maximum input speed 10)	Lost motion	Hysteresis	Angular transmission error 1) 7)	No-load starting torque (max) 9)
	i	T_r [Nm]	T_{acc} [Nm]	T_{em} [Nm]	n_r [rpm]	n_{max} [rpm]				
TS 85	47	41	82	205	2 000	3 800	<1	<1	72	0.6
	85					4 500				0.4
TS 115	55	130	260	650	2 000	2 500	<1	<1	60	0.6
	123					3 500				0.5
TS 125	49	180	450	900	2 000	2 400	<1	<1	60	1.5
	99					3 800				1.3

RIGHT TO CHANGE WITHOUT PRIOR NOTICE RESERVED

- 1) Mean statistical value. For further information see chapter Torsional stiffness, Tilting stiffness.
- 2) Load at output speed 15 rpm and $L_{10} = 12\ 000$ hrs.
- 3) Moment M_c value for $F_a = 0$. If $F_a \neq 0$, see chapter 3.5.
- 4) Axial force $F_{a,max}$ value for $M_c = 0$. If $M_c \neq 0$ see chapter 3.5.
- 6) The parameter depends on the version of the high precision reduction gear.
- 7) The parameter depends on the version of the high precision reduction gear, ratio and lost motion.
- 8) The values of the parameters are informative. The exact value depends on the specific version of the high precision reduction gear.
- 9) Temperatures of the high precision reduction gear lower than 20°C will cause higher no-load starting or back driving torque.
- 10) Instantaneous speed peak that may occur within the working cycle.

Tab. 2.1d: GH series rating table - continued

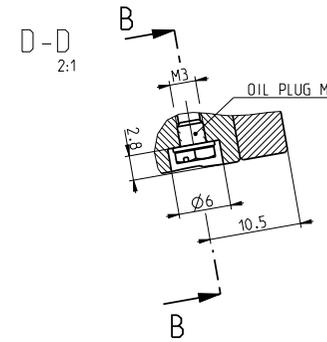
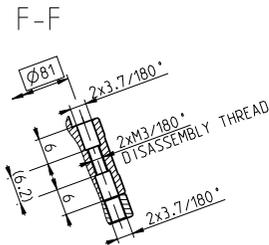
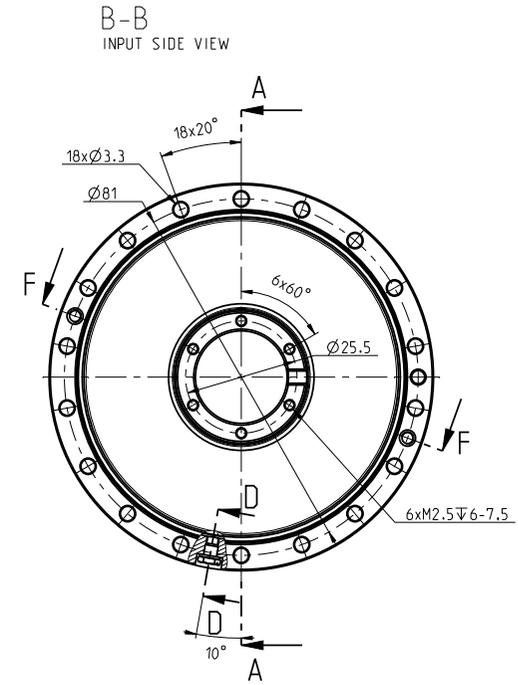
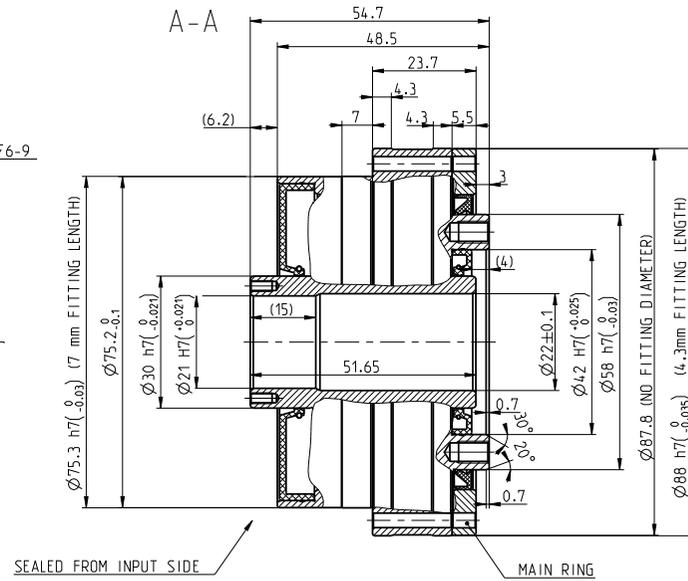
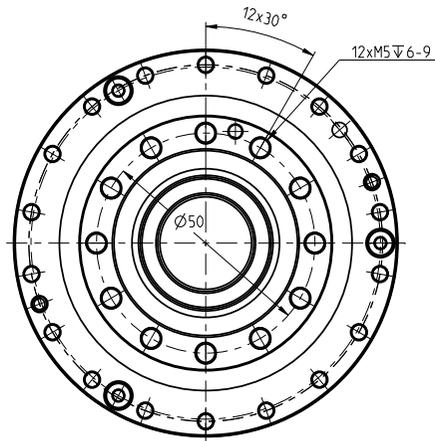
Size	Reduction ratio	Max. backdriving torque 9)	Torsional stiffness 50-100% T _r 1)	Moment stiffness 1)	Rated moment 2) 3)	Allowable moment	Allowable radial force 2)	Allowable axial force 2) 4)	Input inertia 8)	Weight 8)
	i	[Nm]	k _t [Nm/arcmin]	M _t [Nm/arcmin]	M _c [Nm]	M _{cmax} [Nm]	F _r [kN]	F _{a,max} [kN]	I [10 ⁻⁴ kgm ²]	m [kg]
TS 85	47	25	9.5	85	110	220	2	6	0.29	1.3
	85	36	9.7							
TS 115	55	42	21	200	275	550	4	12.5	0.65	2.9
	123	91	25							
TS 125	49	40	28	280	440	880	4.4	13.8	1.06	3.6
	99	95	29							

IMPORTANT NOTES:

- Load values in the table are valid for the nominal life of L₁₀ = 6 000 [Hrs].
- High precision reduction gears are preferred for intermittent cycles (S3-S8); the output speed in applications is inverted-variable.
- The continuous mode cycle (S1) is needed to be consulted with the manufacturer.
- If the output speed in application is less than 0.1 rpm please consult with the manufacturer.
- The values in the table refer to the nominal operating temperature.
- Please note the temperature on the gear case that should not exceed significantly 60°C degrees.

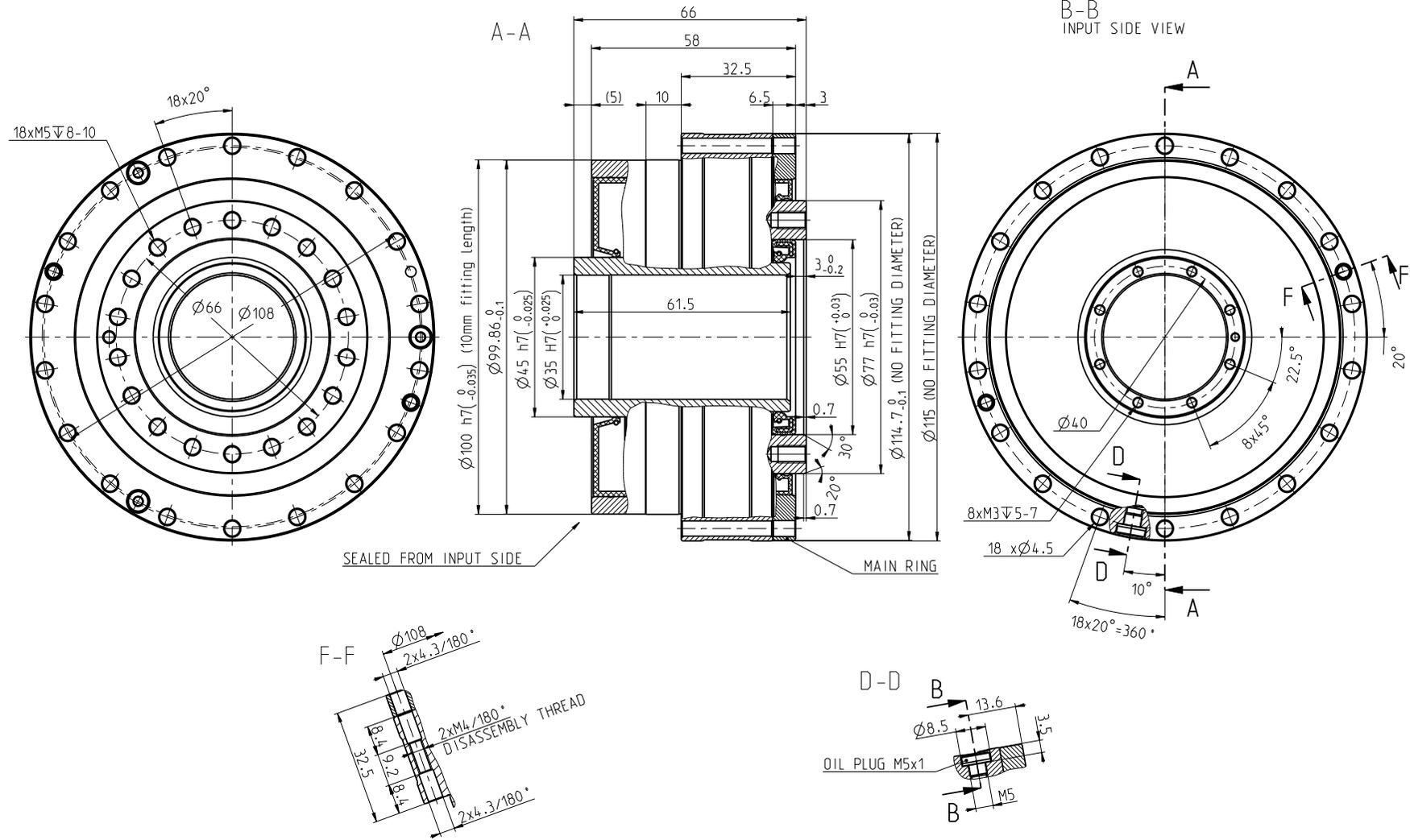
The ratios highlighted in bold are recommended by SPINEA as optimal versions in terms of price and delivery.

TS 85 - i - GH - H25



1. Main ring must be fixed in operation with 18pcs of screw M3, st 12.9, tilghtening torque 1.8 Nm

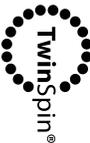
TS 115 - i - GH - H35



1. Main ring must be fixed in operation with 18pcs of screw M3, st 12.9, tilghtening torque 5 Nm

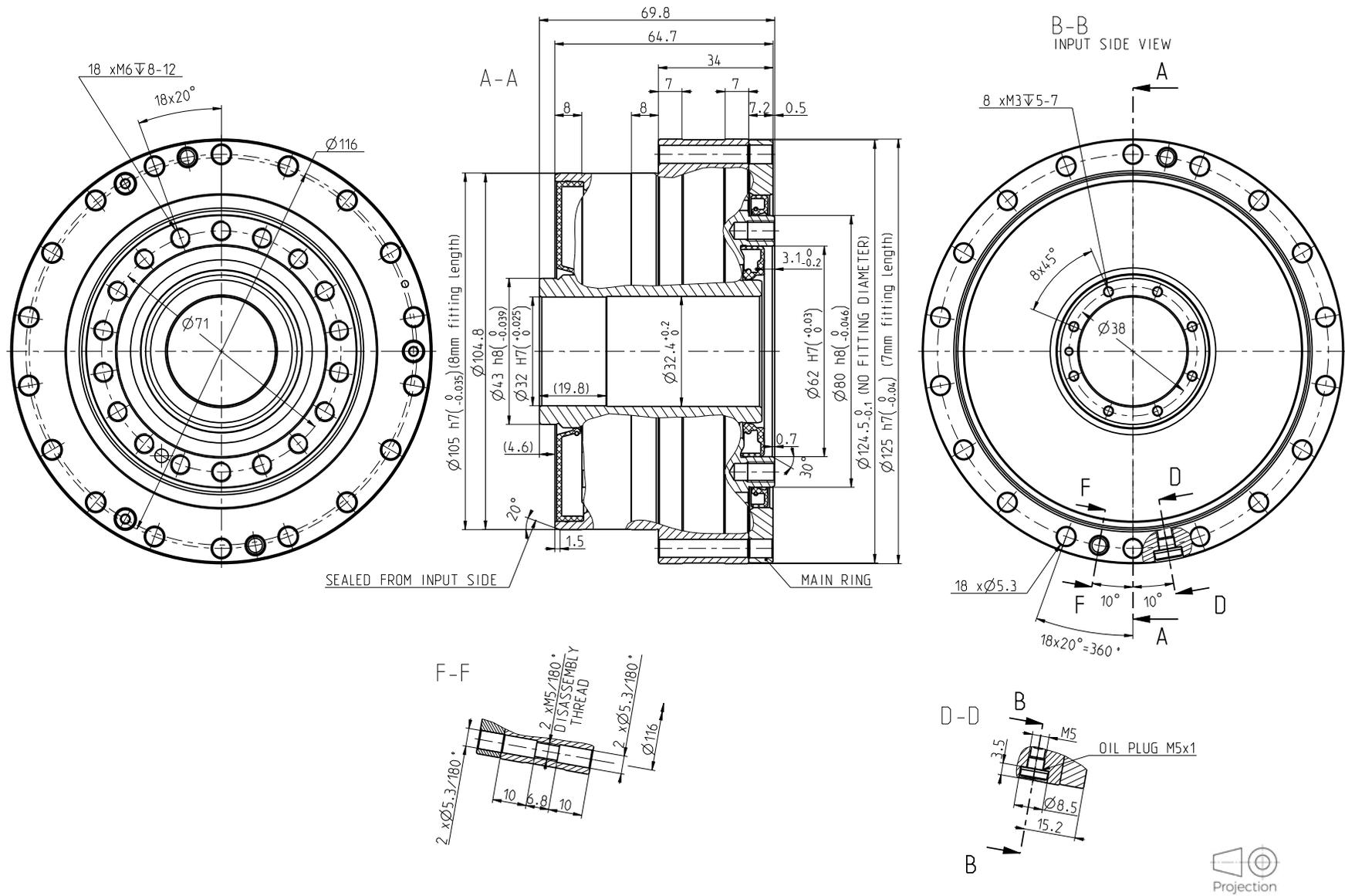
TS 115 - i - GH - H35

Drawings



G series

TS 125 - i - GH - H32



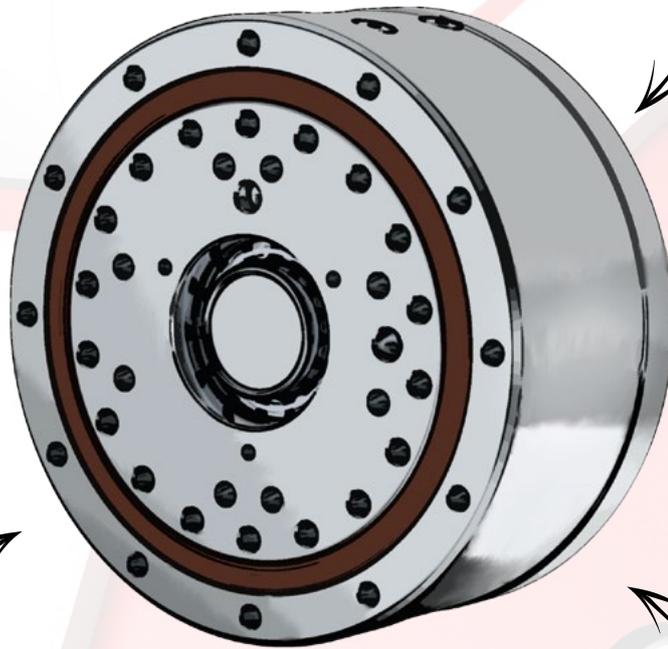
1. Main ring must be fixed in operation with 18pcs of screw M5, st 12.9, tilghtening torque 8 Nm





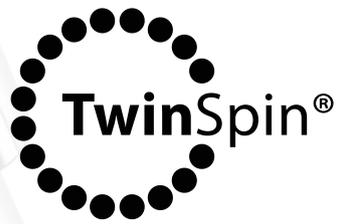
Customisable input shaft

Zero-backlash reduction gear



Compact design

Integrated high capacity bearing



T series

EXCELLENCE IN PERFORMANCE

2.3 T SERIES



Advantages

- zero- backlash reduction gear
- high moment capacity
- excellent positioning accuracy and positioning repeatability
- high torsional and tilting stiffness
- small dimensions and weight
- high reduction ratios
- long lifetime
- easy assembly

The **T series** represents a wide range of TwinSpin® high precision reduction gears with a cylindrical shaped case. The T series high precision reduction gears comprise an accurate reduction mechanism and a high-capacity radial and axial cylindrical roller bearings. This design of reduction gears allows the mounting of the load directly on the output flange or the case without the need of additional bearings. The T series high precision reduction gears are characterized by a modular design, which allows the mounting of your desirable type of motor to the reduction gear by means of a motor connection flange. The T series includes TwinSpin® high precision reduction gears that are not completely sealed; an inlet flange and a gasket kit have to be used for the sealing. Upon the customer's request, SPINEA is able to supply a completely sealed reduction gear with a flange according to the customer's motor.

Tab. 2.3a: T series features

Case	a) TB- threaded holes in the case 1) b) TC- threaded and through holes in case 2
Input flange connection	The shaft sealing / adapter flange is offered in the following versions: a) motor connection flange b) sealed input cover c) without a flange
Input shaft design	The input shaft is offered in the following versions: a) shaft with a keyway b) according to a special request
Installation and operation characteristics	A wider range of modular configurations

1) Valid for TS 60, TS 70, TS 80, TS 110, TS 140

2) Valid for TS 170, TS 200, TS 240, TS 300

Tab. 2.3b: T series ordering specifications

TS - 200 - 125 - TC - P24					
Name	Size	Ratio	Series version	Shaft version	
				P (DIN 6885) ¹⁾	S ²⁾
TS	60	35, 47 , 63	TB	6	•
	70	41, 57, 75	TB	11	•
	80	37, 63 , 85	TB	8	•
	110	33, 67, 89 , 119	TB	14	•
	140	33 , 57, 87, 115 , 139	TB	19	•
	170	33, 59 , 83, 105 , 141	TC	24	•
	200	63 , 83, 125 , 169	TC	28	•
	240	37, 87, 121, 153	TC	28	•
	300	63 , 125, 191	TC	28	•

T series

Note. An example of an ordering code of a modified TwinSpin® T series reduction gear with a motor flange:
 TS200 - 125 - TC - P24 - M235 - P231. The markings M235 and P231 for a specific modification are defined by the manufacturer.
 1) Max. dimension
 2) On request

Shaft version


P

Shaft with a keyway


S

Special shaft

Tab. 2.3c: T series rating table

Size	Reduction ratio	Rated output torque	Acceleration and braking output torque	Permissible output torque at emergency stop	Rated input speed	Max. allowable input speed 9)	Tilting stiffness 1) 5)	Torsional stiffness 1) 6)	Max. no-load starting torque 8)	Max. back-driving torque 8)
	i	T_R [Nm]	T_{max} [Nm]	T_{em} [Nm]	n_R [rpm]	n_{max} [rpm]	M_t [Nm/arcmin]	k_t [Nm/arcmin]	[Nm]	[Nm]
TS 60	35	37	74	185	2 000	4 000	27	3.5	0.16	9
	47					5 000			0.12	9
	63								0.12	10
TS 70	41	50	100	250	2 000	4 000	35	7	0.30	11
	57					5 000			0.15	12
	75								0.14	13
TS 80	37	78	156	390	2 000	4 000	62	9	0.35	14
	63					5 000			0.20	15
	85								0.12	16
TS 110	33	122	244	610	2 000	3 500	150	22	0.35	24
	67					3 900			0.35	28
	89					4 500			0.30	30
	119								0.20	33
TS 140	33	268	670	1 340	2 000	3 000	340	54	0.60	40
	57					3 200			0.40	40
	87					4 500			0.35	55
	115								0.35	65
TS 170	139	495	1 237	2 475	2 000		705	102	0.34	65
	33					3 000			2.00	75
	59					3 500			2.00	85
	83					4 000			1.40	100
	105					4 000			1.20	125
TS 200	141	890	2 225	4 450	2 000		1 070	178	0.40	125
	33					3 500			1.90	90
	83					4 000			1.80	120
	125					4 000			1.70	200
	169					4 500			0.90	210
TS 240	37	1 620	4 050	8 100	1 500	2 000	1 800	340	3.00	90
	87					3 000			1.75	160
	121					3 500			1.70	170
	153					3 700			1.20	180
TS 300	63	2 940	7 350	14 700	1 500	2 500	3 500	680	3.00	200
	125					3 200			2.00	250
	191					3 500			1.50	300

RIGHT TO CHANGE WITHOUT PRIOR NOTICE RESERVED

- 1) Mean statistical value. For further information see chapter Torsional stiffness, Tilting stiffness.
- 2) Load at output speed 15 rpm.
- 3) Moment $M_{c,max}$ value for $F_a=0$. If $F_a \neq 0$, see chapter Moment.
- 4) Axial force F_a,max value for $M_c=0$. If $M_c \neq 0$, see chapter Tilting moment.
- 5) The parameter depends on the version of the high precision reduction gear.
- 6) The parameter depends on the version of the high precision reduction gear, ratio and lost motion.
- 7) The values of the parameters are informative. The exact value depends on the specific version of the high precision reduction gear.
- 8) Temperatures of the high precision reduction gear lower than 20°C will cause higher no-load starting or back driving torque.
- 9) Depends on the duty cycle; a higher input speed may still be possible; please consult the manufacturer.

Tab. 2.3c: T series rating table - continued

Size	Reduction ratio	Max. lost motion	Average angular transmission error 1) 6)	Hysteresis	Max. moment 2) 3)	Rated radial force 2)	Max. axial force 2) 4)	Input inertia 7)	Weight 7)
	i	LM [arcmin]	ATE [arcsec]	H [arcmin]	$M_{c\max}$ [Nm]	F_{rR} [kN]	$F_{a\max}$ [kN]	I [10^{-4} kgm ²]	m [kg]
TS 60	35	<1.5	±36	<1.5	107	2.6	3.7	0.006	0.86
	47								
	63								
TS 70	41	<1.5	±36	<1.5	142	2.8	4.1	0.061	1.05
	57								
	75								
TS 80	37	<1.5	±36	<1.0	280	4.8	6.9	0.03	1.64
	63								
	85								
TS 110	33	<1.0	±20	<1.0	740	9.3	13.1	0.16	3.76
	67								
	89								
	119								
TS 140	33	<1.0	±20	<1.0	1 160	11.5	17	0.67	6.45
	57								
	87								
	115								
TS 170	139	<1.0	±20	<1.0	2 430	19.2	27.9	1.15	11.07
	33								
	59								
	83								
TS 200	105	<1.0	±18	<1.0	3 300	21.1	31.7	2.6	17.23
	141								
	63								
	83								
TS 240	125	<1.0	±18	<1.0	5 720	30.8	47.3	3.9	31.15
	169								
	37								
	87								
TS 300	121	<1.0	±18	<1.0	12 000	45.3	68.1	11.2	55.73
	153								
	63								
	125								
	191								

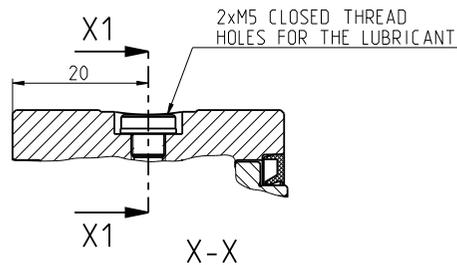
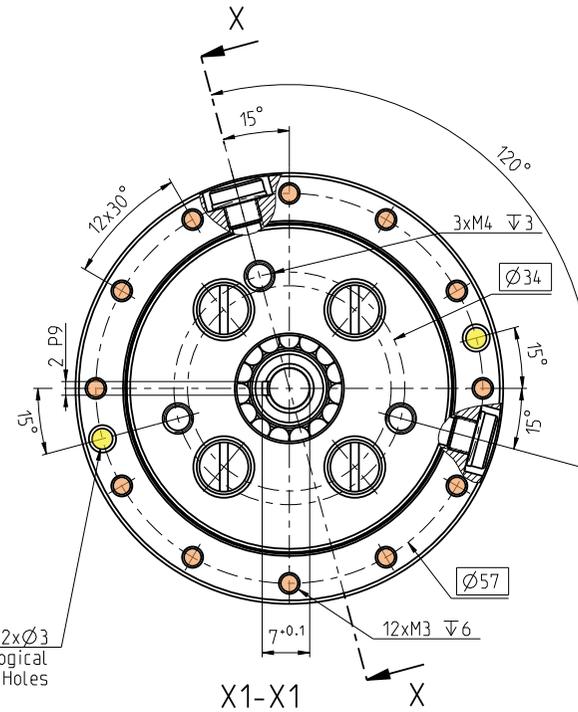
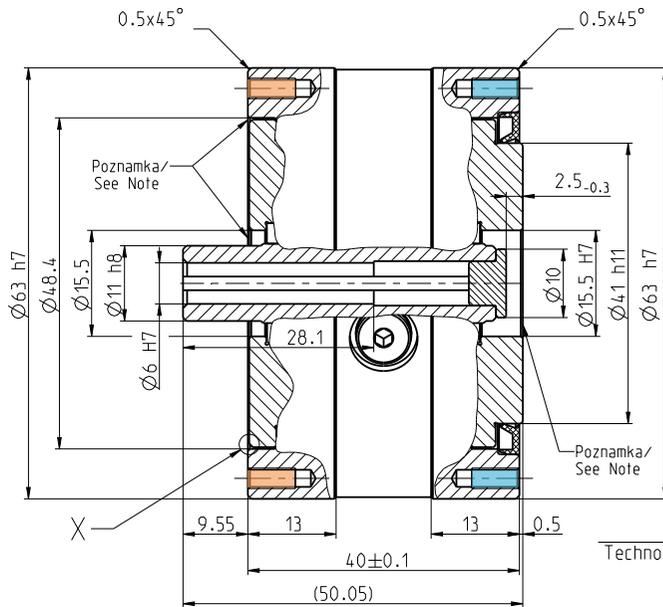
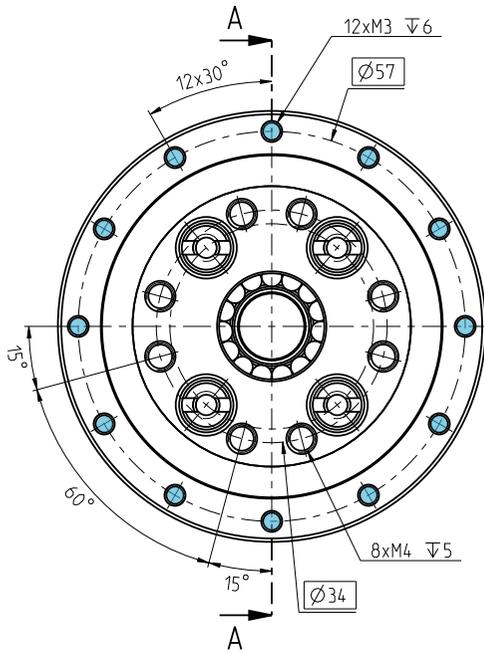
IMPORTANT NOTES:

- Instantaneous speed peak that may occur within the working cycle.
- Note please the temperature on the gear case that should not exceed significantly 60°C degrees.
- Load values in the table are valid for the nominal life of $L_{10} = 6\ 000$ [Hrs].
- High precision reduction gears are preferred for intermittent cycles (S3-S8); the output speed in applications is inverted-variable. The continuous mode cycle (S1) is needed to be consulted with the manufacturer.
- Dimensional pictures of the T series reduction gears are listed in the catalogue without sealing.
- Sealing options are described in the chapter Assembly instructions.
- Please consult the maximum speed in a duty cycle with the manufacturer.
- The values in the table refer to the nominal operating temperature.

The ratios highlighted in bold are recommended by SPINEA as optimal versions in terms of price and delivery.

TS 60 - i - TB - P6

INPUT SIDE VIEW

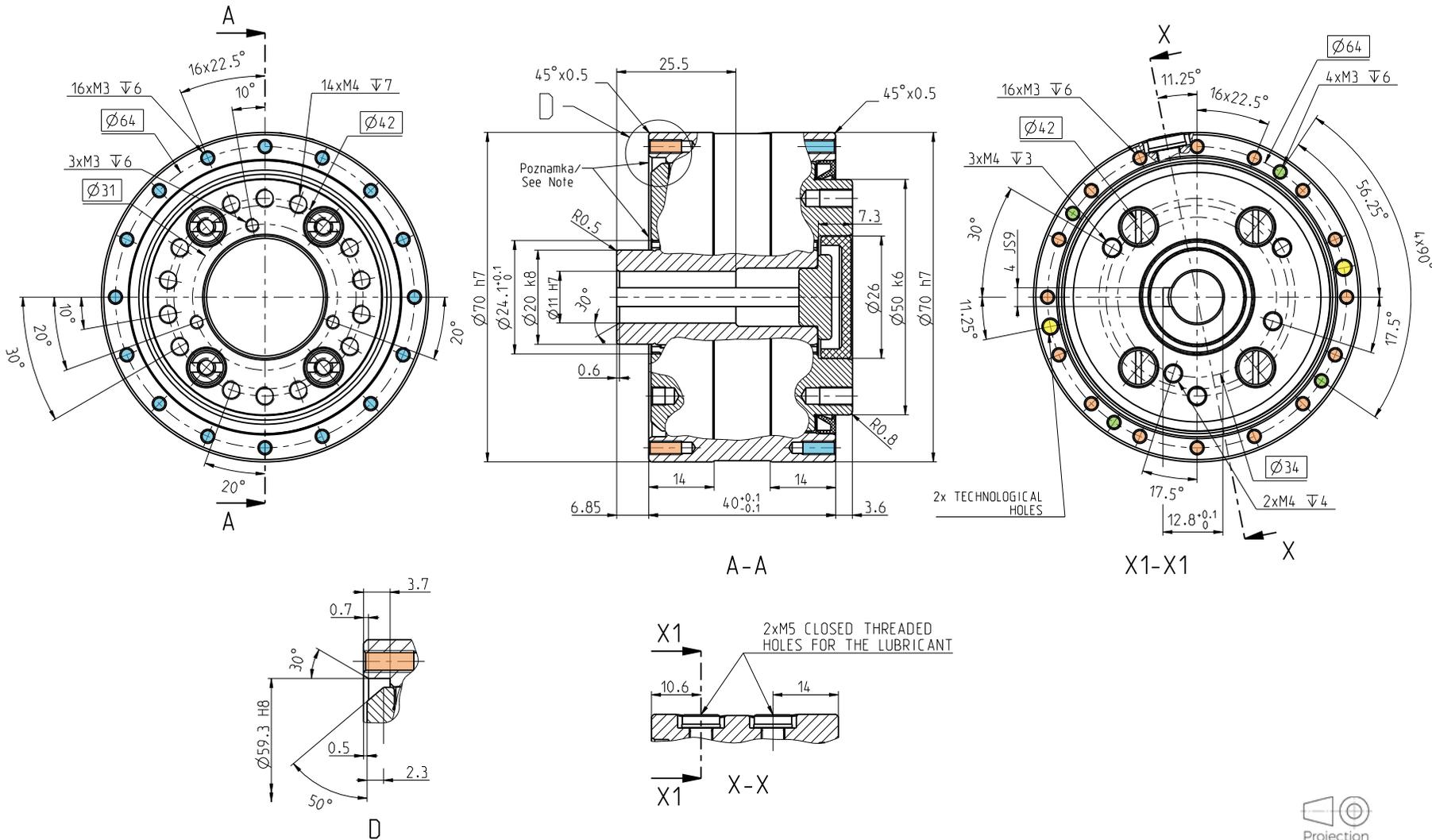


1. Use only standardized components, such as ring seals, bolts, etc.
2. Right to change without prior notice reserved.
3. Unsealed space, see the installation instructions in the TS Catalogue.

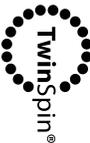


TS 70 - i - TB - P11

INPUT SIDE VIEW



1. Use only standardized components, such as ring seals, bolts, etc.
2. Right to change without prior notice reserved.
3. Unsealed space, see the installation instructions in the TS Catalogue.



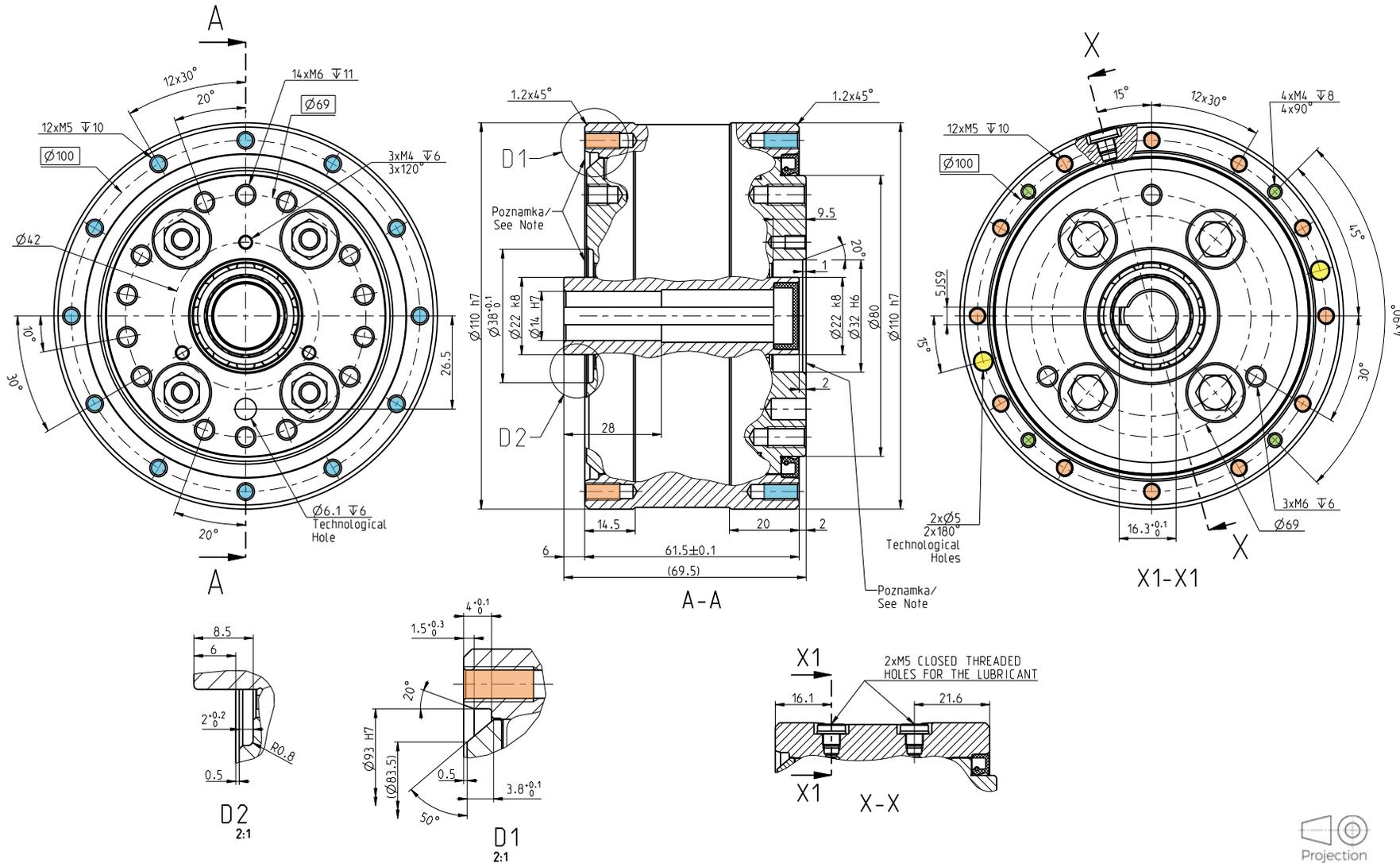
TS 70 - i - TB - P11

Drawings

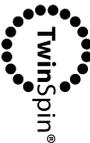
T series

TS 110 - i - TB - P14

INPUT SIDE VIEW



1. Use only standardized components, such as ring seals, bolts, etc.
2. Right to change without prior notice reserved.
3. Unsealed space, see the installation instructions in the TS Catalogue.



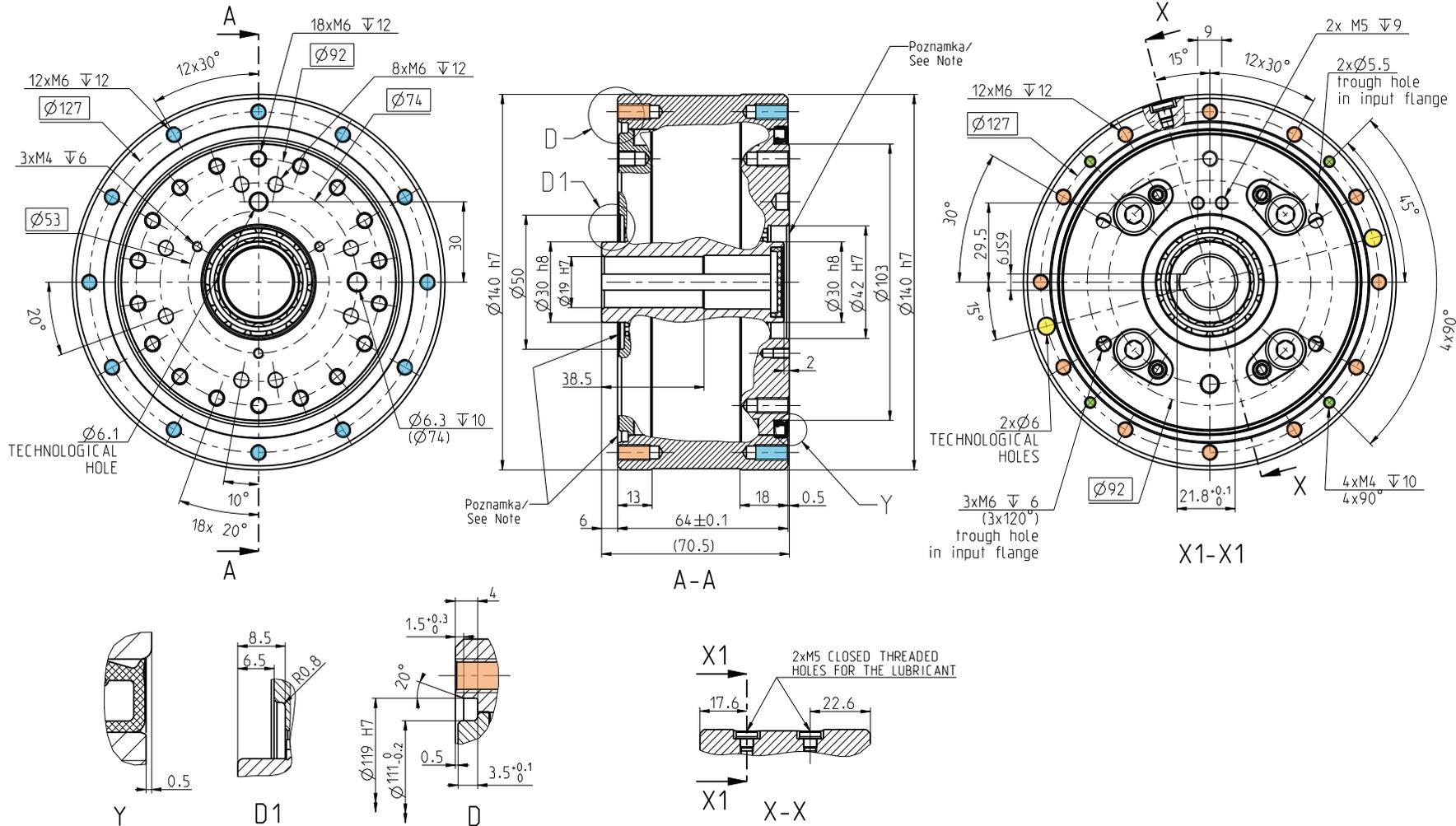
TS 110 - i - TB - P14

Drawings

T series

TS 140 - i - TB - P19

INPUT SIDE VIEW

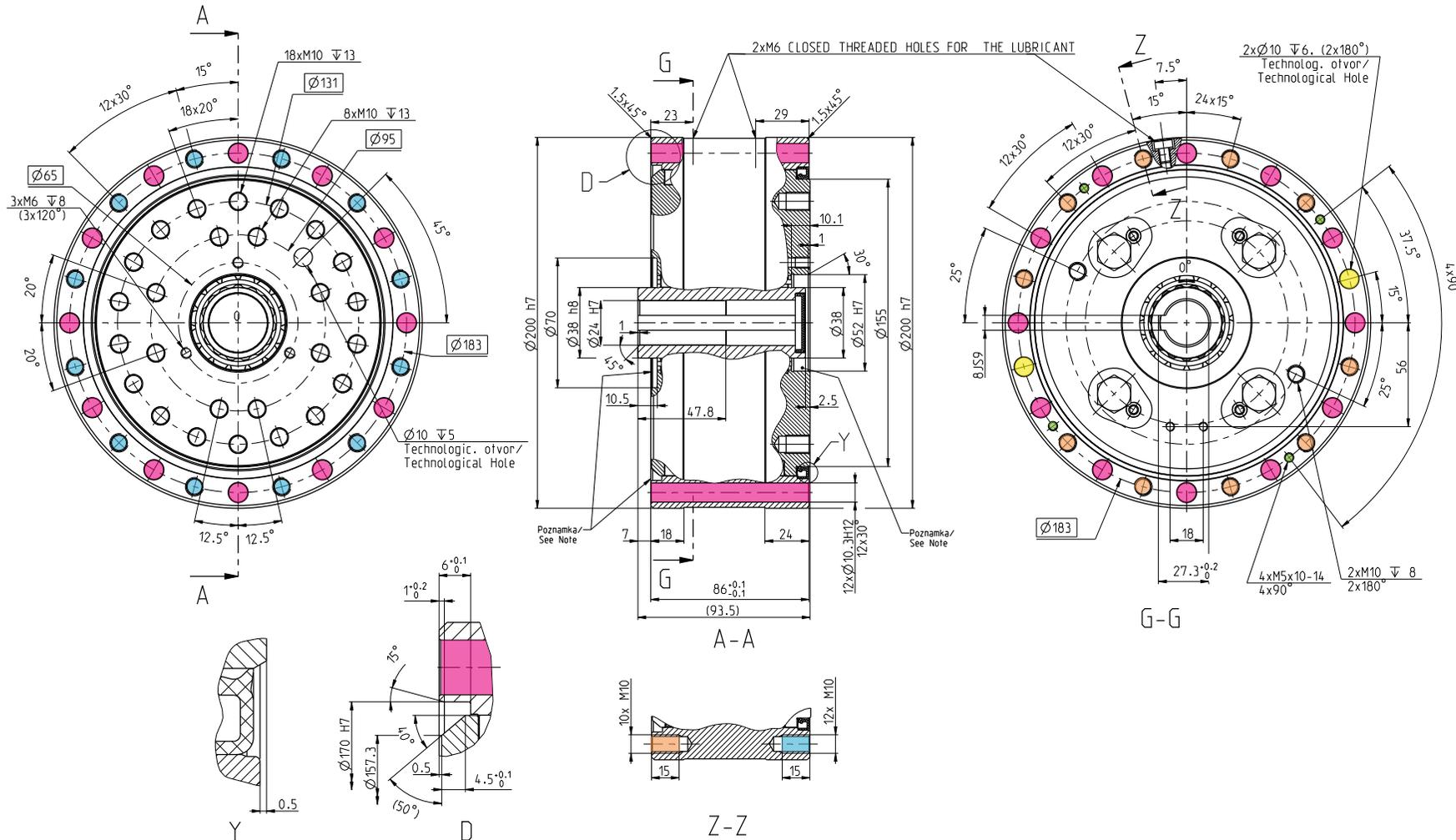


1. Use only standardized components, such as ring seals, bolts, etc.
2. Right to change without prior notice reserved.
3. Unsealed space, see the installation instructions in the TS Catalogue.



TS 200 - i - TC - P24

INPUT SIDE VIEW

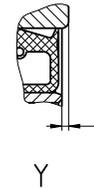
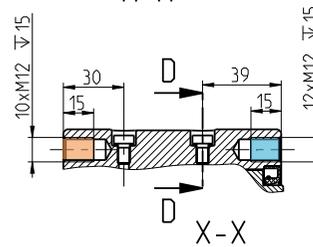
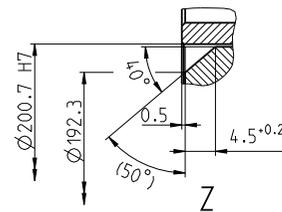
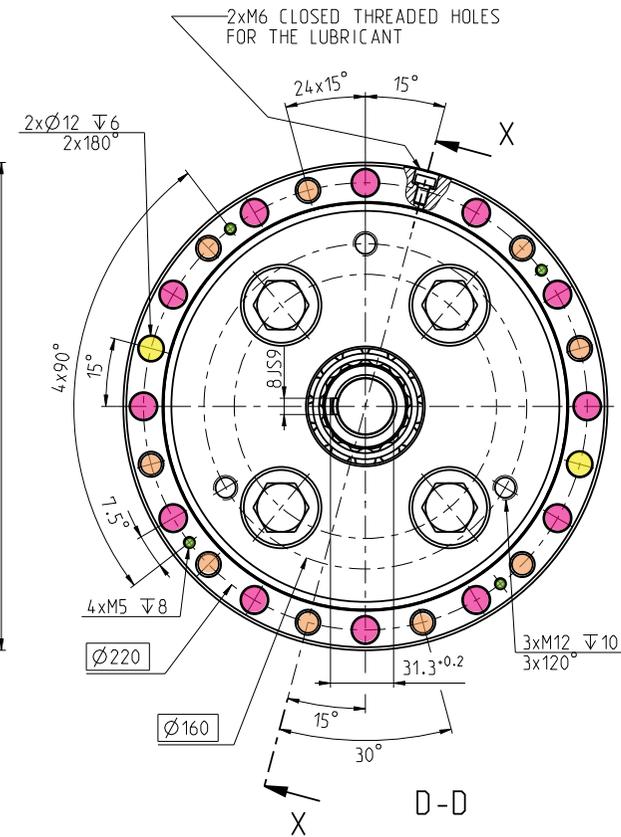
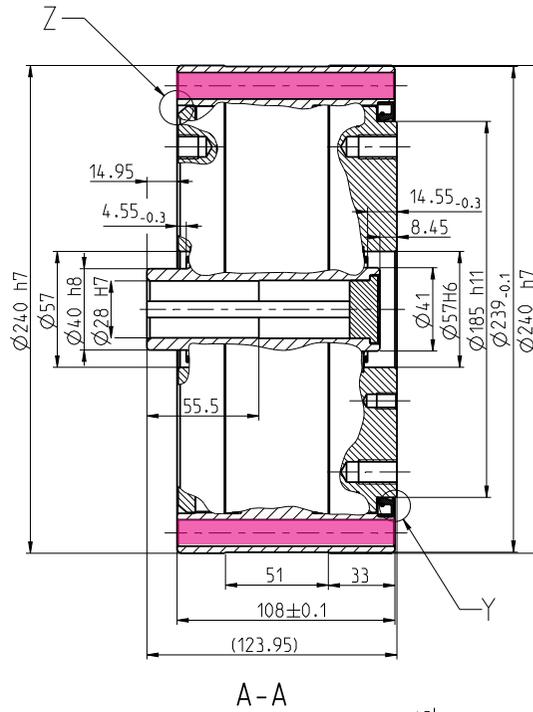
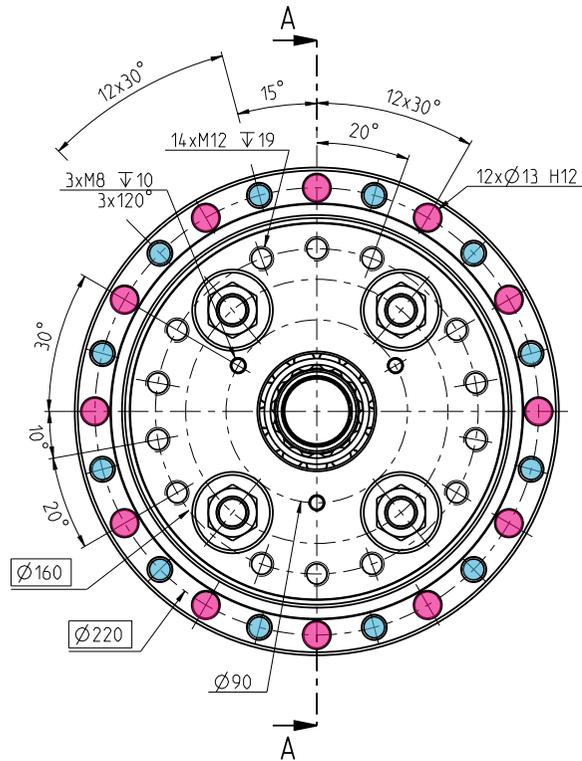


1. Use only standardized components, such as ring seals, bolts, etc.
2. Right to change without prior notice reserved.
3. Unsealed space, see the installation instructions in the TS Catalogue.



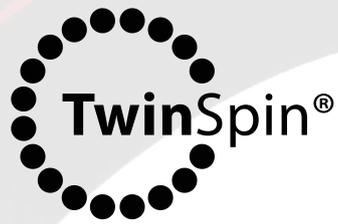
TS 240 - i - TC - P28

INPUT SIDE VIEW



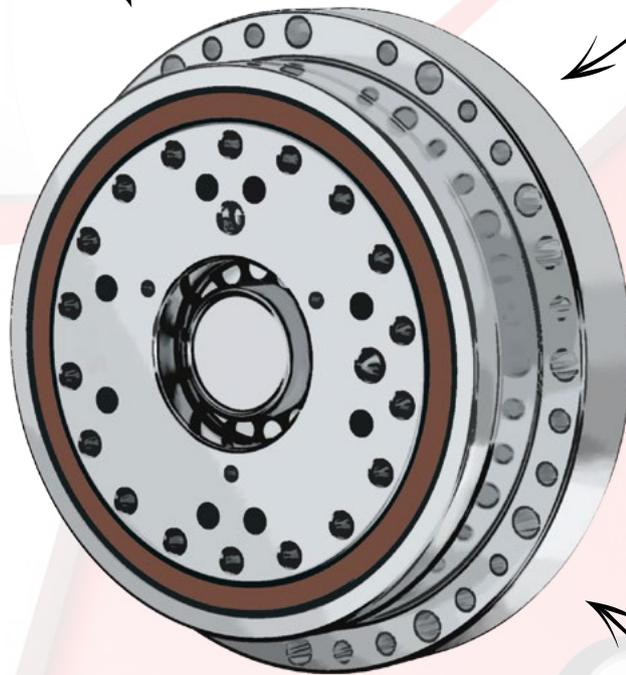
1. Use only standardized components, such as ring seals, bolts, etc.
2. Right to change without prior notice reserved.
3. Unsealed space, see the installation instructions in the TS Catalogue.





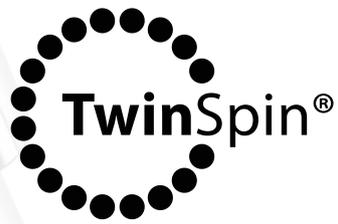
Robust design and overload capacity

Customisable input shaft



Integrated high capacity bearing

Zero-backlash reduction gear



E series

EXCELLENCE IN PRECISION

2.4 E SERIES



Advantages

- zero- backlash reduction gear
- high moment capacity
- excellent positioning accuracy and positioning repeatability
- high torsional and tilting stiffness
- small dimensions and weight
- high reduction ratios
- high efficiency
- long lifetime
- easy assembly

The **E series** represents a wide range of TwinSpin® high precision reduction gears with a flange shaped case. The E series high precision reduction gears comprise an accurate reduction mechanism and high-capacity radial and axial cylindrical bearings. This design of reduction gears allows the mounting of the load directly on the output flange or the case without the need of additional bearings. The E series high precision reduction gears are characterized by a modular design, which allows the mounting of your desirable type of motor to the reduction gear by means of a motor connection flange. The E series includes TwinSpin® high precision reduction gears that are not completely sealed; an inlet flange and a gasket kit have to be used for the sealing. Upon the customer's request, SPINEA is able to supply a completely sealed reduction gear with a flange according to the customer's motor.

Tab. 2.4a: E series features

Case	Threaded and through holes in the case
Input flange connection	The shaft sealing / adapter flange is offered in the following versions: a) motor connection flange b) sealed input cover c) without a flange
Input shaft design	The input shaft is offered in the following versions: a) shaft with a keyway b) according to a special request
Installation and operation characteristics	Special for robotic and general automation

Tab. 2.4b: E series ordering specifications

TS - 200 - 125 - E - P24

Name	Size	Ratio	Series version	Shaft version	
				P (DIN 6885)	S
TS	70	41, 75	E	11	•
	80	37, 85	E	8	•
	110	33, 67, 119	E	14	•
	140	33, 69, 115	E	19	•
	170	59, 125, 141	E	24	•
	200	63, 125, 169	E	28	•
	220	55, 125	E	28	•

E series

Note: An example of an ordering code of a modified TwinSpin® T series reduction gear with a motor flange:
 TS200 - 125 - TC - P24 - M235 - P231. The markings M235 and P231 for a specific modification are defined by the manufacturer.

Shaft version


P

Shaft with a keyway


S

Special shaft

Tab. 2.4c: E series rating table

Size	Reduction ratio	Rated output torque	Acceleration and braking output torque	Permissible output torque at emergency stop	Rated input speed	Max. allowable input speed 9)	Tilting stiffness 1) 5)	Torsional stiffness 1) 6)	Max. no-load starting torque 8)	Max. back-driving torque 8)
	i	T _R [Nm]	T _{max} [Nm]	T _{em} [Nm]	n _R [rpm]	n _{max} [rpm]	M _t [Nm/arcmin]	k _t [Nm/arcmin]	[Nm]	[Nm]
TS 70	41	50	100	250	2 000	4 000	40	8	0.30	11
	75					5 000			0.14	13
TS 80	37	78	156	390	2 000	4 000	70	10	0.35	14
	85					5 000			0.12	16
TS 110	33	122	244	610	2 000	3 500	115	24	0.35	24
	67					3 900			0.35	28
	119					4 500			0.20	33
TS 140	33	268	670	1 340	2 000	3 000	380	62	0.60	40
	69					4 500			0.40	50
	115								0.35	65
TS 170	33	495	1 237	2 475	2 000	3 000	1 100	110	2.00	75
	59					3 500			2.00	85
	125					3 900			1.20	125
	141					4 000			0.40	125
TS 200	49	890	2 225	4 450	2 000	2 500	1 300	200	2.10	80
	63					3 500			1.90	90
	125					4 000			1.70	200
	169					4 500			0.90	210
TS 220	55	1 250	3 125	6 250	2 000	2 400	1 900	310	1.80	75
	125					3 500			1.40	220

RIGHT TO CHANGE WITHOUT PRIOR NOTICE RESERVED

- 1) Mean statistical value. For further information see chapter Torsional stiffness, Tilting stiffness.
- 2) Load at output speed 15 rpm.
- 3) Moment $M_{c_{max}}$ value for $F_a=0$. If $F_a \neq 0$, see chapter Moment.
- 4) Axial force F_a_{max} value for $M_c=0$. If $M_c \neq 0$, see chapter Tilting moment.
- 5) The parameter depends on the version of the high precision reduction gear.
- 6) The parameter depends on the version of the high precision reduction gear, ratio and lost motion.
- 7) The values of the parameters are informative. The exact value depends on the specific version of the high precision reduction gear.
- 8) Temperatures of the high precision reduction gear lower than 20°C will cause higher no-load starting or back driving torque.
- 9) Depends on the duty cycle; a higher input speed may still be possible; please consult the manufacturer.

Tab. 2.4c: E series rating table - continued

Size	Reduction ratio	Max. lost motion	Average angular transmission error 1) 6)	Hysteresis	Max. moment 2) 3)	Rated radial force 2)	Max. axial force 2) 4)	Input inertia 7)	Weight 7)
	i	LM [arcmin]	ATE [arcsec]	H [arcmin]	$M_{c\ max}$ [Nm]	F_{r} [kN]	$F_{a\ max}$ [kN]	I [10 ⁻⁴ kgm ²]	m [kg]
TS 70	41	<1.5	±30	<1.5	142	2.8	4.1	0.061	1
	75								
TS 80	37	<1.5	±30	<1.0	280	4.8	6.9	0.03	1.6
	85								
TS 110	67	<1.0	±17	<1.0	740	9.3	13.1	0.16	3.7
	119								
TS 140	69	<1.0	±17	<1.0	1 160	11.5	17	0.67	5.8
	115								
TS 170	33	<1.0	±17	<1.0	2 430	19.2	27.9	1.15	10.8
	59								
	125								
TS 200	141	<1.0	±15	<1.0	3 300	21.1	31.7	2.6	17.2
	49								
	125								
TS 220	63	<1.0	±15	<1.0	4 400	22.5	35.5	4.8	22.4
	169								
TS 220	55	<1.0	±15	<1.0	4 400	22.5	35.5	4.8	22.4
	125								

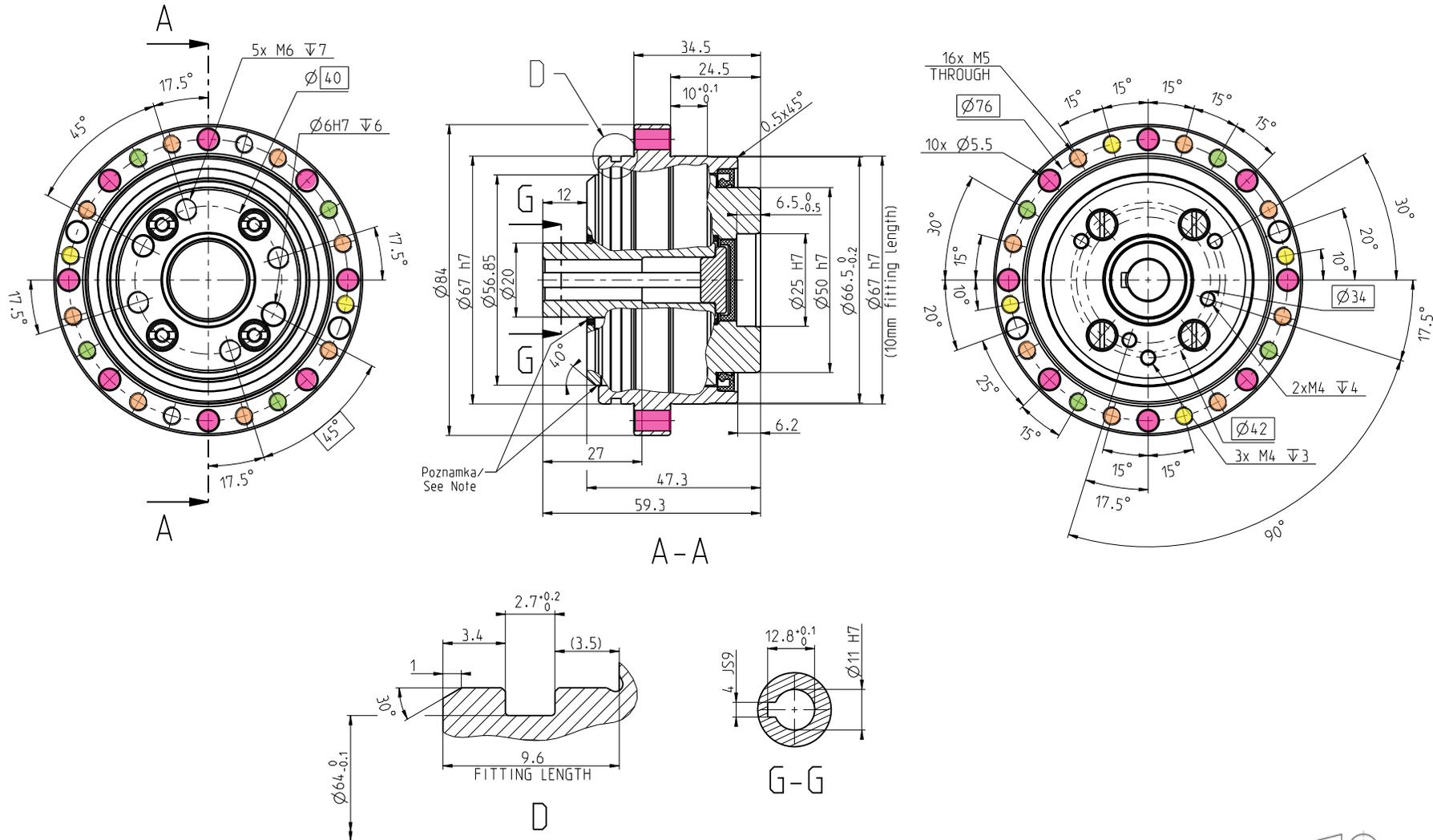
IMPORTANT NOTES:

- Instantaneous speed peak that may occur within the working cycle.
- Note please the temperature on the gear case that should not exceed significantly 60°C degrees.
- Load values in the table are valid for the nominal life of $L_{10} = 6\ 000$ [Hrs].
- High precision reduction gears are preferred for intermittent cycles (S3-S8): the output speed in applications is inverted-variable. The continuous mode cycle (S1) is needed to be consulted with the manufacturer.
- Dimensional pictures of the E series reduction gears are listed in the catalogue without sealing.
- Sealing options are described in the chapter Assembly instructions.
- Please consult the maximum speed in a duty cycle with the manufacturer.
- The values in the table refer to the nominal operating temperature.

The ratios highlighted in bold are recommended by SPINEA as optimal versions in terms of price and delivery.

TS 70-i-E-P11

INPUT SIDE VIEW

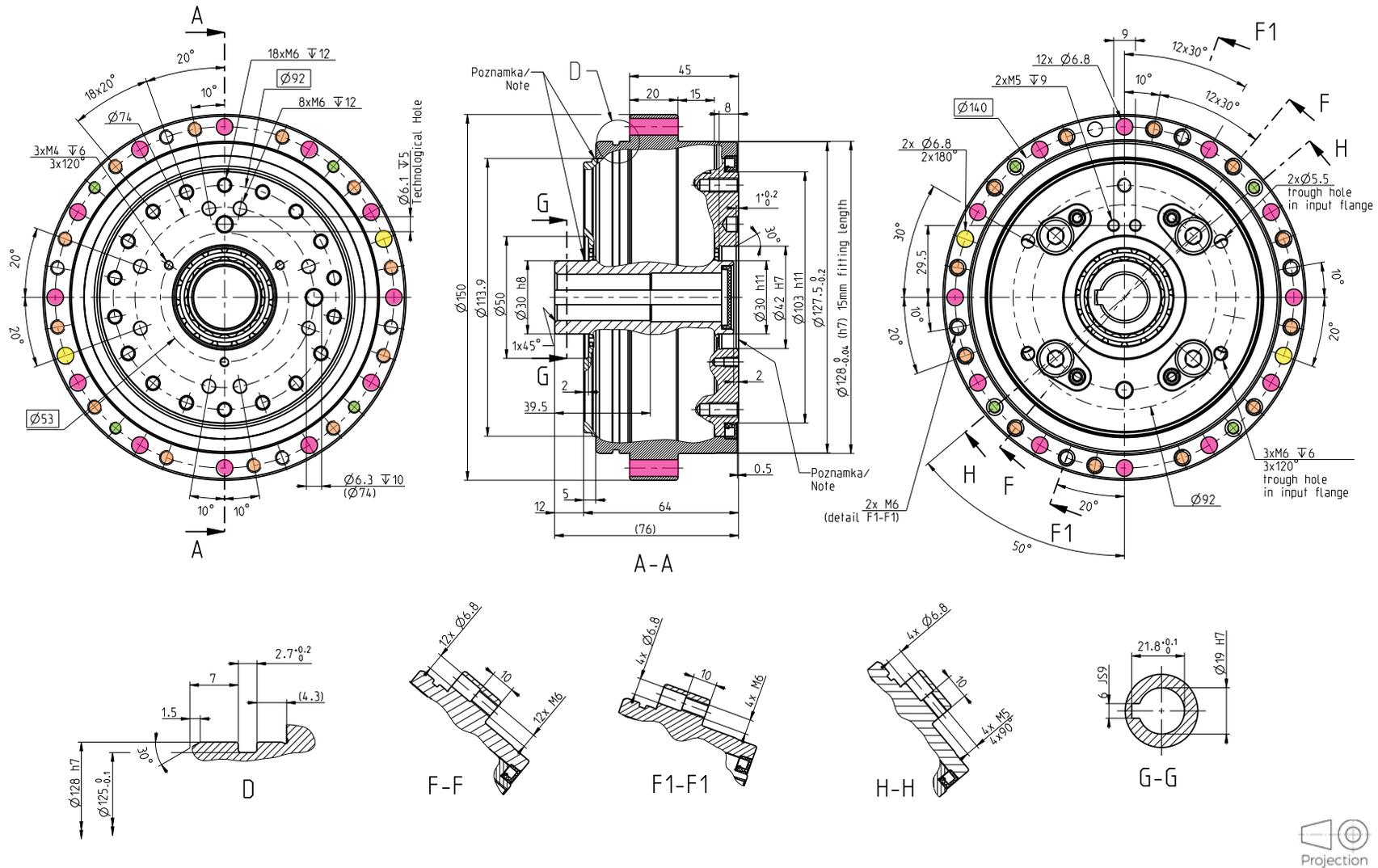


1. Use only standardized components, such as ring seals, bolts, etc.
2. Right to change without prior notice reserved.
3. Unsealed space, see the installation instructions in the TS Catalogue.



TS 140 - i - E - P 19

INPUT SIDE VIEW

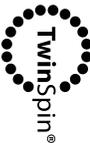


1. Use only standardized components, such as ring seals, bolts, etc.
2. Right to change without prior notice reserved.
3. Unsealed space, see the installation instructions in the TS Catalogue.

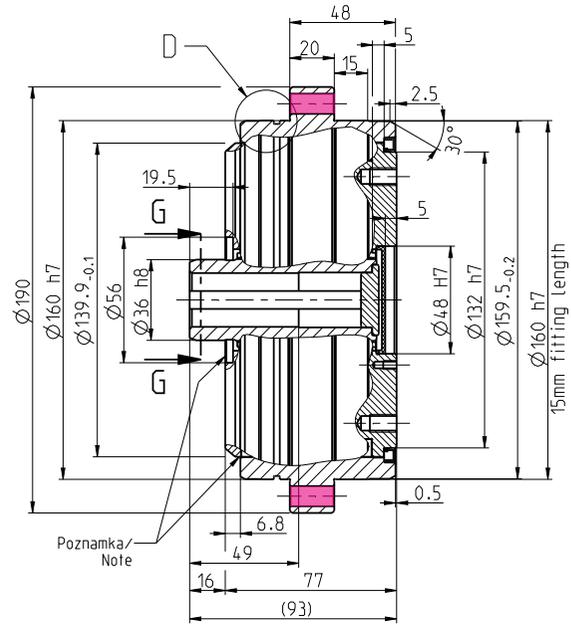
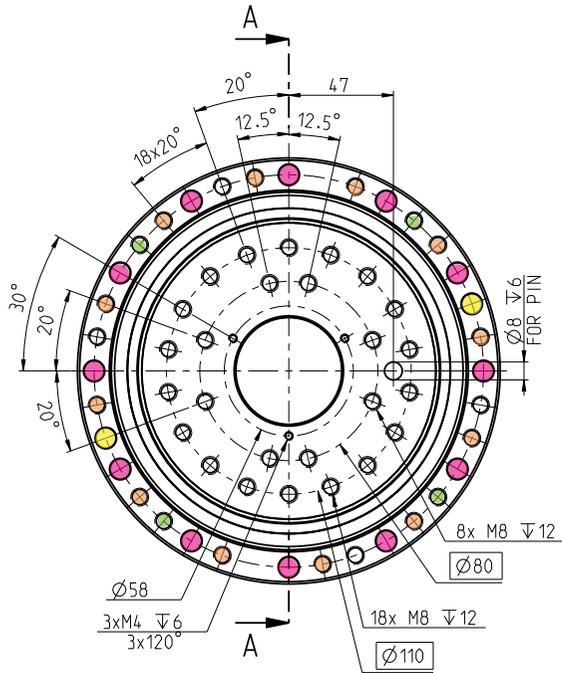


TS 140 - i - E - P 19

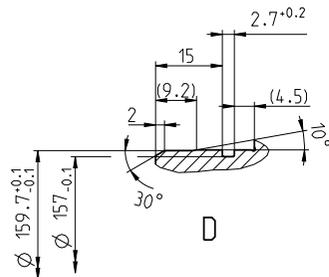
Drawings



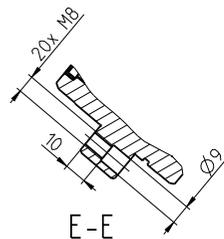
TS 170-i-E-P 24



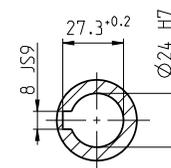
A-A



D

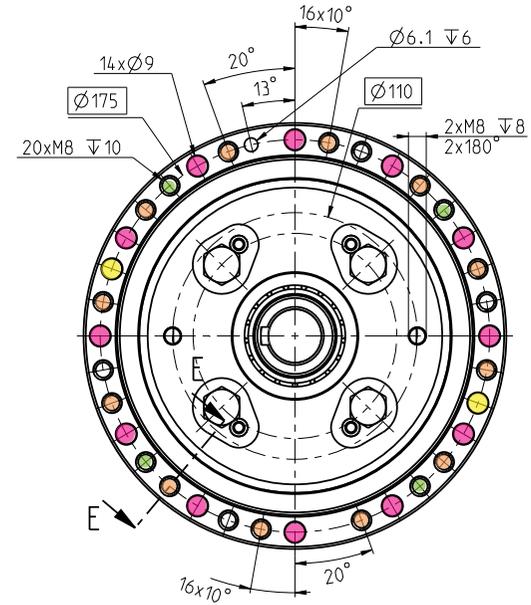


E-E



G-G

INPUT SIDE VIEW



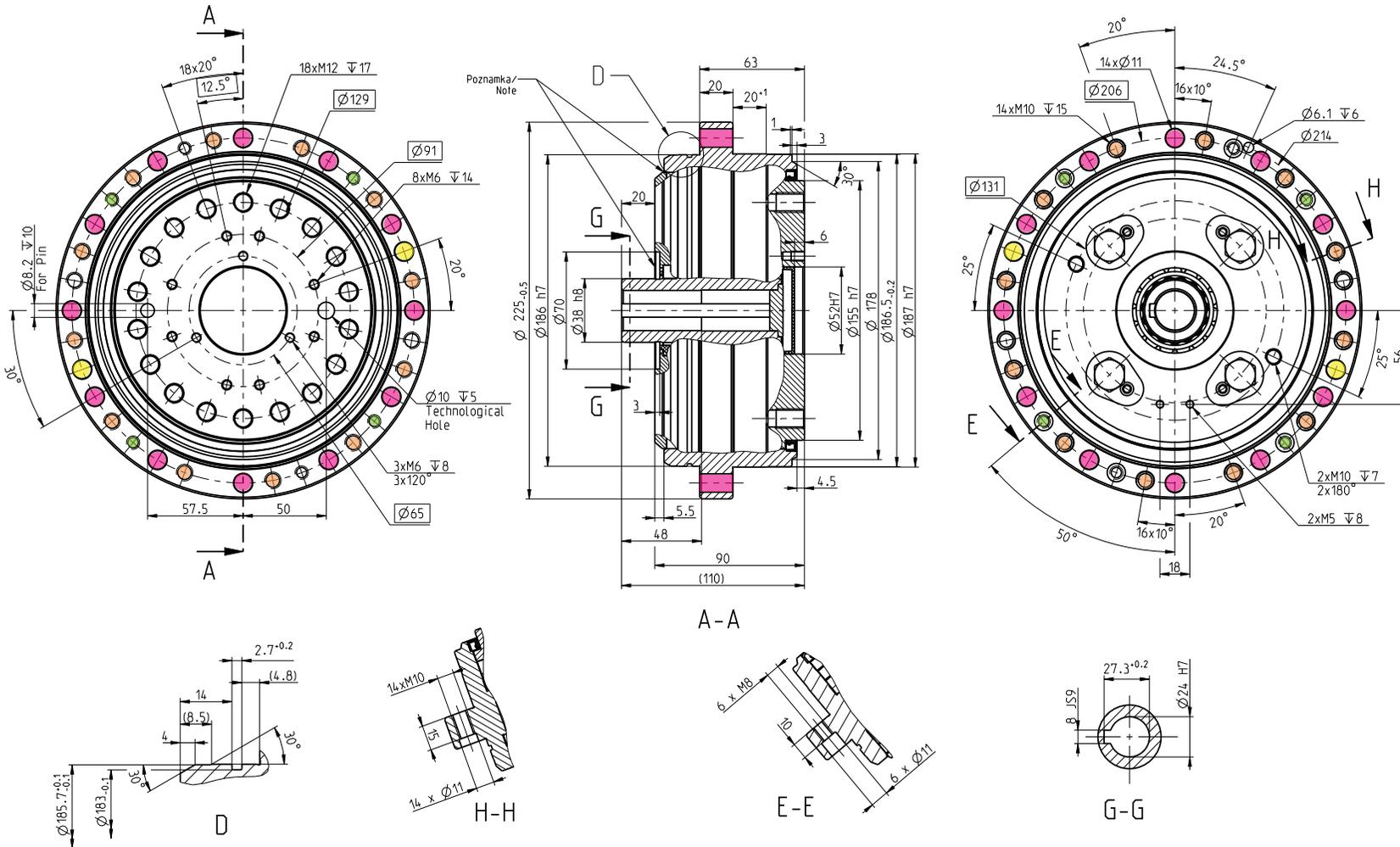
1. Use only standardized components, such as ring seals, bolts, etc.
2. Right to change without prior notice reserved.
3. Unsealed space, see the installation instructions in the TS Catalogue.



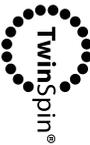
Projection

TS 200 - i - E - P 24

INPUT SIDE VIEW



1. Use only standardized components, such as ring seals, bolts, etc.
2. Right to change without prior notice reserved.
3. Unsealed space, see the installation instructions in the TS Catalogue.



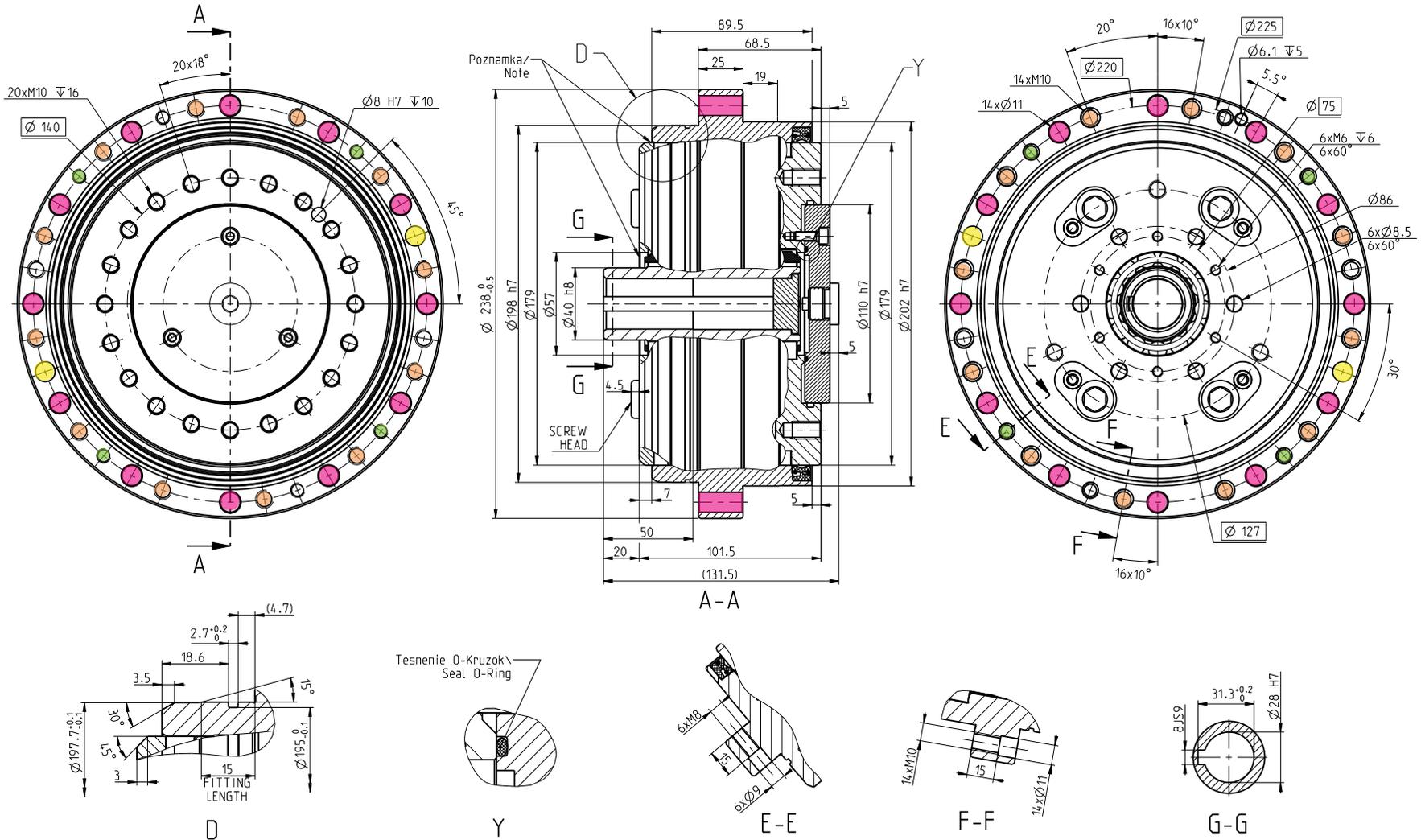
TS 200 - i - E - P 24

Drawings

E series

TS 220 - i - E - P 28

INPUT SIDE VIEW



1. Use only standardized components, such as ring seals, bolts, etc.
2. Right to change without prior notice reserved.
3. Unsealed space, see the installation instructions in the TS Catalogue.

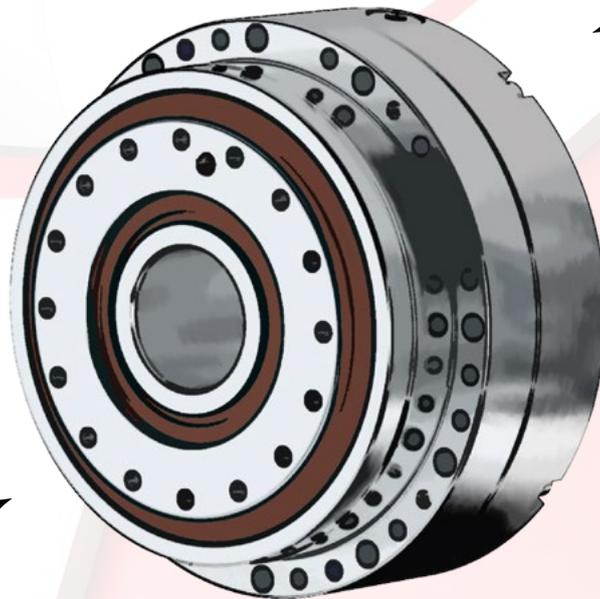






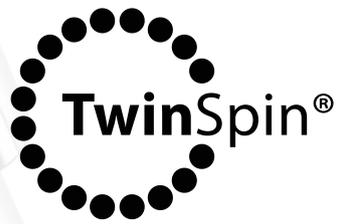
Fully sealed solution

High overload capacity



Integrated high capacity bearing

Zero-backlash reduction gear

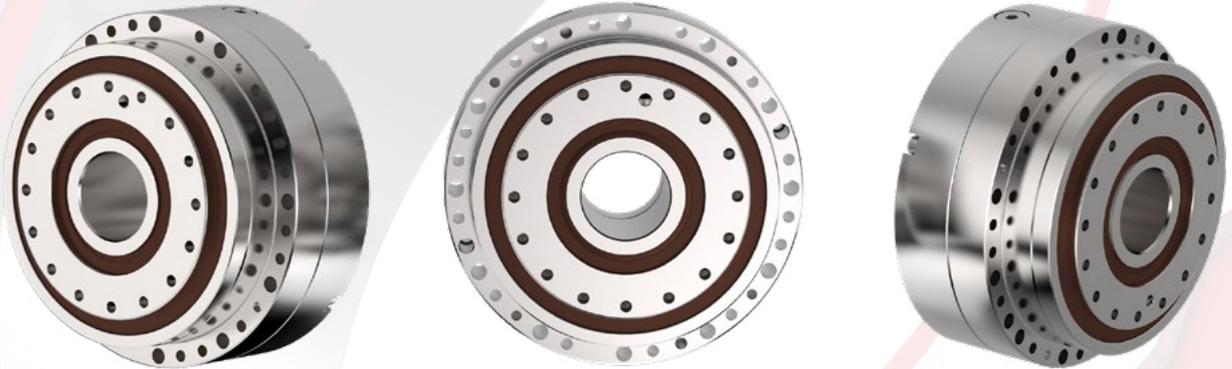


H series

H series

EXCELLENCE IN POSITIONING

2.5 H SERIES



Advantages

- large input shaft hole diameter
- fully sealed
- zero-backlash reduction gears
- high moment capacity
- excellent positioning accuracy and positioning repeatability
- high torsional and tilting stiffness
- small dimensions and weight
- high reduction ratios
- high efficiency
- long lifetime
- easy assembly

The **H series** represents TwinSpin® high precision reduction gears with through-holes in the shafts, also known as the hollow-shaft version. Cables, tubes with compressed air, drive shafts etc. can be led through the hole in the shaft of the gear. The H series is completely sealed and filled with grease for lifetime. The H series high precision reduction gears comprise an accurate reduction mechanism and high-capacity radial and axial cylindrical bearings. This design of the reduction gears allows the mounting of the load directly on the output flange or case without a need of additional bearings.

Tab. 2.5a: H series features

Case	Threaded and through holes in the case
Input flange connection	Completely sealed reduction gear
Input shaft design*	The input shaft is offered in the following versions: a) hollow shaft b) according to a special request
Installation and operation characteristics	Hollow-shaft reduction gears. A large hole in the input shaft allows cables, tubes or an additional shaft to pass through the reduction gear. Suitable for applications where the rotation of the input shaft is achieved by using a tooth belt or a similar arrangement.

*On request

Tab. 2.5b: H series ordering specifications

TS - 200 - 125 - H - H52

Name	Size	Ratio	Series version	Shaft version	
				H	S ¹⁾
TS	70	75	H	13	•
	140	69, 115	H	36	•
	170	69, 125	H	42, 46	•
	200	63, 125	H	52, 56	•
	220	55, 125	H	62, 65	•

H series

Note: An example of an ordering code of a modified H series TwinSpin® reduction gear with a motor flange: TS200 - 125 -H- H56 - M235 - P231. The markings M235 and P231 for a specific modification are defined by the manufacturer.
1) On request

Shaft version


H

Hollow shaft


S

Special shaft

Tab. 2.5c: H series rating table

Size	Reduction ratio	Shaft inside diameter	Rated output torque	Acceleration and braking output torque	Permissible output torque at emergency stop	Rated input speed	Max. allowable input speed 9)	Tilting stiffness 1) 5)	Torsional stiffness 1) 6)	Max. no-load starting torque 8)	Max. back driving torque 8)
	i	d	T _R [Nm]	T _{max} [Nm]	T _{em} [Nm]	n _R [rpm]	n _{max} [rpm]	M _t [Nm/arcmin]	k _t [Nm/arcmin]	[Nm]	[Nm]
TS 70	75	13	50	100	250	2 000	5 500	35	7.5	0.14	13
TS 140	69	36	200	500	1 000	2 000	3 500	340	55	1.6	110
	115						4 500			1.5	130
TS 170	69	42	420	1 050	2 100	2 000	3 200	1 100	110	2.5	180
		46		825	1 650					2.2	240
	125	42		1 050	2 100		3 700			4	250
		46		825	1 650						
TS 200	63	52	712	1 780	3 560	2 000	2 700	2 000	200	3	300
		56		1 100	2 200		3 700			5	170
	125	52		1 780	3 560						
		56		1 100	2 200						
TS 220	55	62	1 100	2 750	5 500	2 000	2 400	2 400	290	5	170
		65		2 000	4 000		3 400			3	350
	125	62		2 750	5 500						
		65		2 000	4 000						

RIGHT TO CHANGE WITHOUT PRIOR NOTICE RESERVED

- 1) Mean statistical value. For further information see chapter Torsional stiffness, Tilting stiffness.
- 2) Load at output speed 15 rpm.
- 3) Moment M_{c,max} value for F_a=0. If F_a ≠ 0, see chapter Moment.
- 4) Axial force F_a max value for M_c=0. If M_c ≠ 0, see chapter Tilting moment.
- 5) The parameter depends on the version of the high precision reduction gear.
- 6) The parameter depends on the version of the high precision reduction gear, ratio and lost motion.
- 7) The values of the parameters are informative. The exact value depends on the specific version of the high precision reduction gear.
- 8) Temperatures of the high precision reduction gear lower than 20°C will cause higher no-load starting or back driving torque.
- 9) Depends on the duty cycle; a higher input speed may still be possible; please consult the manufacturer.

Tab. 2.5c: H series rating table - continued

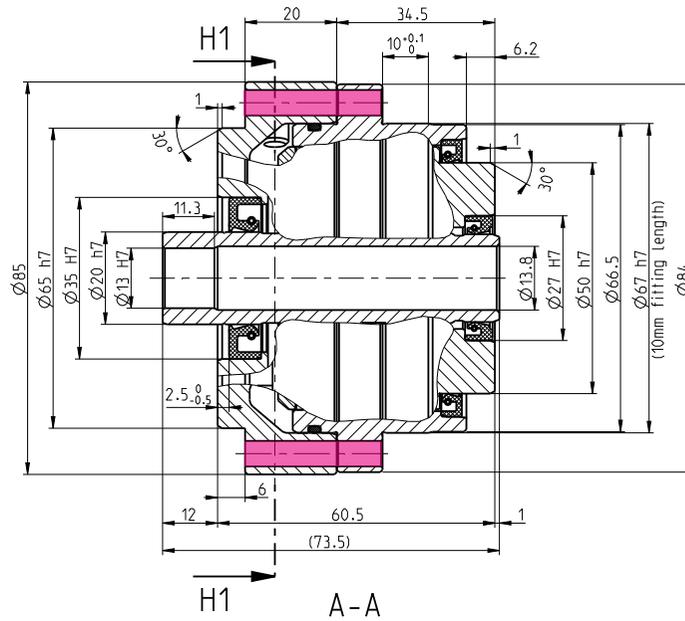
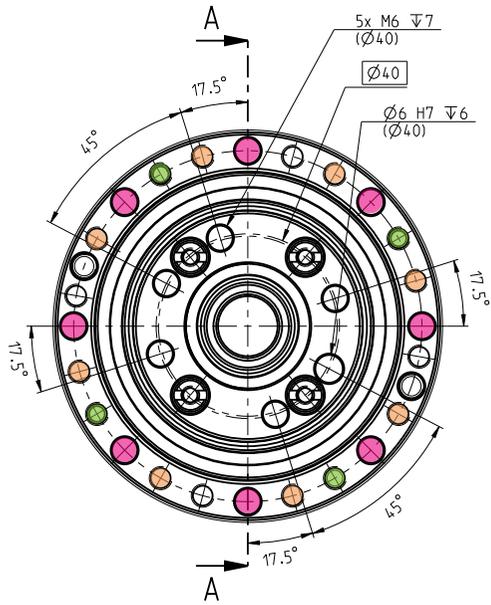
Size	Reduction ratio	Max. lost motion	Average angular transmission error 1) 6)	Hysteresis	Max. moment 2) 3)	Rated radial force 2)	Max. axial force 2) 4)	Input inertia 7)	Weight 7)
	i	LM [arcmin]	ATE [arcsec]	H [arcmin]	$M_{c\ max}$ [Nm]	F_{rR} [kN]	$F_{a\ max}$ [kN]	I [10^{-4} kgm ²]	m [kg]
TS 70	75	<1.5	±30	<1.5	142	2.8	4.1	0.061	1
TS 140	69	<1.5	±17	<1.0	1 160	11.5	17	3.6	7.5
	115								
TS 170	69	<1.0	±17	<1.0	2 000	19.2	27.9	4.8	11.6
	125								
TS 200	69	<1.0	±15	<1.0	3 300	21.5	31.7	18.2	20
	125								
TS 220	55	<1.0	±15	<1.0	4 400	22.5	35.5	31	26
	125								

IMPORTANT NOTES:

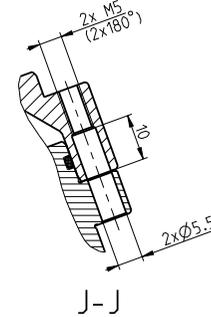
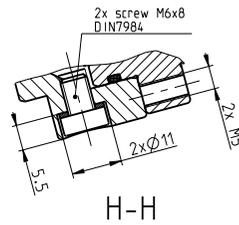
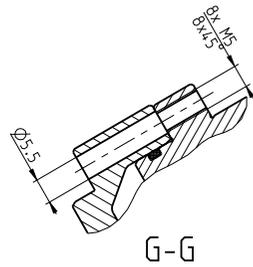
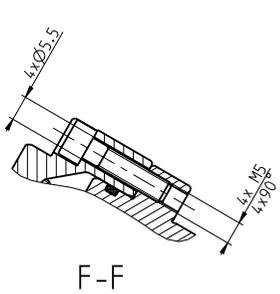
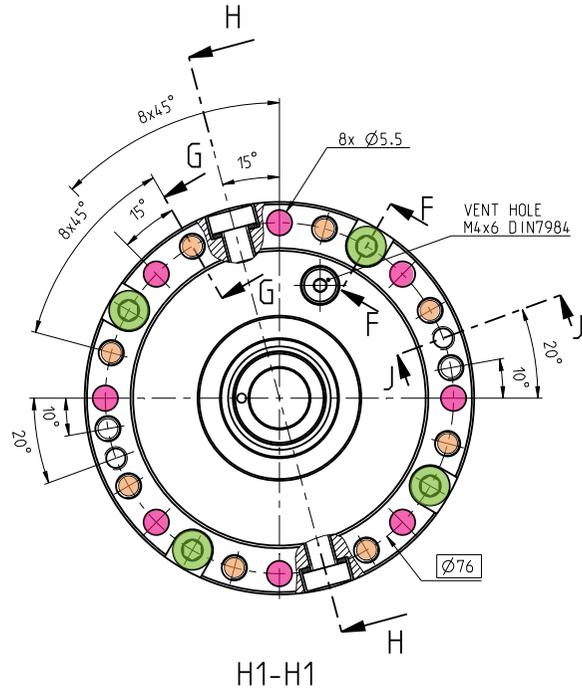
- Instantaneous speed peak that may occur within the working cycle.
- Note please the temperature on the gear case that should not exceed significantly 60°C degrees.
- Load values in the table are valid for the nominal life of $L_{10} = 6\ 000$ [Hrs].
- High precision reduction gears are preferred for intermittent cycles (S3-S8): the output speed in applications is inverted-variable. The continuous mode cycle (S1) is needed to be consulted with the manufacturer.
- Please consult the maximum speed in a duty cycle with the manufacturer.
- The values in the table refer to the nominal operating temperature.

The ratios highlighted in bold are recommended by SPINEA as optimal versions in terms of price and delivery.

TS 70 - i - H - H 13



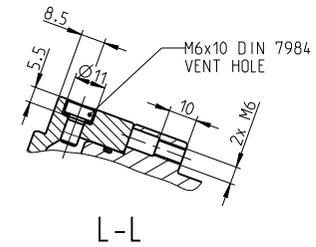
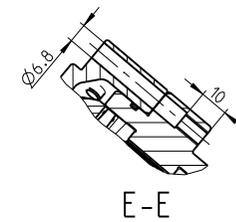
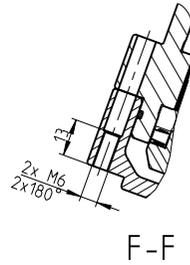
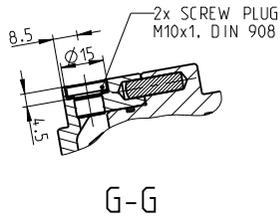
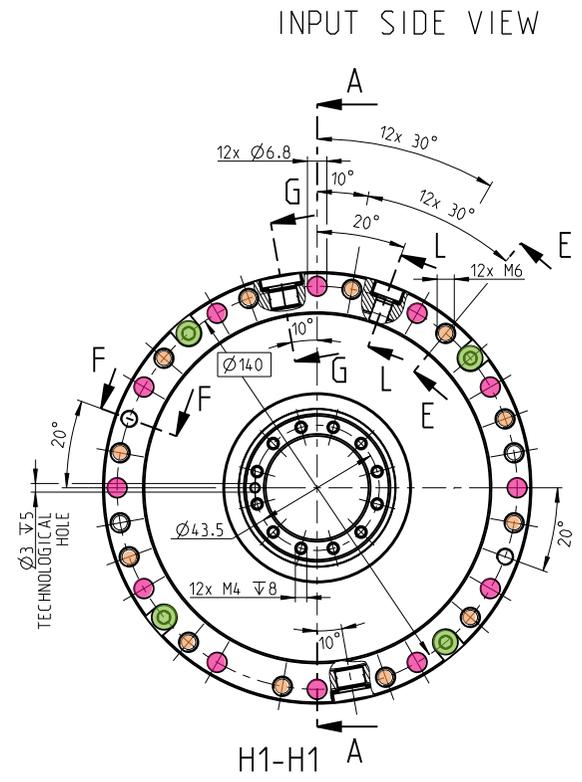
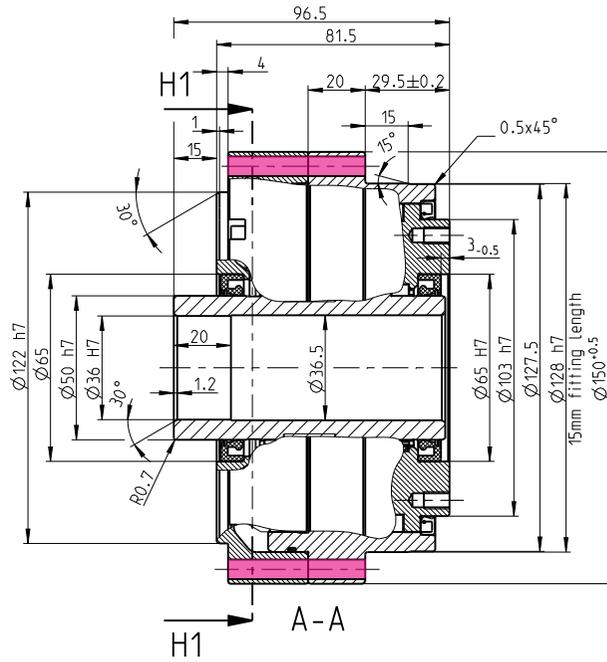
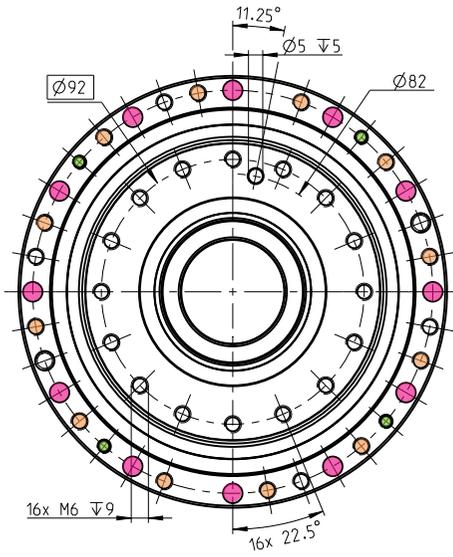
INPUT SIDE VIEW



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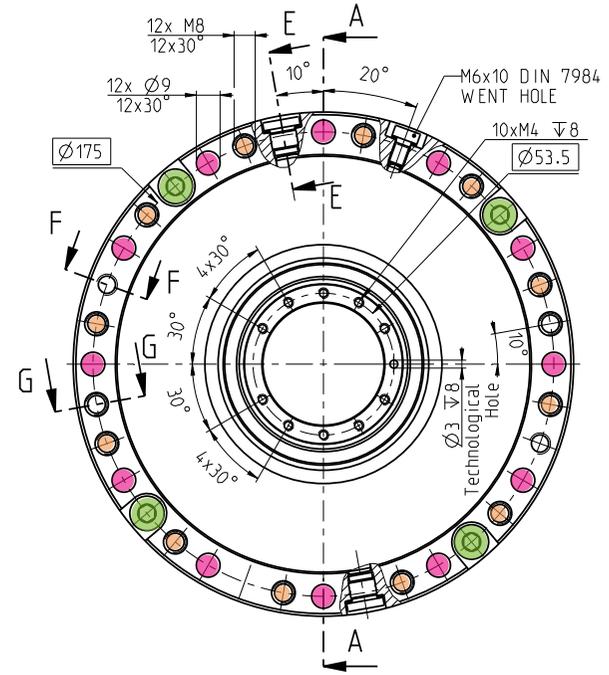
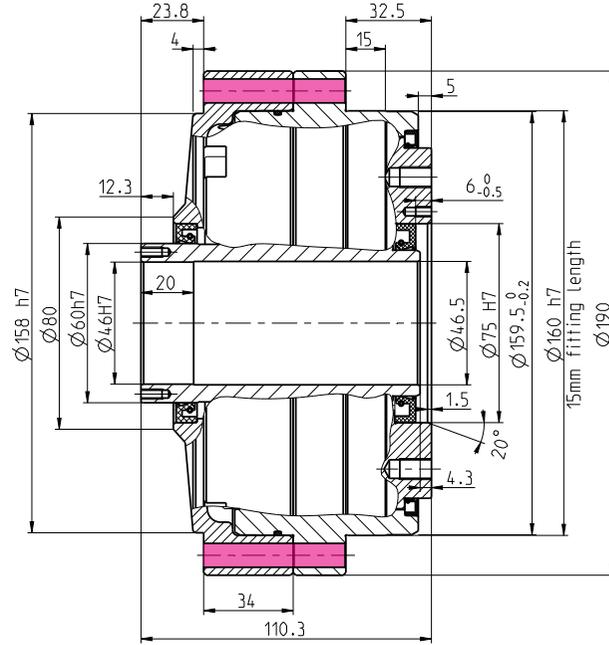
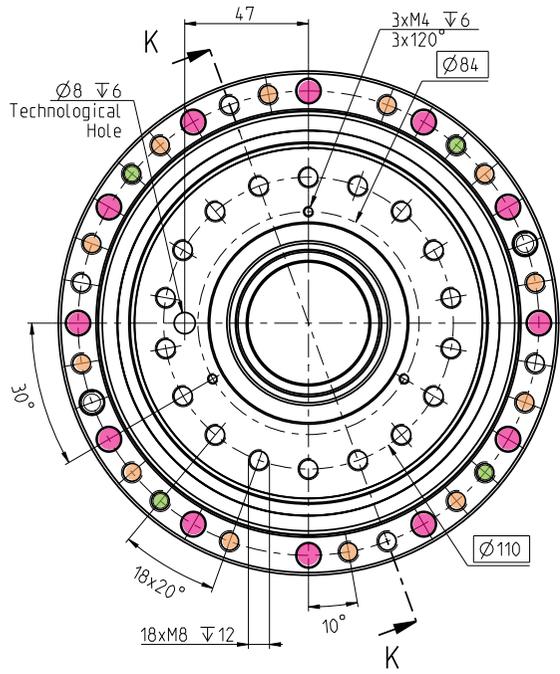
TS 140 - i - H - H 36



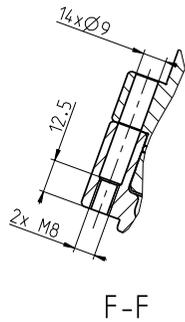
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TS 170 - i - H - H46

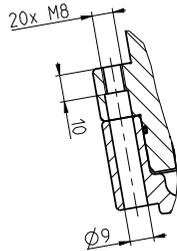
INPUT SIDE VIEW



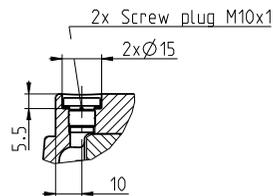
A-A



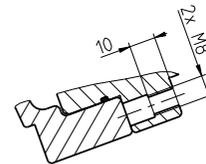
F-F



G-G



E-E

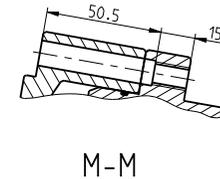
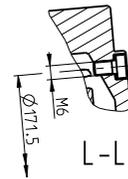
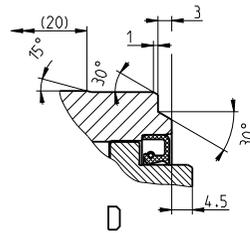
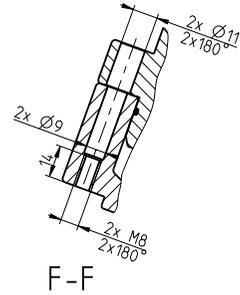
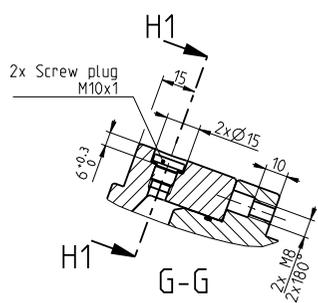
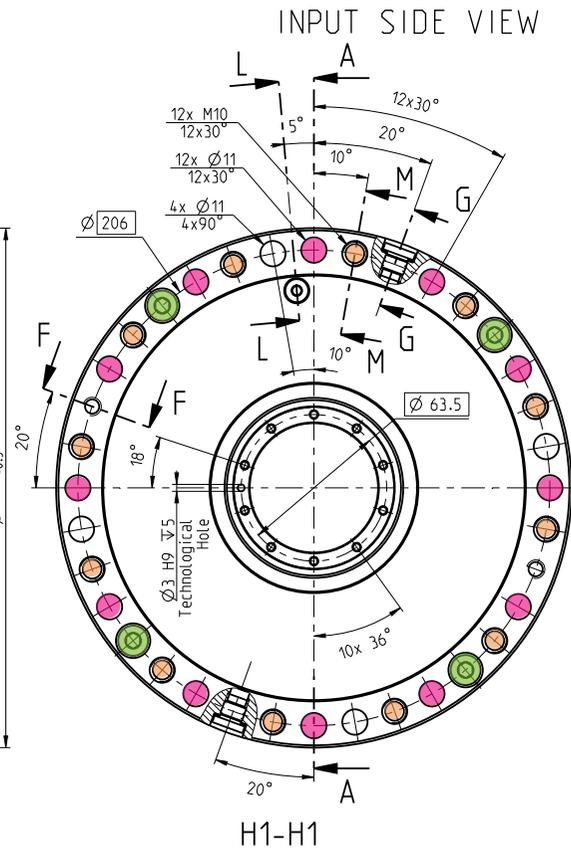
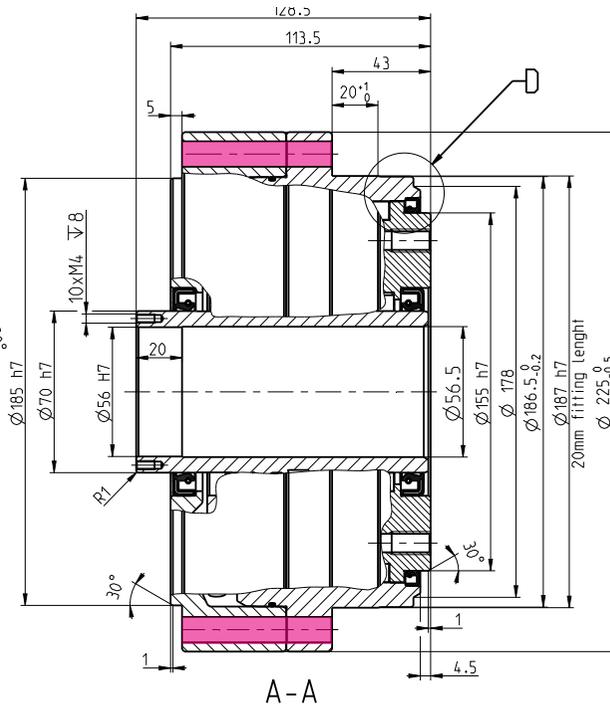
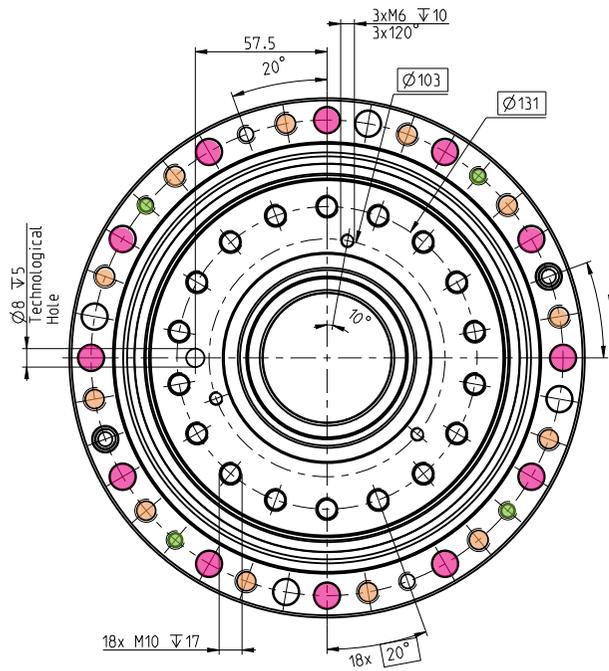


K-K



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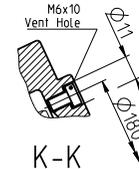
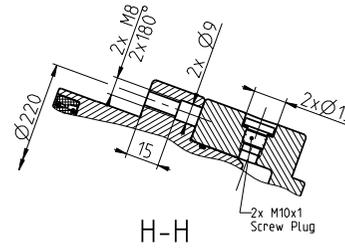
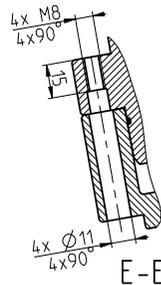
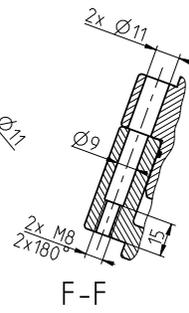
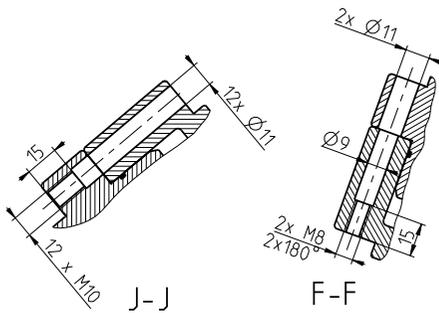
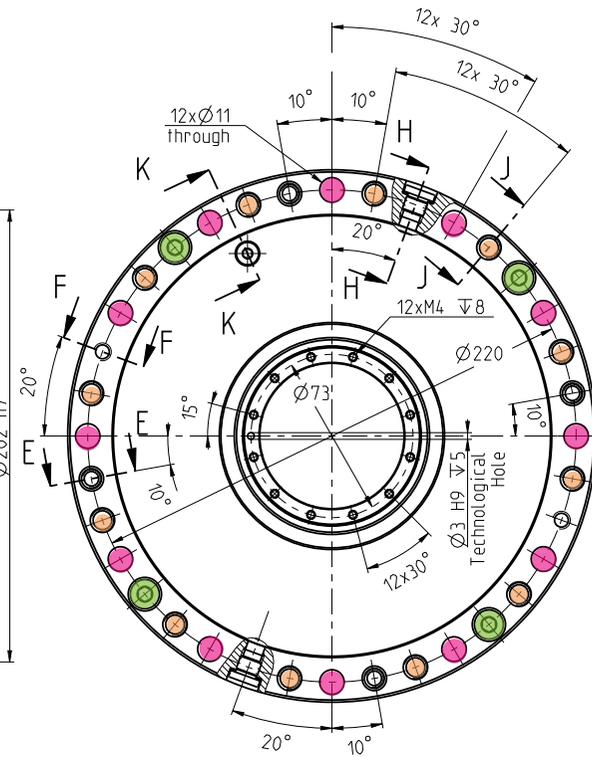
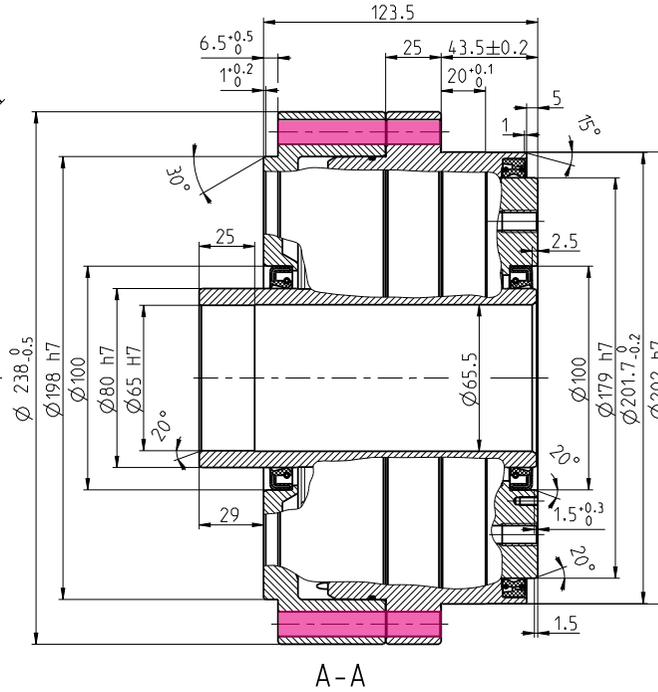
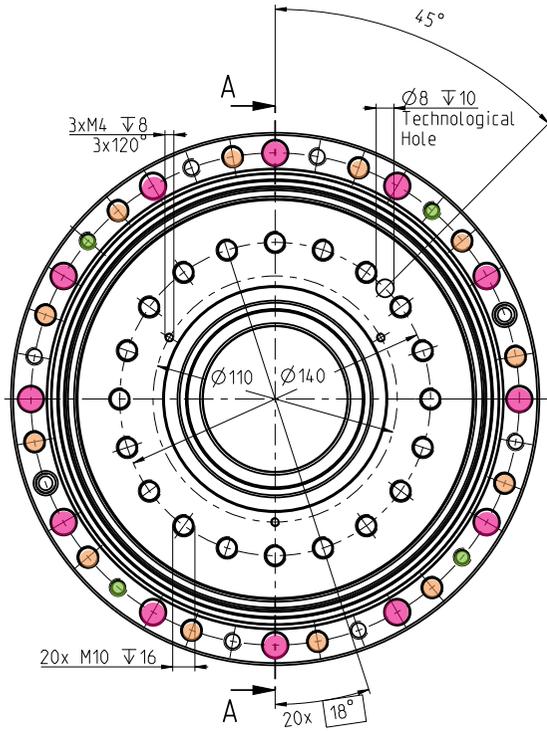
TS 200 - i - H- H56



1. Use only standardized components, such as ring seals, bolts, etc.
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TS 220 - i - H - H 65

INPUT SIDE VIEW



1. Use only standardized components, such as ring seals, bolts, etc.
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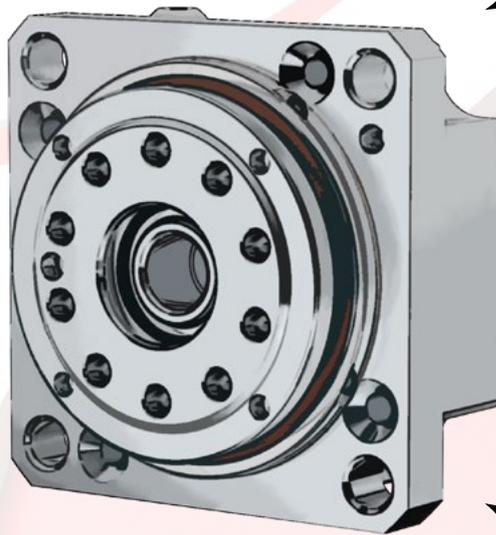






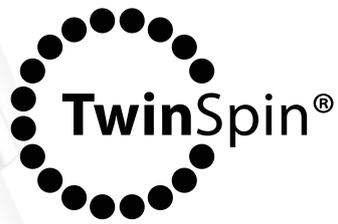
The smallest TwinSpin® compact reducer

High power density



Integrated ball bearings for low friction

Sealed and greased for life



M series

EXCELLENCE IN MOTION

M series

2.6 M SERIES

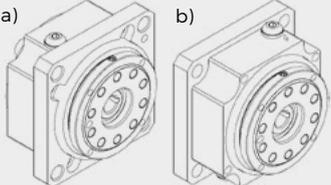


Advantages

- small dimensions and compact design
- series sealed by 2RS ball bearings
- simple installation
- zero- backlash reduction gear
- very low mass
- very high power density
- output deep groove ball bearings with very low friction
- high performance of the reduction gear
- high precision
- high torsional stiffness
- high linearity of torsional stiffness characteristics
- very low friction and high efficiency

The **M series** represents TwinSpin® high precision reduction gears of mini sizes. The M series is filled with grease for lifetime. The sealing of the M series reduction gears is secured by sealed (2RS) ball bearings, which are used as output bearings of the reduction gear, and they are also used for the housing of the input shaft of the reduction gear (slight leakage of the lubricant is allowed). Upon the customer's request, SPINEA is able to supply a completely sealed reduction gear. This design of the reduction gears allows the mounting of the load directly on the output flange or case without a need of additional bearings.

Tab. 2.6a: TwinSpin® M series mini reduction gear versions

<p>Shape of the case</p>	<p>a) The mounting part of the case is located on the output side of the TwinSpin® high precision reduction gear.</p> <p>b) The mounting part of the case is located on the input side of the TwinSpin® high precision reduction gear.</p> <div style="text-align: right;">  </div>
<p>Input shaft connection</p>	<p>a) Direct connection of shafts without couplings. The motor shaft is aligned with the hole with a keyway.</p> <p>b) Indirect connection of shafts with rigid or flexible couplings</p> <p>c) Shafts are aligned according to the customer's requirements.</p>

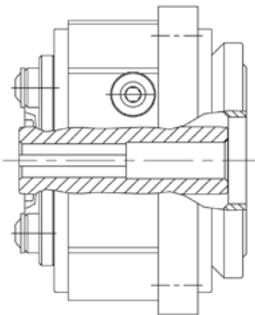
The M series high precision reduction gears are manufactured in several modifications according to the specification of the shaft and the case; see Tab. 2.6a.

Tab. 2.6b: M series ordering specifications

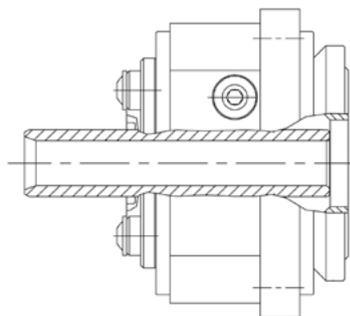
TS - 50 - 63 - M - P6						
Name	Size	Ratio	Series version	Shaft version		
				P	H	S
TS	50	47, 63	M	6	8	according to a special request

Note: An example of an ordering code of a modified TwinSpin® reduction gear with with a motor flange:
 TS 50 - 63 - M - P6- M235 - P231. The markings M235 and P231 for a specific modification are defined by the manufacturer.

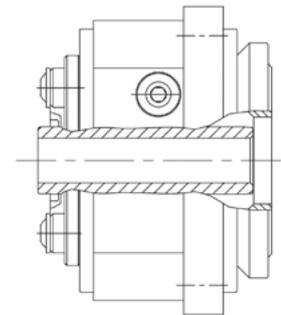
Shaft version



a) P- Shaft with keyway



b) H - Hollow shaft



c) S- Special shaft

Tab. 2.6c: M series rating table

Size	Reduction ratio	Rated output torque	Acceleration and braking output torque	Permissible output torque at emergency stop	Rated input speed	Rated output speed	Max. continuous input speed	Max. allowable input speed 1) 6)	Tilting stiffness 1)	Torsional stiffness 1)
	i	T_R [Nm]	T_{max} [Nm]	T_{em} [Nm]	n_R [rpm]	n_{Rout} [rpm]	n_{cmax} [rpm]	n_{max} [rpm]	M_t [Nm/arcmin]	k_t [Nm/arcmin]
TS 50	47	18	36	90	2 000	32	3 000	5 000	4	2.5
	63									

RIGHT TO CHANGE WITHOUT PRIOR NOTICE RESERVED

- 1) Mean statistical value
- 2) Load at output speed $n_{Rout} = n_R / i$. For TS 50 M at 32 [rpm]
- 3) Moment $M_{c,max}$ at $F_a=0$. If $F_a \neq 0$ see par. 3.5.1
- 4) Radial force $F_{r,max}$ for $F_a=0$. If $F_a \neq 0$ see par. 3.5.1
- 5) Axial force $F_{a,max}$ for $F_r=0$, $M_c=0$. If $M_c \neq 0$, see par. 3.5.1
- 6) At 50% $n_{c,max}$ (max input speed in cycle)
- 7) Applies to the standard version of the high precision reduction gear with the shaft connected by a keyway
- 8) a_2 is the distance of the radial force centre from the front of the output flange [m]

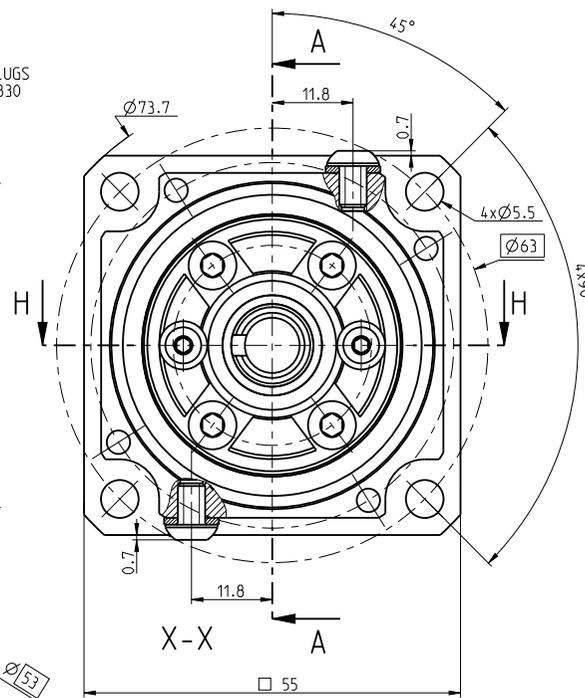
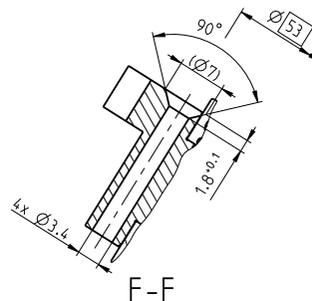
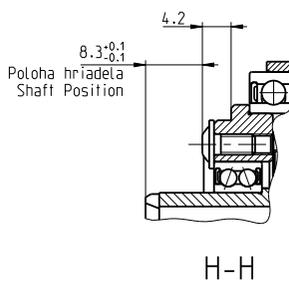
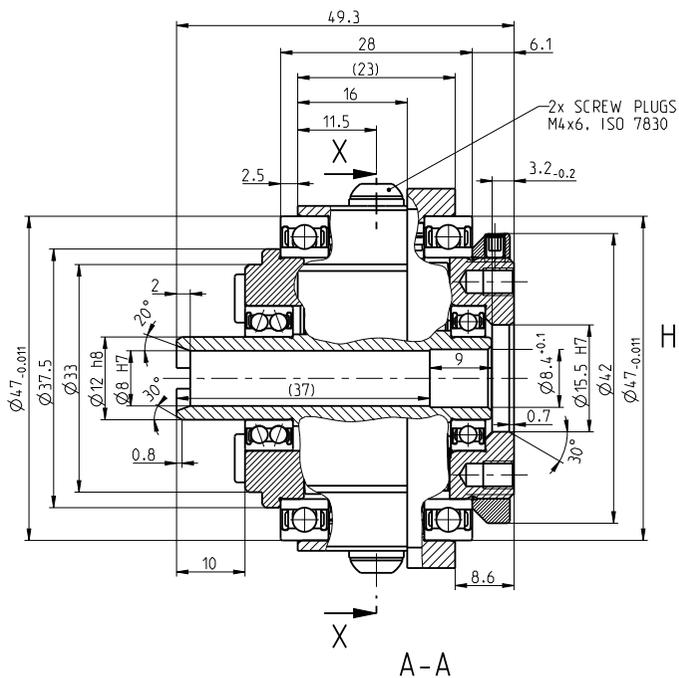
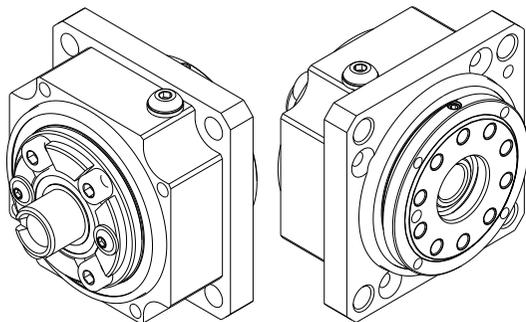
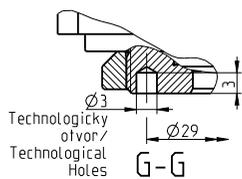
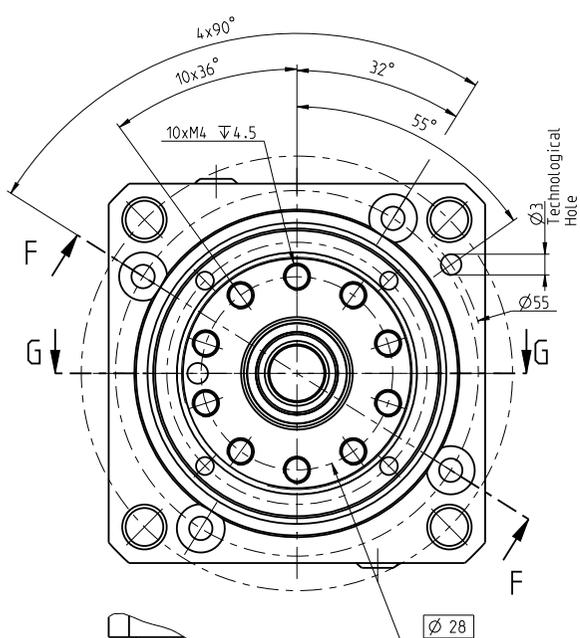
Tab. 2.6c: M series rating table - continued

Average no-load starting torque 1)	Average back driving torque 1)	Max. lost motion	Hysteresis	Max. peak moment 2) 3)	Max radial force 2) 4) 8)	Max. axial force 2) 5)	Input inertia 7)	Weight 7)
[cNm]	[Nm]	LM [arcmin]	H [arcmin]	$M_{c\ max}$ [Nm]	F_{rR} [kN]	$F_{a\ max}$ [kN]	I [10^{-4} kgm ²]	m [kg]
4	3	<1.5	<1.5	44	a2=0 1.44	1.9	0.007	0.47
3	2				a2>0 $0.044/(a2+0.0305)$			

Note:
Load values in Tab. 2.6c are valid for the nominal life of $L_{10} = 6\ 000$ [Hrs].

TS 50 - i - M - H8 - M826

INPUT SIDE VIEW



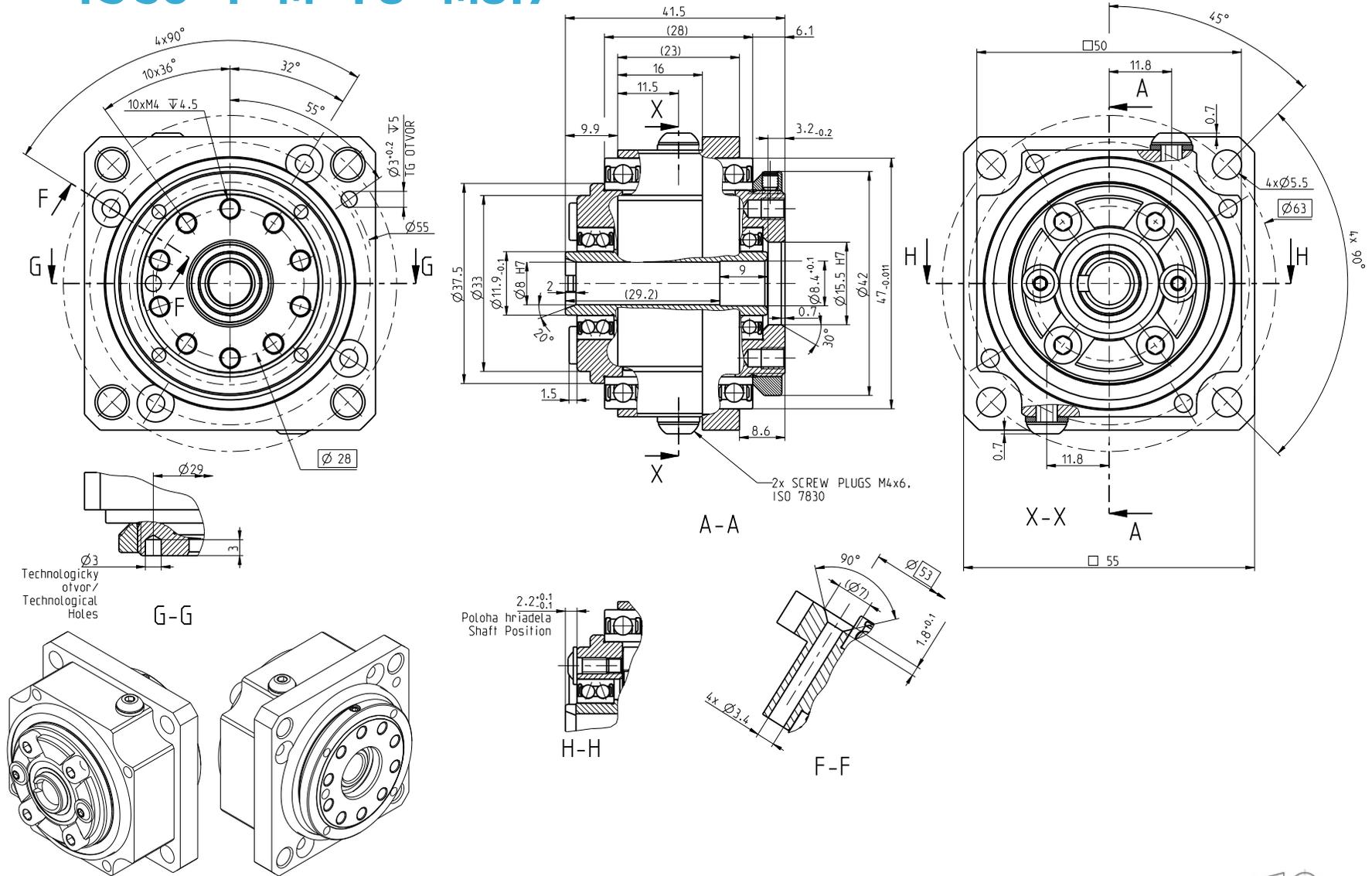
1. Use only standardized components, such as ring seals, bolts, etc.
2. Right to change without prior notice reserved.
3. Unsealed space, see the installation instructions in the TS Catalogue.

TS 50 - i - M - H8 - M826

Drawings



TS 50 - i - M - F8 - M817



1. Use only standardized components, such as ring seals, bolts, etc.
2. Right to change without prior notice reserved.
3. Unsealed space, see the installation instructions in the TS Catalogue.







3. Performance characteristics

3.1 G, GH, T, E, H, M series service life calculation

The nominal service life of the TwinSpin® reduction gear is determined by the service life of the bearings on the input shaft. This nominal service life is limited by the material fatigue of the bearings. It does not take into account other factors that may be a limit to the practical service life, such as insufficient lubrication, contamination or overload. The nominal service life is only a statistical value.

It denotes a time in operation under rated conditions during which 10% of a large number of reduction gears get damaged due to material fatigue. For further explanations or special calculations for your specific application please contact the Sales Department or your local sales representative.

The service life for a given speed and load values can be calculated as follows:

$$L_h = k \cdot \frac{n_R}{n_a} \cdot \left(\frac{T_R}{T_a} \right)^{\frac{10}{3}} \text{ [hrs]}$$

k – 6,000 hour service life [Hrs]

L_h – required service life [hrs]

T_a – average output torque [Nm]

n_a – average input speed [rpm]

T_R – rated output torque [Nm]

n_R – rated input speed [rpm]

3.2 M series maximum continuous input speed ($n_{c \max}$)

The maximum continuous input speed is the speed limit in the continuous operation mode S1. If higher speeds are required, please contact the sales department.

3.3 G, GH, T, E, H, M series maximum acceleration and braking torques

Due to inertial loads, the torque applied during acceleration and braking is higher than the rated value. The maximum allowable torque when the reduction gear accelerates or decelerates is shown in Tab. 2.3c, Tab. 2.4c, Tab. 2.5c, and Tab. 2.6c.

3.4 G, GH, T, E, H, M series maximum emergency stop torque (T_{em})

An emergency stop and the induced shock load may result in torque values higher than the nominal value. The maximum allowable torque value is provided in Tab. 2.3c, Tab. 2.4c, Tab. 2.5c, and Tab. 2.6c. It should be noted that its occurrence is accidental and rare, and it is not part of a regular duty cycle in any way.

3.5 Allowable radial-axial load and moment load on the output flange of the G, GH, T, E, H series

Radial and axial loads act independently thanks to the integrated radial-axial output bearings. The allowed radial load (F_r) is provided in the rating table in Chapter 2. The moment (Fig. 3.6a and Fig. 3.6b) is expressed as follows:

$$M_c = F_r \cdot a + F_a \cdot b$$

a – radial force F_r arm [m]

b – axial force F_a arm [m]

M_c – moment [Nm]

F_r – radial load [N]

F_a – axial load [N]

The allowable load for the moment (M_c) and the axial force (F_a) is shown in Fig. 3.5. A point with coordinates (M_c , F_a) must lie in the area under the line of the selected reduction gear. For example, in the case of TS 170 T, E, at an output speed of 15 rpm, $L_{10} = 6\,000$ hrs and moment $M_c = 1\,500$ Nm, the maximum axial force may be 10.7 kN (see Fig. 3.5). The allowable radial and axial loads determine the allowable dynamic load that can be applied on a reduction gear. For more detailed calculations for specific conditions please contact the sales department or your local sales representative.

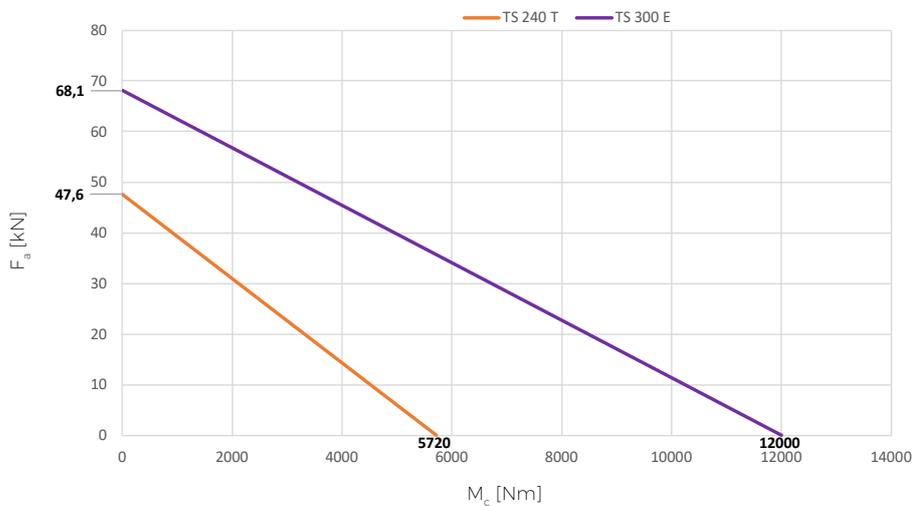
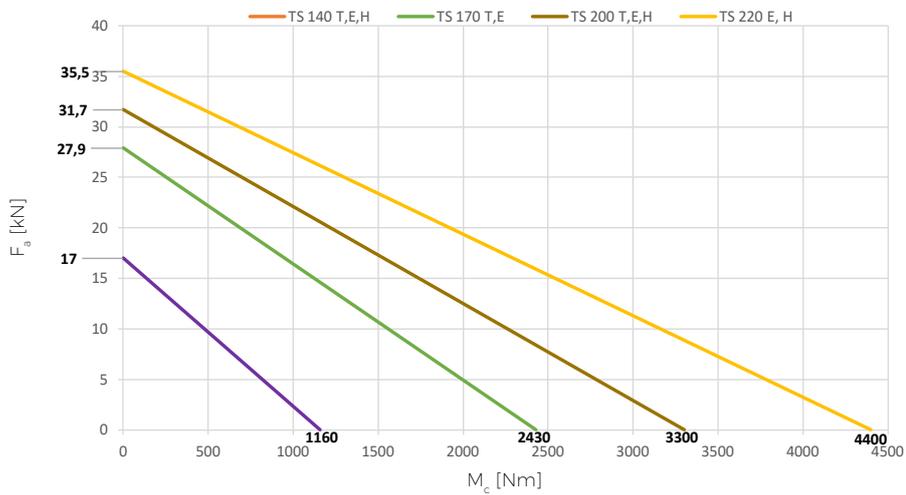
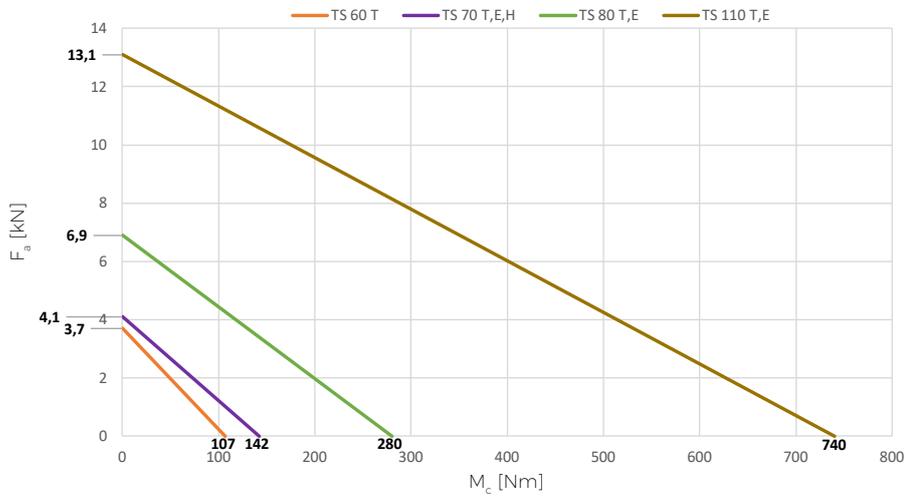
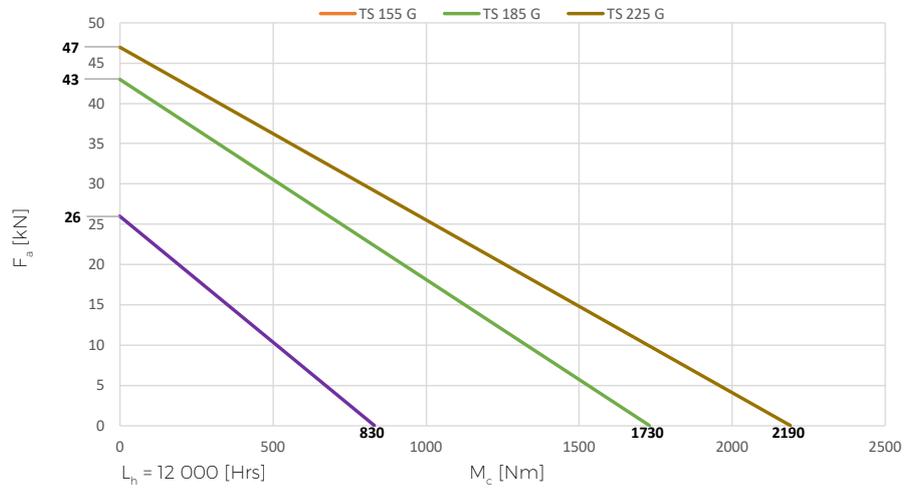
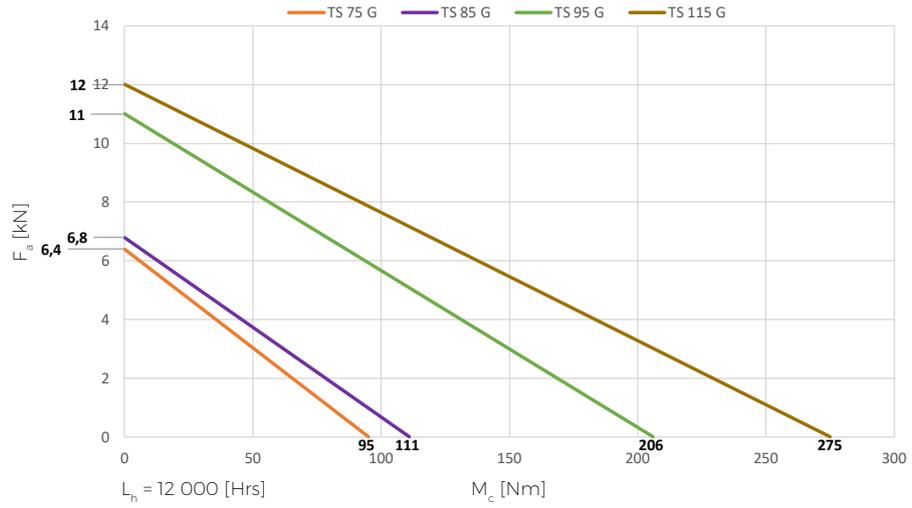


Fig. 3.5: Relation between the moment and the axial force



3.5.1 Allowable radial-axial load and moment on the output flange of the **M** series

The output flange of the TwinSpin® M series reduction gear is able to transmit external loads from the radial force F_r , axial force F_a and moment M_c . The moment is expressed as follows

$$M_c = F_r \cdot a + F_a \cdot b$$

M_c – moment [Nm]

F_r – radial load [N]

F_a – axial load [N]

b – arm of force F_a [m]

a_1 – perpendicular distance between the centre of the output bearings and the face of the output flange [m]

a_2 – perpendicular distance between the vector of force F_r and the face of the output flange [m]

a_3 – perpendicular distance between the centre of the output bearing A and the face of the output flange [m]

$a = a_1 + a_2$ – arm of force F_r in relation to the centre of the output bearings [m]

A, B – identification of the bearings

A – bearing of the output side of the reduction gear

B – bearing of the input side of the reduction gear

R_{Ax} , R_{Ay} , R_{Bx} , R_{By} – reaction identification on x-axis (axial direction) and y-axis (radial direction) in bearings A,B

L_1 – distance between the centres of the output bearings [m]

$L_2 = a_2 + a_3$ – perpendicular distance between the vector of force F_r and the centre of the output bearing A [m]

The moment applied to the most loaded bearing A according to Fig. 3.5.1 is expressed as follows:

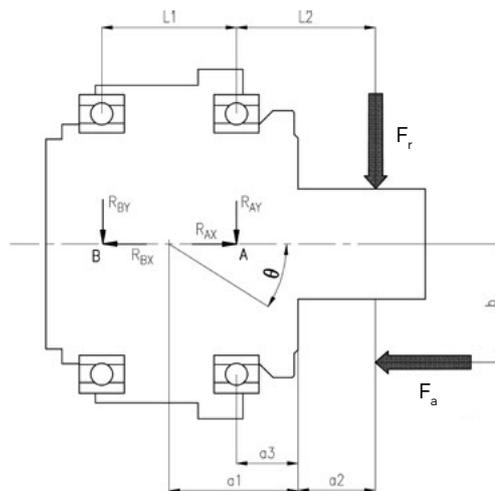


Fig. 3.5.1: Loading of the M series reduction gear and the angle of tilt

$$M_c = F_r (a_2 + a_3) + F_a b = F_r \cdot L_2 + F_a b$$

When checking external loads of the TwinSpin® M series reduction gear, proceed as follows:

a) Allowable axial load

$$F_a \leq F_{a, \max}$$

according to the Tab. 3.5.4

b) Allowable moment

$$M_c \leq M_{c, \max}$$

according to the Tab. 3.5.5

c) Allowable radial load

$$F_r \leq F_{r, \max}$$

according to the Tab. 3.5.6

d) Equivalent load

$$Pr_A \leq P_{r, \max}$$

according to the Tab. 3.5.3

Tab. 3.5.1: Distances a_1 , a_3 and L_1 from Fig. 3.5.1

TS series M	TS 50
Distance a_1 [m]	0.02
Distance a_3 [m]	0.0095
Distance L_1 [m]	0.021

3.5.2 M series output bearings load capacity

The standard version of the TwinSpin® M series reduction gear has two sealed (2RS) deep groove ball bearings as output bearings. Tab. 3.5.2a describes the basic dynamic and static load capacity of the two bearings and Table 3.5.2b is used for the calculation of the equivalent loading of one output deep groove ball bearing of the reduction gear.

Tab. 3.5.2a: Capacity of M series deep groove ball bearings

TwinSpin® M series reduction gear	TS 50
Basic dynamic load capacity C_r [kN]	4.75
Basic static load capacity C_o [kN]	3.85

Tab. 3.5.2b: Calculation of the equivalent load of one M series deep groove ball bearing

Equivalent Radial Load	Dynamic equivalent radial load $P_r = X \cdot R_y + Y \cdot R_x$ Values X and Y are in the table on the right	R_x/C_o	e	$R_x/R_y \leq e$		$R_y/R_x > e$	
				X	Y	X	Y
	Static equivalent radial load = $0.6 R_y + 0.5 R_x$	0.084 0.11 0.17	0.28 0.30 0.34	1	0	0.56	1.55 1.45 1.31
	if value $P_{or} < R_y$, $P_{or} = R_y$	0.28 0.42 0.56	0.38 0.42 0.44				1.15 1.04 1.00

Where R_x , R_y are reactions in bearings A, B, i.e. identified as R_{Ax} , R_{Ay} , R_{Bx} , R_{By} according to Fig. 3.5.1.

3.5.3 M series output bearings allowable load

The tables of nominal values Tab. 3.5.4, Tab. 3.5.5, and Tab. 3.5.6. show the allowable radial force $F_{r \max}$, allowable axial load $F_{a \max}$ and allowable moment $M_{c \max}$ applied to the output flange of the TwinSpin® M series reduction gear according to Fig. 3.5.1 This is the load at which the gear achieves the nominal service life of its output bearing $L_{10} = 6000$ Hrs at the nominal output speed $n_{r \text{out}}$. The equivalent radial load can be determined from the formula:

$$L_{10} = \frac{10^6}{60 \cdot n} \cdot \left(\frac{C_r}{P_r} \right)^3 \quad P_r = \frac{C_r}{(L_{10} \cdot 60 \cdot n \cdot 10^{-6})^{\frac{1}{3}}}$$

L_{10} – service life [hour]

n – operational speed [rpm]

C_r – basic dynamic load of the bearing [N]

P_r – equivalent radial load [N]

Tab. 3.5.3: Equivalent maximum radial load of the M series output bearing

M series high precision reduction gear ($L_{10} = k$, $n = n_{r \text{out}}$)	TS 50
Ratio i	63
Equivalent max. radial load of the output bearing $P_{r \max}$ [N]	2 100

3.5.4 M series allowable axial load $F_{a \max}$

Tab. 3.5.4 shows the maximum allowable axial load $F_{a \max}$ where the arm of the force is $b = 0$ (Fig. 3.5.1) and $F_r = 0$ and $M_c = 0$.

 Tab. 3.5.4: Allowable axial load $F_{a \max}$ on the M series output bearing

M series high precision reduction gear ($L_{10} = k$, $n = n_{r \text{out}}$)	TS 50
Ratio i	63
Allowable axial load $F_{a \max}$ [N] ($F_r = 0$, $M_c = 0$, $b = 0$)	1 900

3.5.5 M series allowable moment $M_{c \max}$

When only an external moment M_c is applied to the output flange or the TwinSpin® M series reduction gear, the following applies to the maximum value $M_{c \max}$ of the moment in Tab. 3.5.5:

$$M_{c \max} = P_{r \max} \cdot L_1$$

Tab. 3.5.5: Allowable moment at the output flange of the M series high precision reduction gear

M series high precision reduction gear ($L_{10} = k \cdot n = n_{r \text{out}}$)	TS 50
Allowable moment $M_{c \max}$ [Nm] ($F_a = 0$)	44

3.5.6 M series allowable radial load $F_{r \max}$

The allowable radial load values $F_{r \max}$ when $F_a = 0$ (Tab. 3.5.6) are calculated from the formula:

$$F_{r \max} = \frac{M_{c \max}}{(a_2 + a_3 + L_1)}$$

Tab. 3.5.6: Allowable radial load on the M series output flange

M series high precision reduction gear ($L_{10} = k \cdot n = n_{r \text{out}}$)	TS 50
Allowable radial load $F_{r \max}$ [N]	$44/(a_2 + 0.0305)$
Allowable radial load for $a_2 = 0$, $F_{r \max}$ [N]	1 440 N

Where a_2 is the perpendicular distance between the vector of force F_r and the face of the output flange [m] Fig. 3.5.1

3.5.7 M series output flange allowable load when applying both F_r radial force and F_a axial force

When both a radial force F_r and an axial force F_a are applied to the output flange, then, according to Tab. 3.5.2b, the equivalent load is calculated as follows:

$$PrA = X \cdot \left(\frac{F_a \cdot b + F_r(a_2 + a_3)}{L_1} + F_r \right) + Y \cdot F_a$$

$$PrA = X \cdot \left(\frac{M_c}{L_1} + F_r \right) + Y \cdot F_a$$

Where the coefficients X and Y are calculated according to Tab. 3.5.3 as follows:

$$\frac{RAx}{C_{or}} = \frac{F_a}{C_{or}} \rightarrow X, Y$$

$$\frac{RAx}{RAy} = \frac{F_a}{\frac{F_a \cdot b + F_r(a_2 + a_3)}{L_1} + F_r} \rightarrow X, Y$$

$$\frac{RAx}{RAy} = \frac{F_a}{\frac{M_c}{L_1} + F_r} \rightarrow X, Y$$

3.6 G, GH, T, E, H, M series output flange tilting stiffness and deflection angle

The TwinSpin® reduction gears are able to withstand external forces and moment loads by means of integrated output bearings. When the output flange is loaded, the flange deflection angle is proportional to the applied moment. The tilting stiffness (M_t) is a moment at which the output flange deflects by an angle $\Theta = 1'$. The M_t values are specified in the rating table in Chapter 2. The tilting angle of the output flange (Fig. 3.6a, Fig. 3.6b and Fig. 3.5.1) can be determined as follows:

$$\Theta = \frac{F_r \cdot a + F_a \cdot b}{M_t}$$

Θ – output flange tilting angle [arc min]

M_t – tilting stiffness [Nm/arcmin]

F_r – radial load [N]

F_a – axial load [N]

a – arm of force F_r [m]

$a = a_1 + a_2$

$a_1 = L / 2$

b – arm of force F_a [m]

The output flange is fixed from both sides.

The radial load is $2x F_r$.

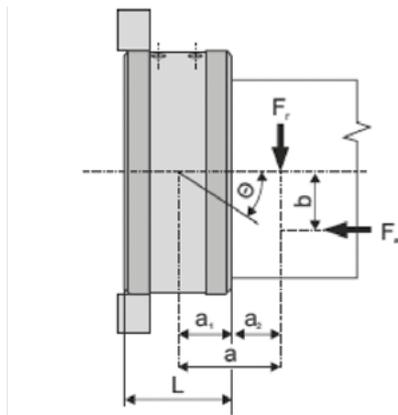


Fig. 3.6a: Load and moment on the T, E, H, M series output flange

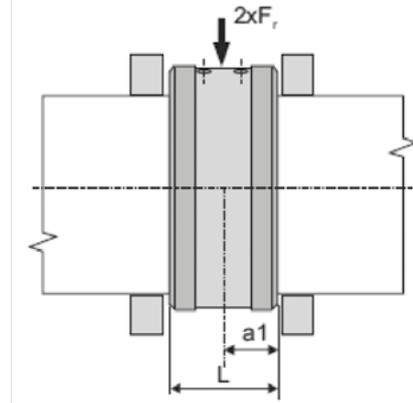


Fig. 3.6b: Load and moment on the T, E, H, M series output flange

3.7 G, GH, T, E, H, M series lost motion, hysteresis and torsional stiffness

If the input shaft and the case are fixed and a torque is applied to the output flange, then the load diagram has the shape of a hysteresis curve (Fig. 3.7a).

The transmission mechanism of TwinSpin® reduction gears is manufactured and assembled in such a way that there is zero backlash in the gear. Hysteresis H expresses the amount of friction in the reduction gear. Hysteresis loss occurs as a result of the internal friction in the reduction gear. The hysteresis of the torsional turn H [arcmin] is measured as an angular difference determined by the intersections of the hysteresis curve with the turn axis at point $T_p = 0$ [Nm].

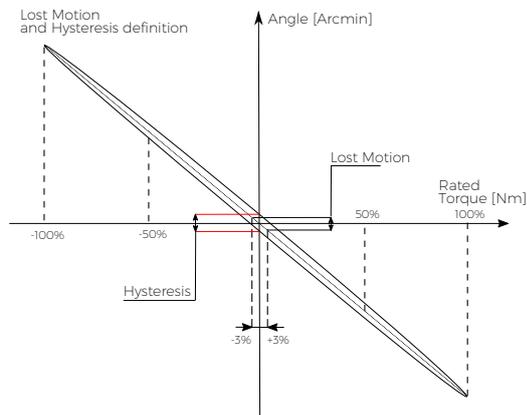


Fig. 3.7a: T, E, H, M series hysteresis curve and the definition of stiffness

Torsional stiffness (k_t) is defined as follows:

$$k_t = \frac{d}{c}$$

Torsional stiffness and lost motion values are provided in the rating table in Chapter 2. The torsional stiffness values are statistical values for a particular reduction ratio. High precision reduction gears with hysteresis and lost motion of ≤ 0.6 [arcmin] can be supplied on request.

The hysteresis characteristic of TS 140-139-TB with lost motion under 0.5 [arcmin] is illustrated in Fig. 3.7b.

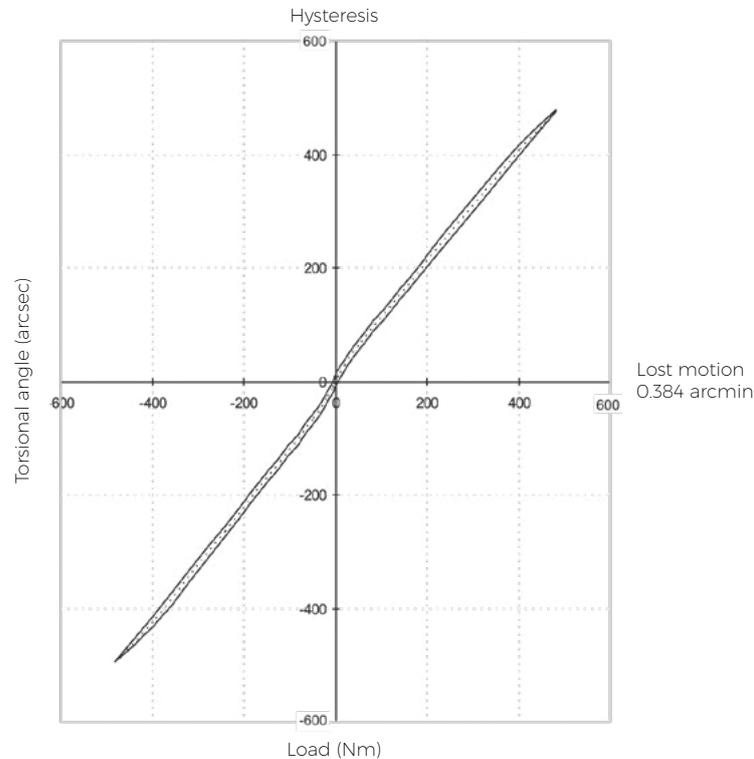


Fig. 3.7b: Hysteresis curve of TS 140-139-TB

3.8 G, GH, T, E, H, M series torsional vibrations

Torsional vibration is indicated in the peripheral direction of an inertia load driven by the reduction gear. Low vibration is extremely important for applications where high precision contouring is required. For example, a tool centre point of a robot end point has to follow a desired trajectory as precisely as possible. If robot joints vibrate, the trajectory tracking is poor. Added axes of a machine tool is another application example where very smooth running of a high precision reduction gear is required.

An accelerometer installed on a defined lever arm registers the vibration of an inertia load. A reference measurement of peripheral acceleration and position deviation is shown in Fig. 3.8. TwinSpin® runs extremely smoothly. For an input speed higher than 500 rpm the peripheral deviation is about 10 μm . The value of the external diameter amplitude LFD/LFA stabilizes when the input speed reaches and exceeds 900 rpm. For that reason the maximum input speed 900 rpm was chosen for the evaluation of torsional vibration.

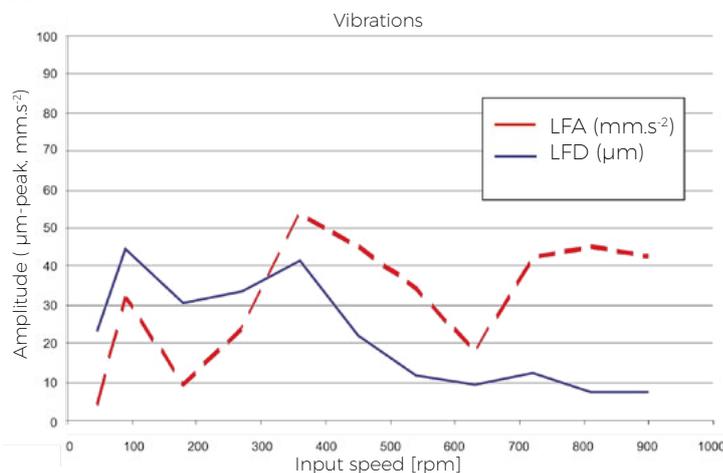


Fig. 3.8: Vibrations of TS 170-105-TC

3.9 G, GH, T, E, H, M series angular transmission accuracy

The angular transmission error is the difference between the theoretical output angle of rotation and the actual angle of rotation. The angular transmission error of the TwinSpin® high precision reduction gear is typically 1 arcmin or less. Fig. 3.9 shows an example of the angular transmission error measured on a specific TwinSpin® reduction gear TS 140-139-TB. The influence of the load on the angular transmission accuracy is relatively low.

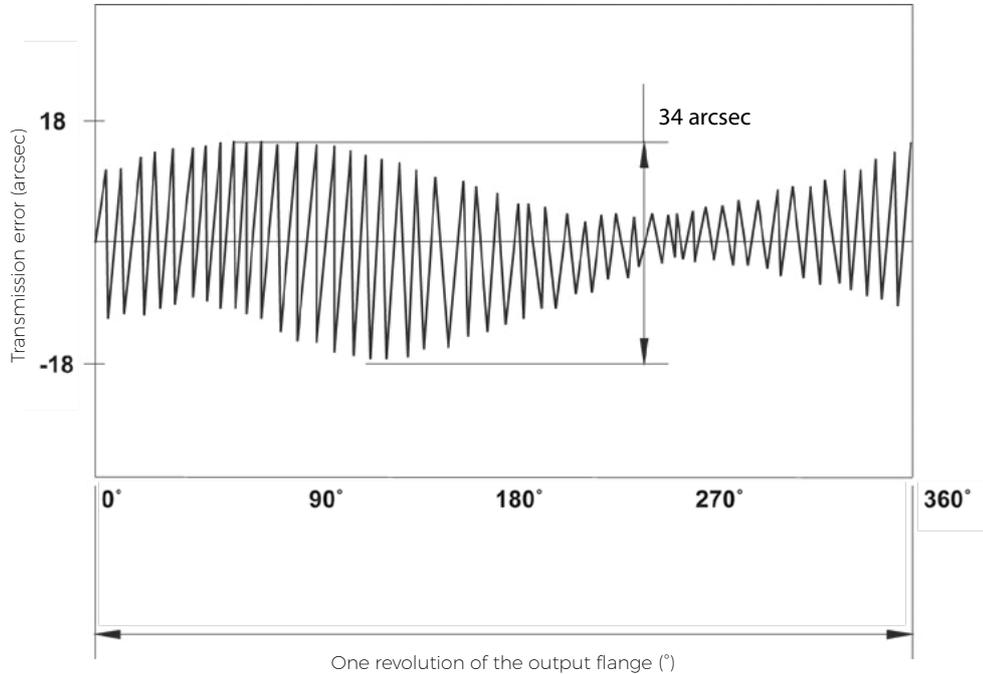


Fig. 3.9: Angular transmission error measurement

Measuring conditions
 Model: TS 140-139-TB
 Load conditions: no load

3.10 G, GH, T, E, H, M series no-load starting torque

The no-load starting torque is a quasi-static torque required to start rotation of the input shaft, if no load is applied to the output flange. The rating tables provide values for the starting torque, statistically evaluated from current production tests. Attributes in the table are specified only for a temperature of 20 °C. For a temperature of the reduction gear lower than 20°C there will be a higher no load starting torque. For a specific application please consult with the manufacturer.

3.11 G, GH, T, E, H, M series back-driving torque

The back-driving torque is the torque applied to the output flange that is required to start rotation of the input shaft under no-load. Chapter 2 provides values for back-driving torque, statistically evaluated from the current production tests.

3.12 G, GH, T, E, H, M series maximum moment of the input shaft ($M_{c\ in}$)

Since the input shaft is supported on both sides by bearings, radial loads $F_{r\ in}$ may be applied. The moment on the input shaft resulting from a radial load (Fig. 3.12a T, E, H series Fig. 3.12b M series) can be calculated as follows:

$$M_{c\ in} - \text{allowable moments [Nm]}$$

$$M_{c\ in} = F_{r\ in} \cdot a \quad - \text{valid for T, E, H series}$$

$$M_{c\ in} = F_{r\ in} \cdot a_{in} + F_{a\ in} \cdot b_{in} \quad - \text{valid for M series}$$

a – load force arm [m]
 $F_{r\ in}$ – radial load [N]

Allowable moments $M_{c\ in}$ on the input shaft are provided in Tab. 3.12.

Tab. 3.12: Allowable moment $M_{c_{in}}$ on the input shaft under the conditions specified in the parameter tables of Chapter 2

Size	TS 50	TS 60	TS 70	TS 80	TS 110	TS 140	TS 140	TS 170	TS 170	TS 200	TS 200	TS 220	TS 220	TS 240	TS 300
$M_{c_{in}}$ [Nm]	M series 3	T series 6	T, E, H series 11	T, E series 16	T, E series 35	T, E series 68	H series 25	T, E, H series 126	H series 60	T, E series 157	H series 95	E series 210	H series 127	T series 260	T series 378

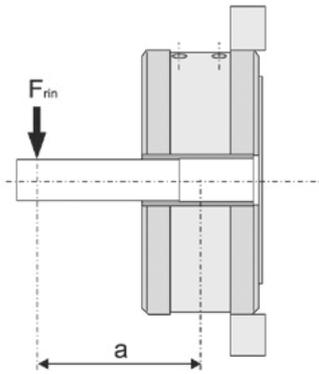


Fig. 3.12a: Radial load of the T, E, H series input shaft

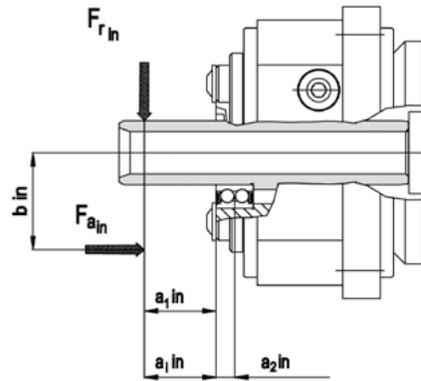
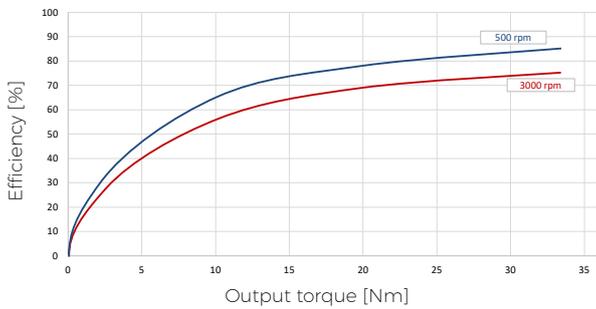


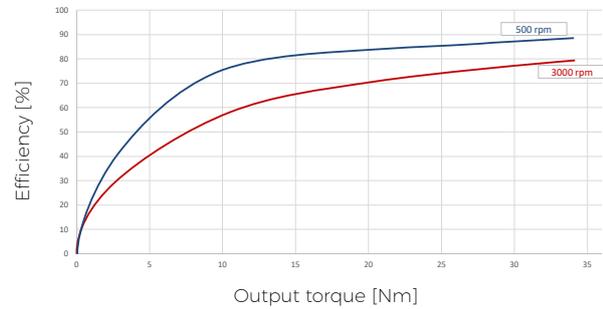
Fig. 3.12b: Radial load of the input shaft M series

3.13 G series efficiency chart

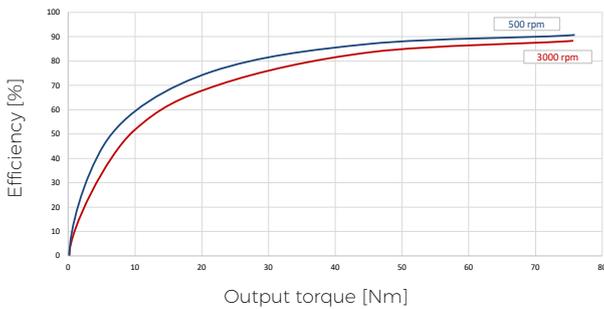
The efficiency of the TwinSpin® reduction gears depends on the input speed, output load, viscosity of lubricant, operational temperature and Lost Motion.



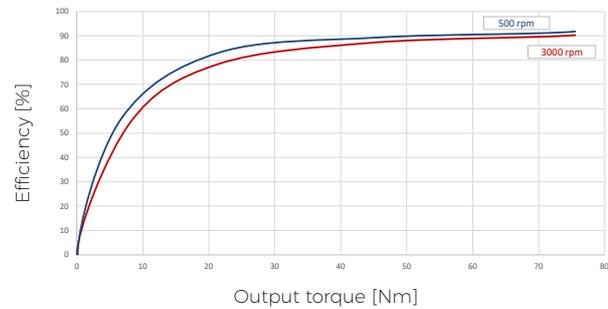
TS 75G, ratio 63 at 25°C
H = 0.39 arcmin
LM = 0.86 arcmin



TS 75G, ratio 63 at 40°C
H = 0.39 arcmin
LM = 0.86 arcmin

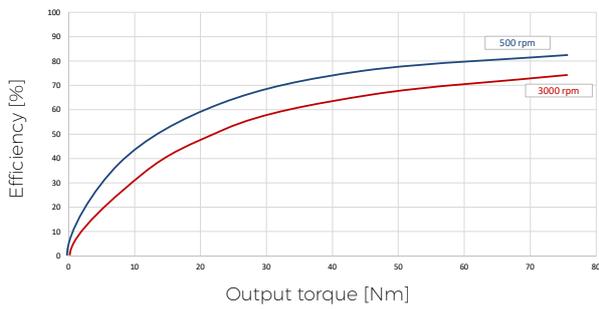


TS 85G, ratio 33 at 25°C
H = 0.59 arcmin
LM = 0.8 arcmin

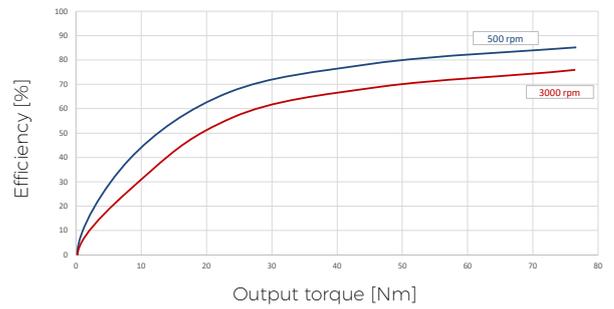


TS 85G, ratio 33 at 40°C
H = 0.59 arcmin
LM = 0.8 arcmin

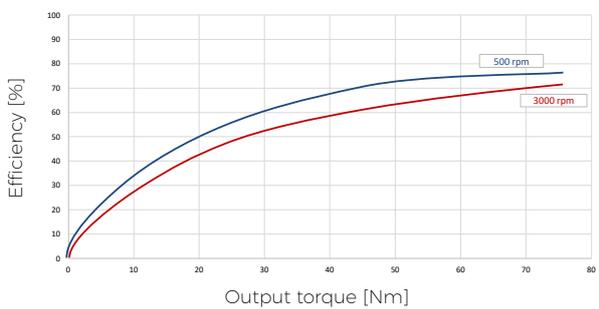
Fig. 3.13: Efficiency charts



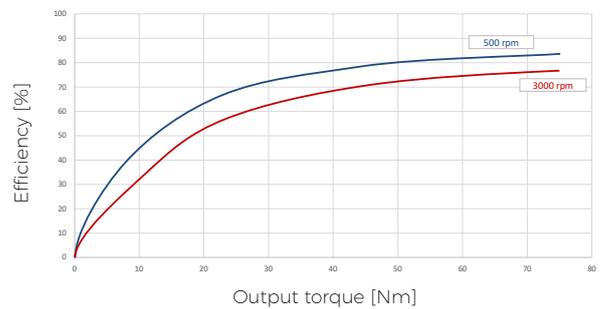
TS 85G, ratio 63 at 25°C
H = 1.01 arcmin
LM = 0.78 arcmin



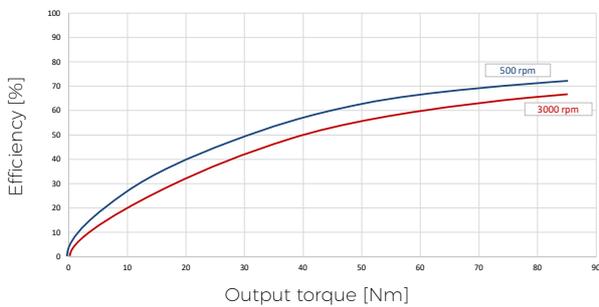
TS 85G, ratio 63 at 40°C
H = 1.01 arcmin
LM = 0.78 arcmin



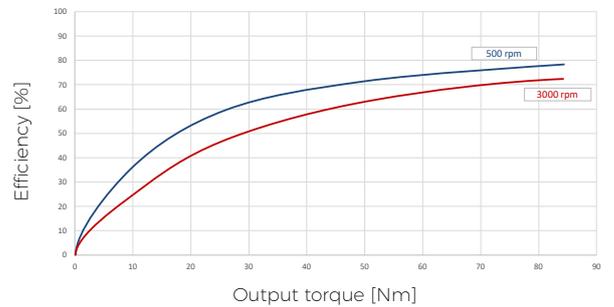
TS 85G, ratio 79 at 25°C
H = 0.72 arcmin
LM = 0.48 arcmin



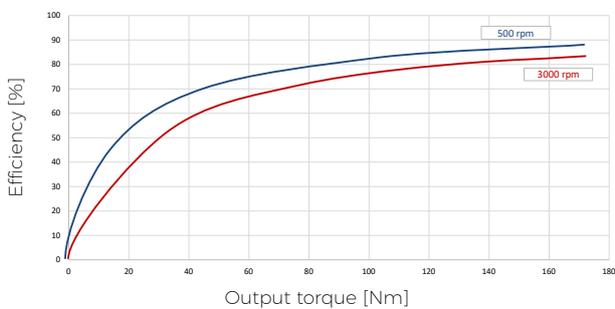
TS 85G, ratio 79 at 40°C
H = 0.72 arcmin
LM = 0.48 arcmin



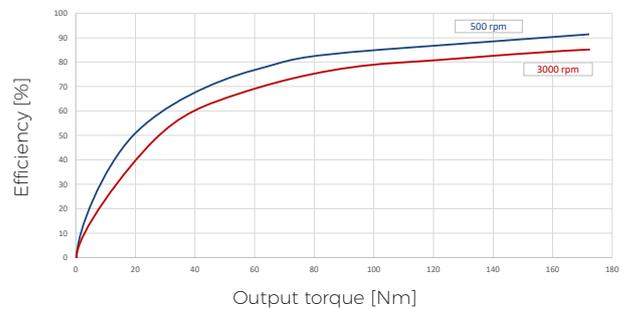
TS 95G, ratio 95 at 25°C
H = 0.69 arcmin
LM = 0.35 arcmin



TS 95G, ratio 95 at 40°C
H = 0.69 arcmin
LM = 0.35 arcmin

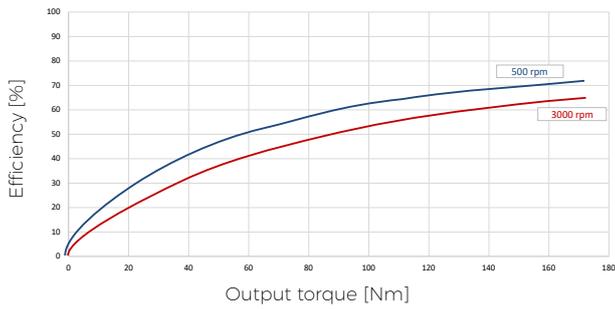


TS 115G, ratio 43 at 25°C
H = 0.84 arcmin
LM = 0.36 arcmin

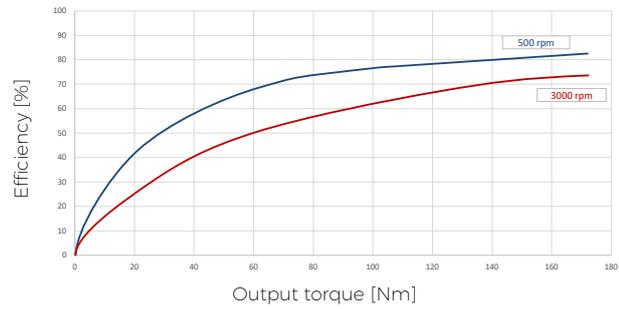


TS 115G, ratio 43 at 40°C
H = 0.84 arcmin
LM = 0.36 arcmin

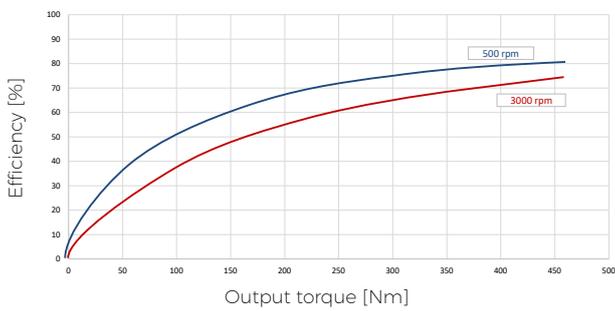
Fig. 3.13: Efficiency charts



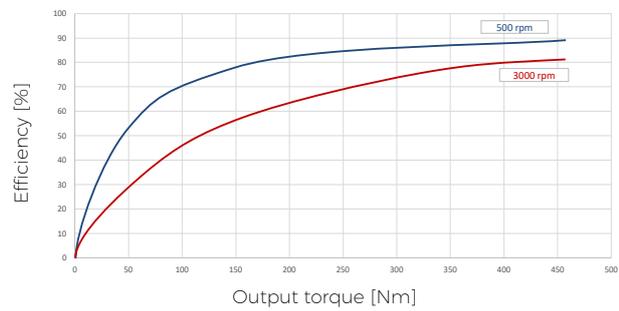
TS 115G, ratio 123 at 25°C
H = 0.96 arcmin
LM = 0.48 arcmin



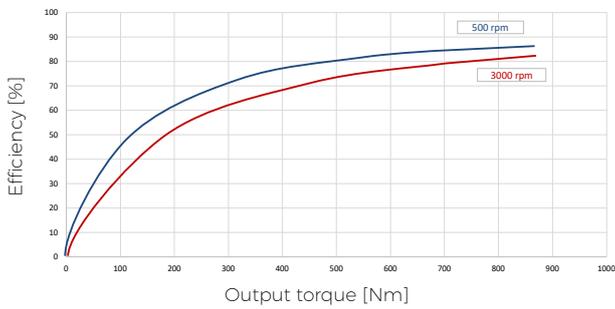
TS 115G, ratio 123 at 40°C
H = 0.96 arcmin
LM = 0.48 arcmin



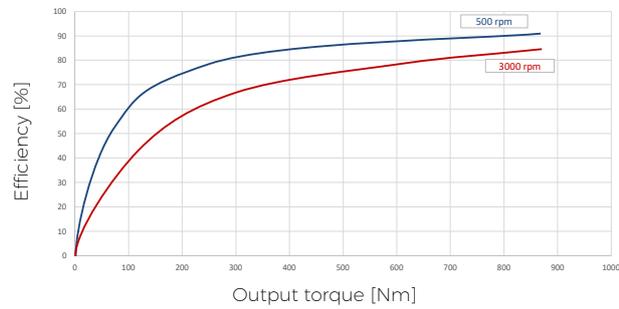
TS 155G, ratio 109 at 25°C
H = 0.49 arcmin
LM = 0.73 arcmin



TS 155G, ratio 109 at 40°C
H = 0.49 arcmin
LM = 0.73 arcmin



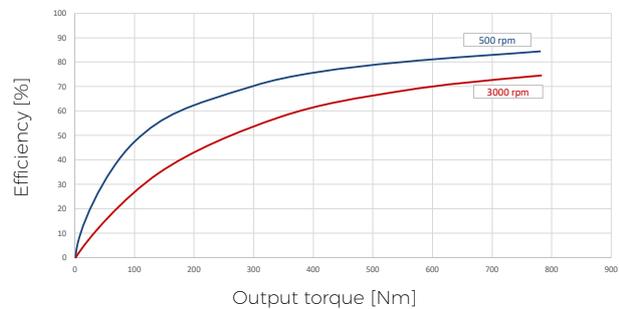
TS 185G, ratio 57 at 25°C
H = 0.3 arcmin
LM = 0.47 arcmin



TS 185G, ratio 57 at 40°C
H = 0.3 arcmin
LM = 0.47 arcmin



TS 185G, ratio 117 at 25°C
H = 0.48 arcmin
LM = 0.37 arcmin



TS 185G, ratio 117 at 40°C
H = 0.48 arcmin
LM = 0.37 arcmin

Fig. 3.13: Efficiency charts

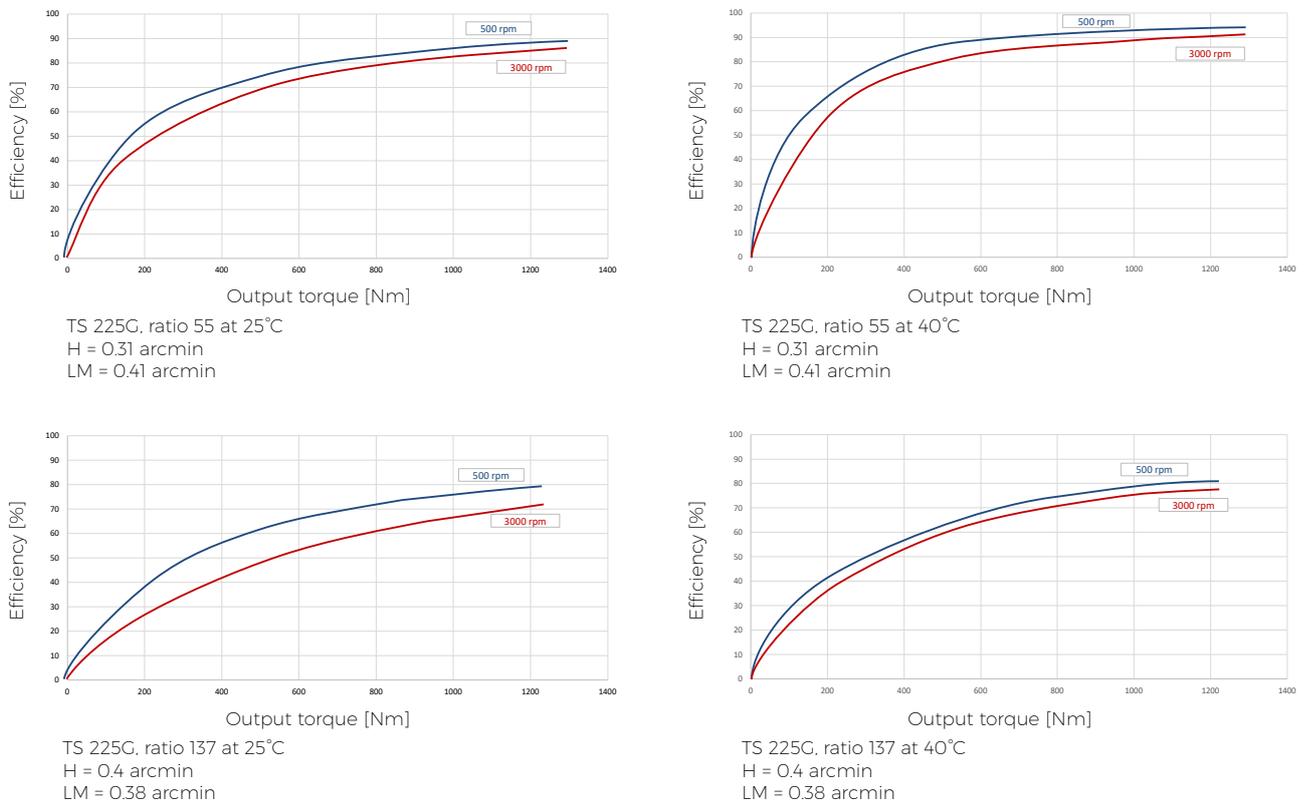


Fig. 3.13: Efficiency charts

3.14 GH series efficiency chart

The efficiency of the TwinSpin® reduction gears depends on the input speed, output load, viscosity of lubricant, operational temperature and Lost Motion.

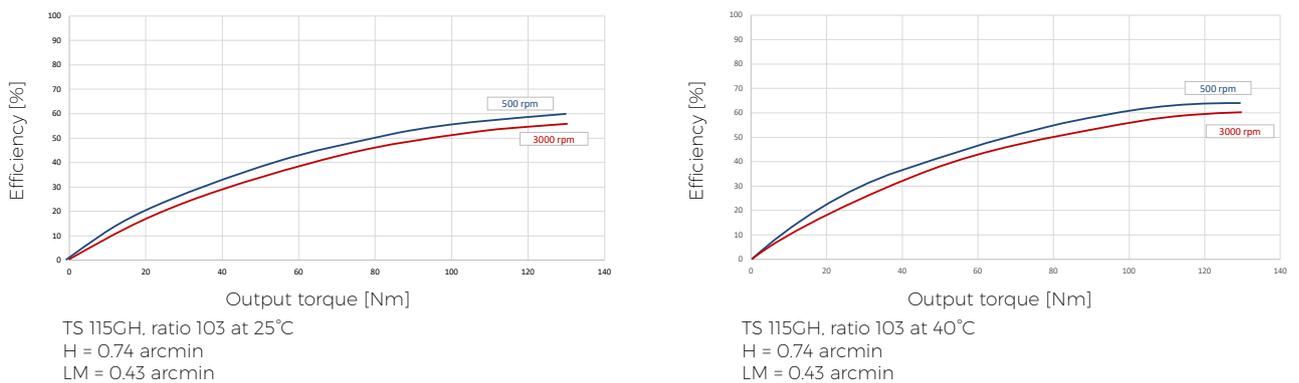


Fig. 3.14: Efficiency charts

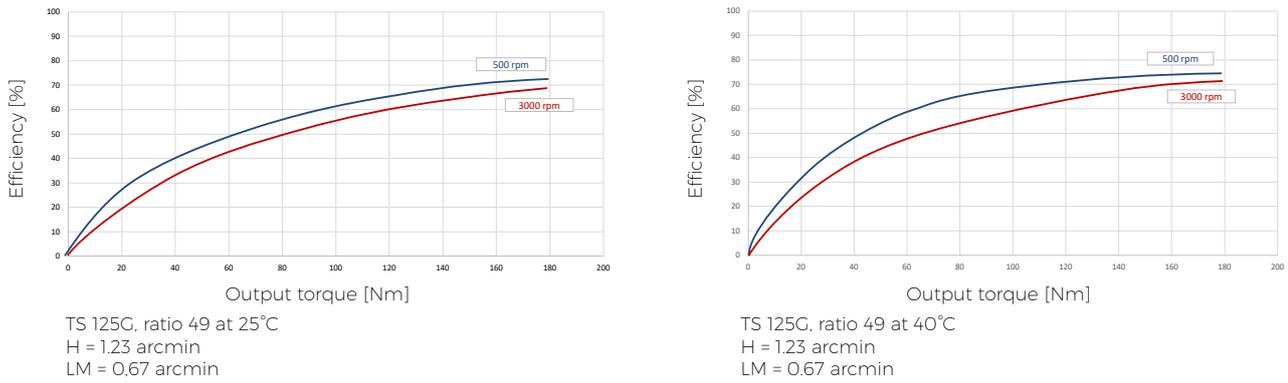


Fig. 3.14: Efficiency charts

3.15 G series no-load running torque

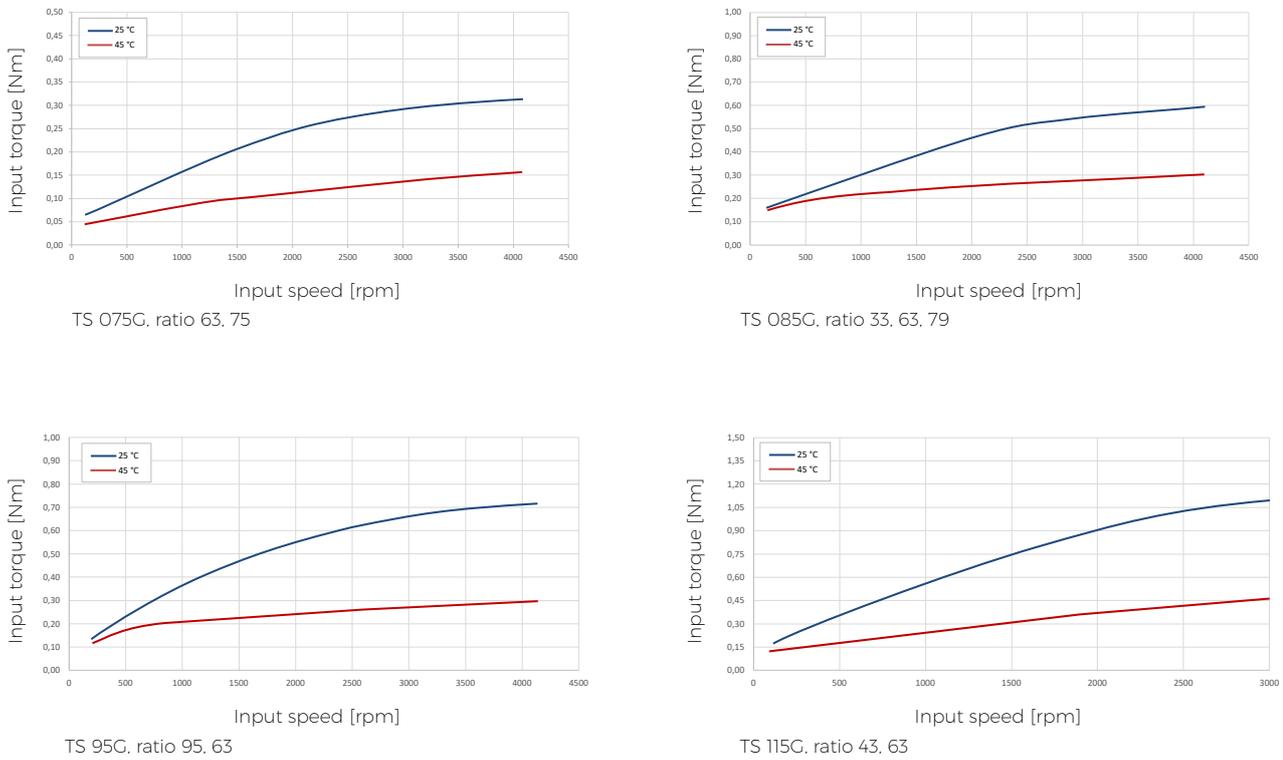
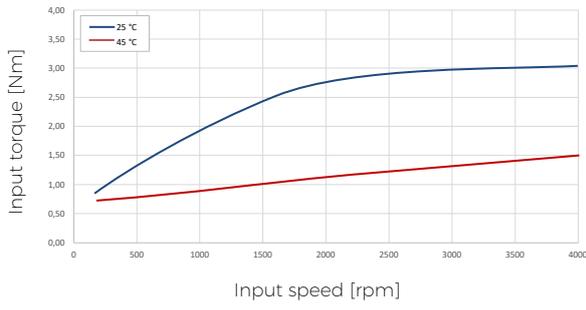
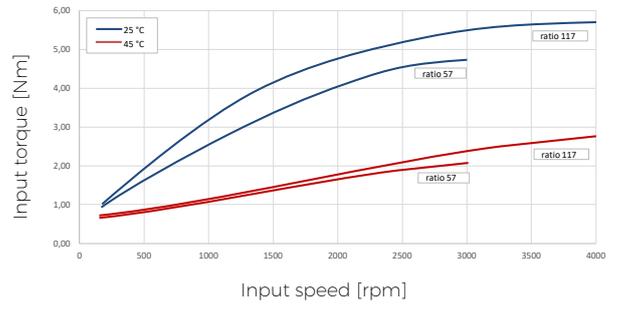


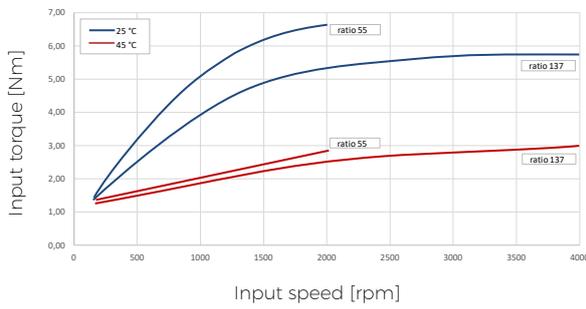
Fig. 3.15: No-load running torque charts



TS 155G, ratio 109



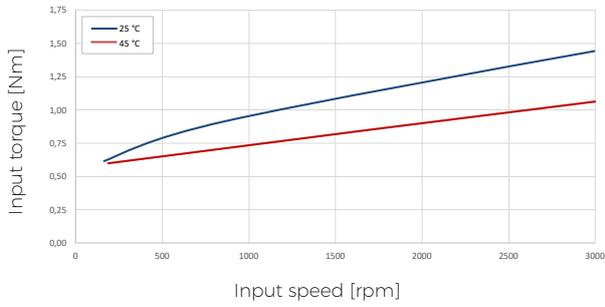
TS 185G, ratio 57, 117



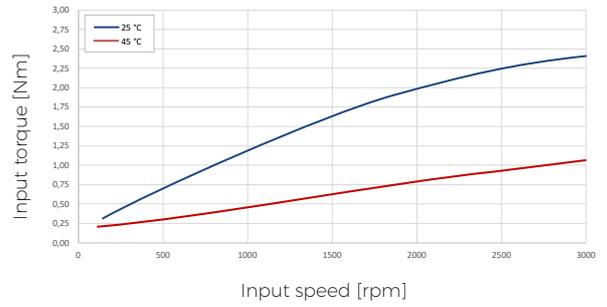
TS 225G, ratio 55, 137

Fig. 3.15: No-load running torque charts

3.16 GH series no-load running torque



TS 115GH, ratio 55, 103

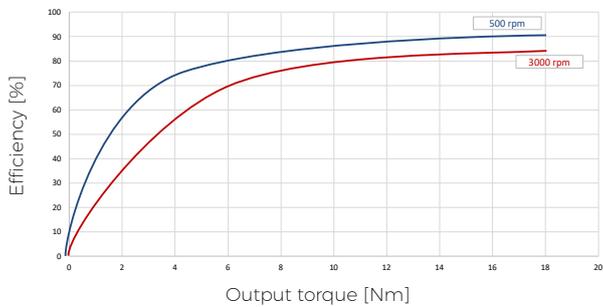


TS 125GH, ratio 49

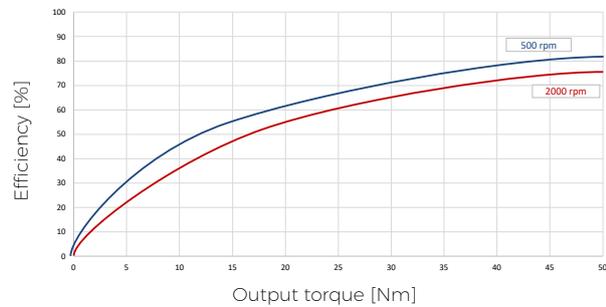
Fig. 3.16: No-load running torque charts

3.17 T, E, H, M series efficiency chart

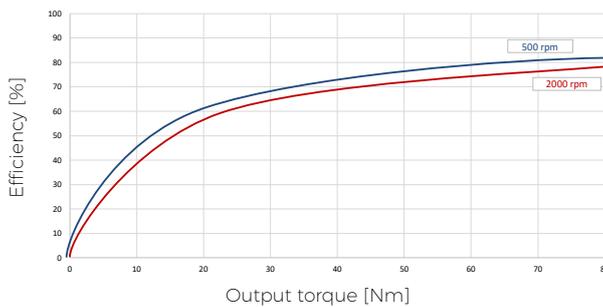
The efficiency of the TwinSpin® reduction gears depends on the input speed, output load, viscosity of lubricant, operational temperature and Lost Motion.



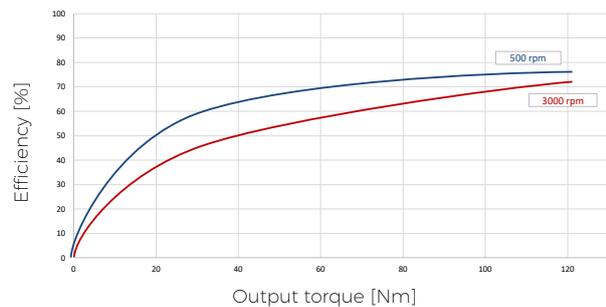
TS 50, ratio 63 at 50°C
 H = 0.7 arcmin
 LM = 0.56 arcmin
 Max. speed = 3 000 rpm



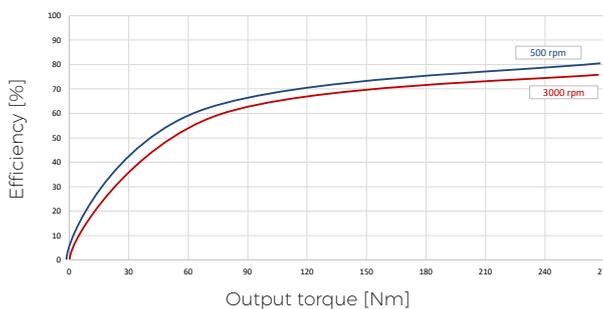
TS 70-TB, ratio 75 at 45°C
 H = 0.7 arcmin
 LM = 0.4 arcmin
 Max. speed = 3 000 rpm



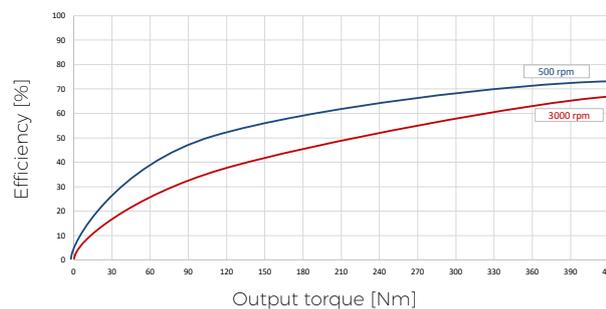
TS 80-TB, ratio 85 at 45°C
 H = 0.87 arcmin
 LM = 1 arcmin
 Max. speed = 3 000 rpm



TS 110-TB, ratio 89 at 45°C
 H = 0.43 arcmin
 LM = 0.34 arcmin
 Max. speed = 2 000 rpm

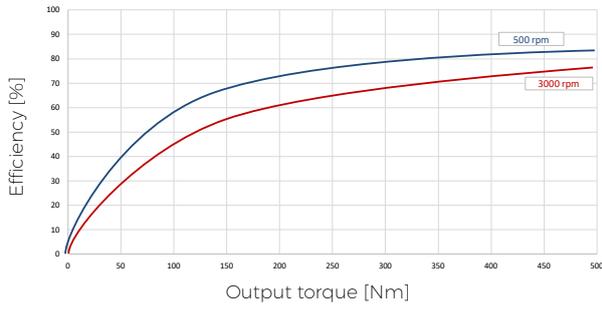


TS 140-TB, ratio 57 at 45°C
 H = 0.5 arcmin
 LM = 1 arcmin
 Max. speed = 3 000 rpm

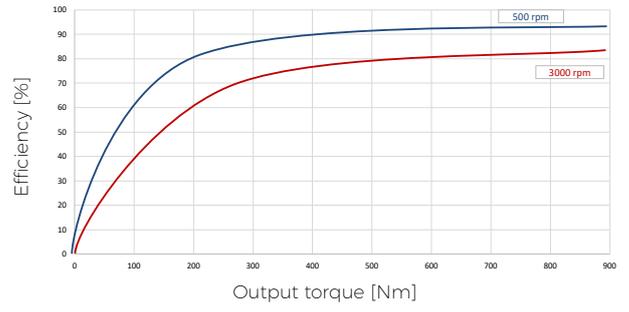


TS 170-H, ratio 69 at 60°C
 H = 0.6 arcmin
 LM = 0.5 arcmin
 Max. speed = 3 000 rpm

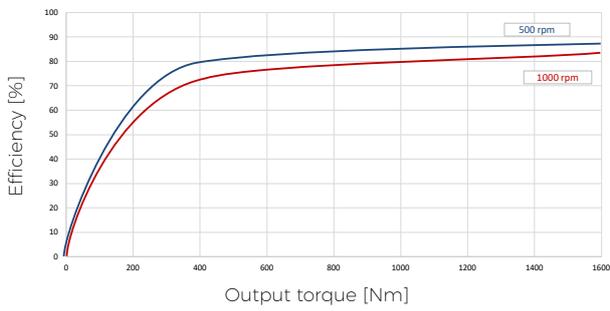
Fig. 3.17: Efficiency charts



TS 170-TC, ratio 125 at 60°C
 H = 1 arcmin
 LM = 0.85 arcmin
 Max. speed = 3 000 rpm



TS 200-TC, ratio 125 at 60°C
 H = 0.71 arcmin
 LM = 0.5 arcmin
 Max. speed = 3 000 rpm



TS 240, ratio 37 at 50°C
 H = 1 arcmin
 LM = 0.82 arcmin
 Max. speed = 1 000 rpm

Fig. 3.17: Efficiency charts

3.18 G, GH, T, E, H, M series rotation direction and reduction ratio

In the following equations, $+i_{out}$ represents input and output rotations in one direction, $-i_{out}$ represents input and output rotations in the opposite direction. The available reduction ratio "i" values are provided in the rating tables in Chapter 2.

$$i_{out} = \frac{\text{speed}_{input}}{\text{speed}_{output}}$$

Tab. 3.18: Rotation direction and reduction ratio

Speed Reduction			
	Input: Input shaft Output: Output flange Fixed: Case	Input: Input shaft Output: Case Fixed: Output flange	Input: Output flange Output: Case Fixed: Input shaft
Speed Acceleration	$i_{out} = -i$ 	$i_{out} = i + 1$ 	$i_{out} = \frac{i+1}{i}$
	Input: Output flange Output: Input shaft Fixed: Case	Input: Case Output: Input shaft Fixed: Output flange	Input: Case Output: Output flange Fixed: Input shaft
Differential configuration	$i_{out} = \frac{-1}{i}$ 	$i_{out} = \frac{1}{i+1}$ $\frac{1}{i+1} = \frac{n_{case} - n_{flange}}{n_{shaft} - n_{flange}}$ 	$i_{out} = \frac{i}{i+1}$ Input: Output: Fixed:
	All three parts can rotate		

4. TwinSpin® selection procedure

4.1 G, GH, T, E, H, M series duty cycle

- T_1 – maximum output torque at acceleration [Nm]
- T_2 – output torque at constant speed [Nm]
- T_3 – maximum output torque at deceleration [Nm]
- T_{max} – max. output torque at emergency stop [Nm]
- T_{em} – allowable emergency torque
- t_1 – acceleration time [s]
- t_2 – constant motion time [s]
- t_3 – deceleration time [s]
- t_4 – idle time [s]
- t – duty cycle time [s]
- $n_{c\ max}$ – maximum continuous input speed [rpm]
- n_1 – average input speed at acceleration [rpm]
- n_2 – input speed at constant motion [rpm]
- n_3 – average input speed at deceleration [rpm]
- n_{max} – maximum input speed [rpm]
- F_r – radial output flange load [N]
- F_{r1}, F_{r2}, F_{r3} – radial output flange load during acceleration, during constant speed and during deceleration [N]
- F_a – axial output flange load [N]
- a – radial load effective arm F_r [m]
- b – axial load effective arm F_a [m]
- i – reduction ratio

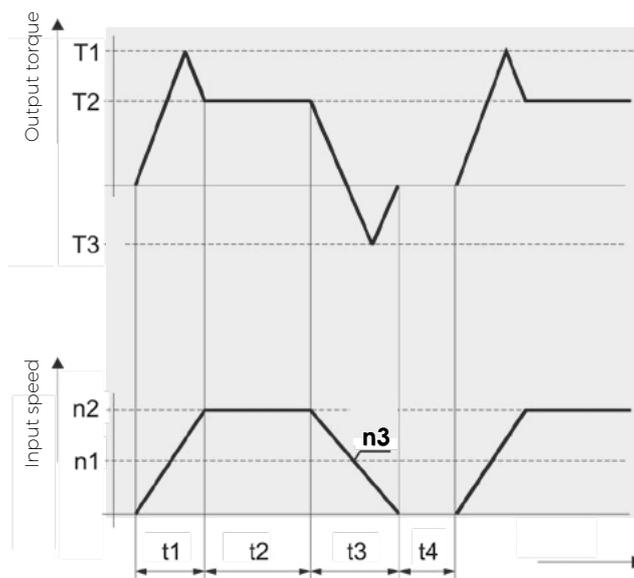


Fig. 4.1: Duty cycle

In case the duty cycle is different from the one shown, please supply the drawing and values of your duty cycle. These values are important to us to be able to effectively determine lifetimes of TwinSpin® reduction gears.

4.2 G, GH, T, E, H series selection flowchart

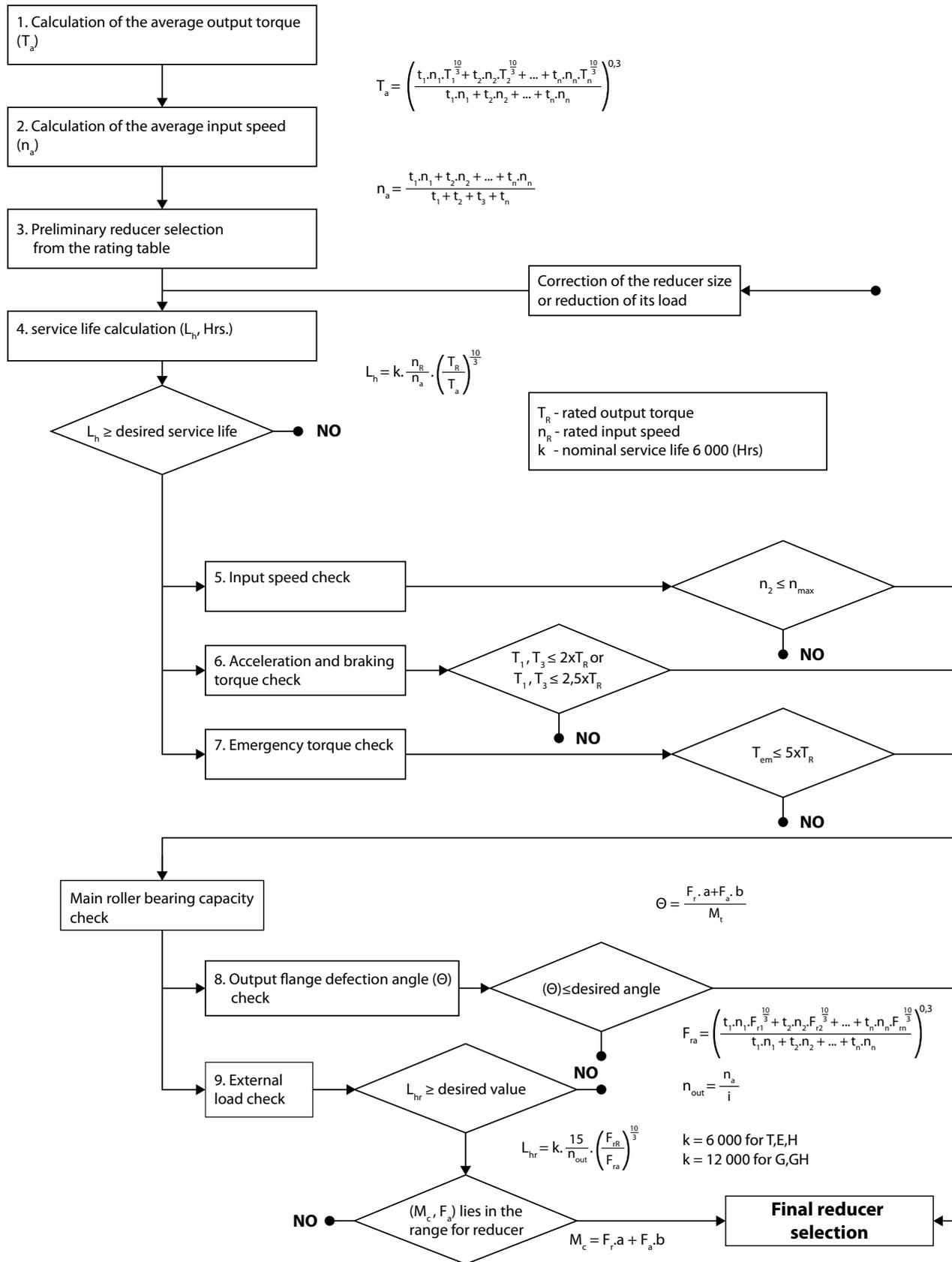


Fig. 4.2: Flowchart

4.2.1 M series selection flowchart

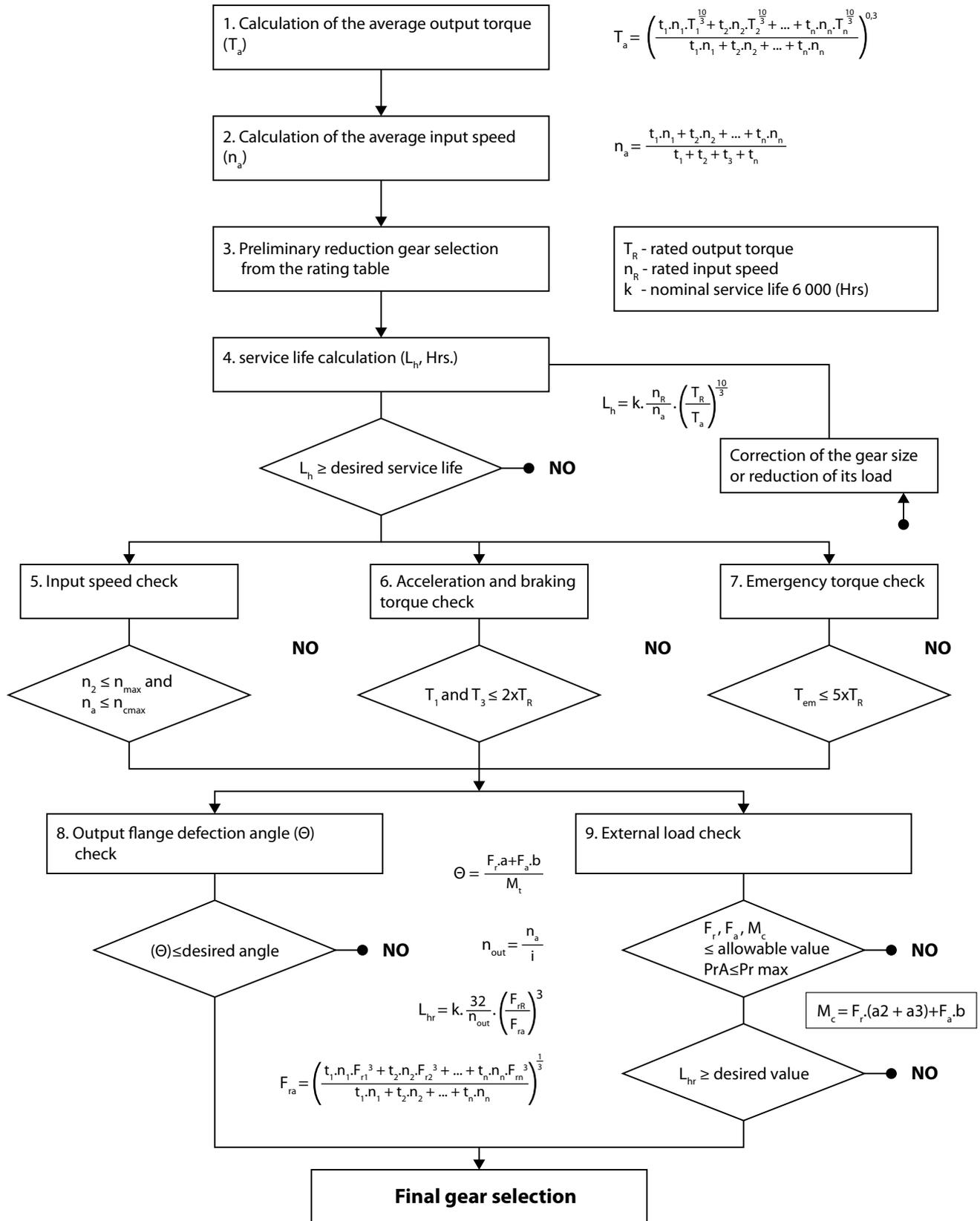


Fig. 4.2.1: Flowchart

4.3 T, E, H series selection flowchart

Input data - selected conditions

$T_1 = 420 \text{ Nm}$	- Acceleration torque
$T_2 = 310 \text{ Nm}$	- Constant torque
$T_3 = 520 \text{ Nm}$	- Braking torque
$T_{em} = 1\,500 \text{ Nm}$	- Emergency torque
$n_1 = 1\,500 \text{ rpm}$	- Average acceleration input speed
$n_2 = 3\,000 \text{ rpm}$	- Constant input speed
$n_3 = 1\,500 \text{ rpm}$	- Average braking input speed
$F_r = 1\,500 \text{ N}$	- Radial load
$F_a = 1\,500 \text{ N}$	- Axial load
$a_2 = 0.15 \text{ m}$	- Radial force tilting arm
$b = 0.2 \text{ m}$	- Axial force tilting arm
$\Theta_{max} = 3 \text{ arcmin.}$	- Max. allowable output flange deflection angle
$t_1 = 0.3 \text{ sec.}$	- Acceleration time
$t_2 = 0.5 \text{ sec.}$	- Constant speed time
$t_3 = 0.2 \text{ sec.}$	- Braking time

Calculation example

1. Calculation of average output torque (T_a)

$$T_a = \left(\frac{0.3 \times 1500 \times 420^{\frac{10}{3}} + 0.5 \times 3000 \times 310^{\frac{10}{3}} + 0.2 \times 1500 \times 520^{\frac{10}{3}}}{0.3 \times 1500 + 0.5 \times 3000 + 0.2 \times 1500} \right)^{0.3} = 379.6 \text{ Nm}$$

2. Calculation of average input speed (n_a)

$$n_a = \frac{0.3 \times 1500 + 0.5 \times 3000 + 0.2 \times 1500}{0.3 + 0.5 + 0.2} = 2250 \text{ rpm}$$

3. Preliminary selection of a reduction gear from the rating table (Chapter 2): **TS 170-141-TC**

Technical specifications of the selected reduction gear:

$T_R = 495 \text{ Nm}$	- Rated output torque
$n_R = 2\,000 \text{ rpm}$	- Rated input speed
$T_{max} = 1\,238 \text{ Nm}$	- Maximum torque
$T_{em} = 2\,475 \text{ Nm}$	- Emergency torque
$n_{max} = 4\,000 \text{ rpm}$	- Maximum input speed
$M_t = 705 \text{ Nm/arcmin.}$	- Tilting stiffness
$M_{cmax} = 2\,430 \text{ Nm}$	- Maximum moment ($F_a = 0$)
$F_{rmax} = 19\,300 \text{ N}$	- Maximum radial force
$F_{amax} = 27\,900 \text{ N}$	- Maximum axial force ($M_c = 0$)

4. Service life calculation (L_h)

$$L_h = 6000 \times \frac{2000}{2250} \times \left(\frac{495}{379.6} \right)^{\frac{10}{3}} = 12919 \text{ hrs}$$

5. Input speed check (n_2, n_{max})

$$(n_2 = 3\,000 \text{ rpm}) < (n_{max} = 4\,000 \text{ rpm}) \text{ ok}$$

6. Acceleration and braking torque check (T_1, T_3, T_{max})

$$\begin{aligned} (T_1 = 420 \text{ Nm}) < (T_{max} = 1\,238 \text{ Nm}) \text{ ok} \\ (T_3 = 520 \text{ Nm}) < (T_{max} = 1\,238 \text{ Nm}) \text{ ok} \end{aligned}$$

 7. Emergency braking torque check (T_{em})

$$(T_{em} = 1\,500 \text{ Nm}) < (2\,475 \text{ Nm}) \text{ ok}$$

 8. Output flange tilting angle check (Θ)

$$(\Theta = \frac{1500 \times 0.1885 + 1500 \times 0.2}{705} = \frac{582.75}{705} = 0^\circ 0' 49'' < (\Theta_{max} = 3') \text{ ok}$$

 9. External load check (F_r, F_a, M_c) Tilting arm (see Fig. 3.6)

$$\begin{aligned} a &= a_1 + a_2 \\ a_1 &= L/2 = 77 \text{ mm}/2 = 38.5 \text{ mm} = 0.0385 \text{ m} \\ a &= 0.0385 + 0.15 = 0.1885 \text{ m} \end{aligned}$$

$$(F_r = 1\,500 \text{ N}) < (F_{max} = 19\,300 \text{ N}) \text{ ok}$$

Service life calculation of the main bearing (L_{hr}) at radial force $F_r = 1500 \text{ N}$

$$n_{out} = \frac{2250}{141} = 15.95$$

$$L_{hr} = 6000 \times \frac{15}{15.95} \times \left(\frac{19250}{1500} \right)^{\frac{10}{3}} = 27.9 \times 10^6 \text{ hrs}$$

Moment on the output flange

$$M_c = 1\,500 \times 0.1885 + 1\,500 \times 0.2 = 582.75 \text{ Nm}$$

Maximum allowable moment at axial force $F_a = 1500 \text{ N}$

$$M_{c\text{allow}} = M_{c\text{max}} - \frac{M_{c\text{max}} \times F_a}{F_{a\text{max}}} = 2430 - \frac{2430 \times 1500}{27900} = 2300 \text{ Nm}$$

$$(M_c = 582.75) < (M_{c\text{allow}} = 2300 \text{ Nm}) \text{ ok}$$

Based on Chapter 3.5, a point with the coordinates of (M_c, F_a), i.e. (582.75 Nm; 1.5 kN), lies inside the range for the selected TS 170 reduction gear.

Since all the requirements have been met, selection of the TS 170-141-TC reduction gear is correct.

4.3.1 M series selection example

Input data - selection conditions

$T_1 = 15 \text{ Nm}$	- Acceleration torque
$T_2 = 10 \text{ Nm}$	- Constant torque
$T_3 = 14 \text{ Nm}$	- Braking torque
$T_{em} = 25 \text{ Nm}$	- Emergency torque
$t_1 = 0.3 \text{ sec.}$	- Acceleration time
$t_2 = 0.5 \text{ sec.}$	- Constant speed time
$t_3 = 0.2 \text{ sec.}$	- Braking time
$N_1 = N_3 = 1\,500/\text{min}$	- Avg. accel. input speed / Avg. braking input speed
$N_2 = 3\,000/\text{min}$	- Constant input speed
$F_r = 300 \text{ N}$	- Radial load
$F_a = 400 \text{ N}$	- Axial load
$a_2 = 0.012 \text{ m}$	- Radial force tilting arm
$b = 0.015 \text{ m}$	- Axial force tilting arm
$\Theta = 5^\circ$	- Output flange deflection angle

Calculation example

1. Calculation of average output torque (T_a)

$$T_a = \left(\frac{0,3 \times 1500 \times 15^{\frac{10}{3}} + 0,5 \times 3000 \times 10^{\frac{10}{3}} + 0,2 \times 1500 \times 14^{\frac{10}{3}}}{0,3 \times 1500 + 0,5 \times 3000 + 0,2 \times 1500} \right)^{0,3} = 12 \text{ Nm}$$

2. Calculation of average input speed (n_a)

$$n_a = \frac{0,3 \times 1500 + 0,5 \times 3000 + 0,2 \times 1500}{0,3 + 0,5 + 0,2} = 2250 \text{ rpm}$$

3. Preliminary selection of a reduction gear from the rating table (Chapter 2): **TS 50-63-M-P6**

General specifications of the TwinSpin® reduction gear are:

$T_R = 18 \text{ Nm}$	- Rated output torque
$n_R = 2\,000 \text{ rpm}$	- Rated input speed
$T_{max} = 36 \text{ Nm}$	- Maximum torque
$T_{em} = 90 \text{ Nm}$	- Emergency torque
$n_{max} = 5\,000 \text{ rpm}$	- Maximum allowable input speed
$n_{c,max} = 3\,000 \text{ rpm}$	- Maximum continuous input speed
$M_t = 4 \text{ Nm/arcmin.}$	- Tilting stiffness
$a_1 = 0.02 \text{ m}; a_2 = 0.012 \text{ m}$	- Distance of action
$a = 0.02 + 0.012 = 0.032 \text{ m}$	- Distance of action
$F_{r,max} = 44/(a_2 + 0.0305) \text{ N}$	- Max. radial force
$F_{a,max} = 1\,900 \text{ N} (F_r = 0, M_c = 0)$	- Max. axial force ($M_c = 0$)



4. Calculation of the life of M series TwinSpin® reduction gear (L_h)

$$L_h = 6000 \frac{2000}{2250} \left(\frac{18}{12} \right)^{\frac{10}{3}} = 20\,605 \text{ hrs}$$

5. Control of input speed

$$n_2 = 3000/\text{min} < 5000 \text{ rpm and } n_a = 2250/\text{min} < n_{c\text{max}} = 3000 \text{ rpm}$$

6. Control of start-up and braking torque

$$T_1 = 15 \text{ Nm} < 36 \text{ Nm and } T_3 = 14 < 36 \text{ Nm}$$

7. Control of torque during emergency braking

$$T_{em} = 25 \text{ Nm} < 90 \text{ Nm}$$

8. Control of tilt angle Θ of the output flange

$$\Theta = \frac{300 \cdot 0,032 + 400 \cdot 0,015}{4} = 3,9 < 5'$$

9. Control of external load on the reduction gear's output flange

$$\text{a) } F_a = 400 \text{ N} < F_{a\text{max}} = 1900 \text{ N}$$

$$\begin{aligned} \text{b) } M_c &= F_a \cdot b + F_r \cdot (a_2 + a_3) \\ M_c &= 400 \cdot 0,015 + 300 \cdot (0,012 + 0,0095) = 12,45 \text{ Nm} \\ M_c &= 12,45 \text{ Nm} < M_{c\text{max}} = 44 \text{ Nm} \end{aligned}$$

$$\begin{aligned} \text{c) } F_{r\text{max}} &= M_{c\text{max}} / (a_2 + 0,0305) \\ F_{r\text{max}} &= 44 / (0,012 + 0,0305) \\ F_{r\text{max}} &= 1035,3 \text{ N} \\ F_r &= 300 \text{ N} < F_{r\text{max}} \end{aligned}$$

$$\text{d) } PrA = X \cdot (M_c / L_1 + F_r) + Y \cdot F_a$$

Calculation of coefficients X and Y according to Tab. 3.5.2b

$$\begin{aligned} RAx / Cor &= F_a / Cor \rightarrow e \\ 400 / 3850 &= 0,104 \rightarrow e = 0,30 \end{aligned}$$

$$\begin{aligned} RAx / RAy &= F_a / (M_c / L_1 + F_r) \rightarrow X, Y \\ 400 / (12,45 / 0,021 + 300) &= 0,448 > e \rightarrow X = 0,56; Y = 1,46 \end{aligned}$$

$$\begin{aligned} PrA &= X \cdot (M_c / L_1 + F_r) + Y \cdot F_a \\ PrA &= 0,56 \cdot (12,45 / 0,021 + 300) + 1,46 \cdot 400 \\ PrA &= 1084 \text{ N} < P_{r\text{max}} = 2\,100 \text{ N} \end{aligned}$$

Calculation of the life of the main bearing

$$\begin{aligned} n_{out} &= \frac{2250}{63} = 35,71 \text{ rpm} \\ L_{hr} &= 6000 \cdot \frac{32}{35,71} \cdot \left(\frac{1035,3}{300} \right)^3 = 220\,977 \text{ hrs} \end{aligned}$$

Since all requirements have been met, the selection of the TS 50-63-M reduction gear is correct.



5. Assembly

5.1 G, GH, T, E, H, M series assembly manual

To get the maximum performance from the TwinSpin® high precision reduction gear, it is important to pay attention to the installation, assembly accuracy, sealing and lubrication. Most motor adapter flanges are available on request, please contact the sales department or your local sales representative for further assistance.

5.1.2 G series tightening torques

For the safe transmission of external loads applied to the TwinSpin® high precision reduction gear, it is required to use connecting screws of at least 10.9 grade and to degrease contact surfaces of friction joints before the installation. Tightening torques of screws are shown in Tab. 5.1.2a.

Allowable torques transmitted through connecting screws on flange and case are shown in Tab. Tab. 5.1.2b.

Tab. 5.1.2a: Tightening torques of screws

Screw	Tightening torque [Nm]	Clamping force [N]	Screw material class and specification
M3	1.9 / 2.2	3 100 / 3 700	10.9 / 12.9K* *10K / 12K R _m = 1 000 / 1 200 MPa - min. tensile strength of screw material R _{p0.2} = 900 / 1 080 MPa - min. yield strengths
M4	4.3 / 5.1	5 300 / 6400	
M5	8.4 / 10.2	8 800 / 10 600	
M6	14 / 17	12 400 / 14 900	
M8	35 / 42	22 750 / 27 300	
M10	70 / 85	36 200 / 43 500	
M12	122 / 147	52 900 / 63 500	

Tab. 5.1.2b: Allowable torques transmitted through connecting screws

Size	Number x screw	Pitch diameter [mm]	Transmitted torque [Nm]	Number x screw	Pitch diameter [mm]	Transmitted torque [Nm]
TS 75	12xM5	38	360	18xM3	69	340
TS 85	12xM5	50	470	18xM3	81	400
TS 95	18xM4	53	450	18xM4	88	760
TS 115	18xM5	68	970	18xM4	108	930
TS 125	18xM6	71	1 190	18xM5	116	1 380
TS 155**	18xM8	96	2 950	28xM5	146	2 670
TS 185**	24xM8	119	4 870	30xM6	177	4 940
TS 225**	32xM8	156	8 500	21xM8	207	7 400

** Screw material 10K

5.1.1 T series installation examples - unsealed gears

- Description of T model installations on Fig. 5.1.2 a, b, c, d:

Fig. 5.1.2 (a, b, c, d) shows examples of possible high precision reduction gear installations, their connections and sealing methods. In the case of direct connections (case a) of the reduction gear with a motor shaft, tolerances must be observed to avoid uncontrolled bending pressure and overload of the motor shaft. The tolerance values are given in Tab. 5.1.5.

Fig. 5.1.2b shows the direct method of the connection between a motor shaft and the reduction gear shaft, where the torque from the engine is transmitted through a keyway. The advantage of this connection is the short design length of the drive. This method of connection can be used if the motor shaft has a keyway and its diameter is identical with the diameter of the hole in the shaft of the reduction gear.

Fig. 5.1.2b shows the most common method of connection by using a flange with a shaft seal.

If the motor shaft does not have a keyway or its diameter is not equal to the diameter of the hole in the shaft of the reduction gear, then rigid (Fig. 5.1.2c) or flexible couplings (Fig. 5.1.2d) may be used.

A toothed pulley may be fixed with a shaft inserted into the hole of the reduction gear according to Fig. 5.1.2d, or with a reduction gear with an extended shaft.

When installing the reduction gear, please observe the dimensional tolerances of mounting diameters and prevent contamination of the reduction gear and/or leakage of the lubricant. For this purpose see Fig. 5.1.3a.

Motors that meet the standard flange and keyway tolerances, as are specified in the DIN 42955 standard, are acceptable for standard applications. To make use of the overall performance and lifetime characteristics of TwinSpin® and for high precision applications, the manufacturer recommends to choose motors that comply with the DIN 42955R standard.

Further examples of possible installations are available in the TwinSpin® Application Handbook.

Please contact the sales department or your local sales representative for further details.

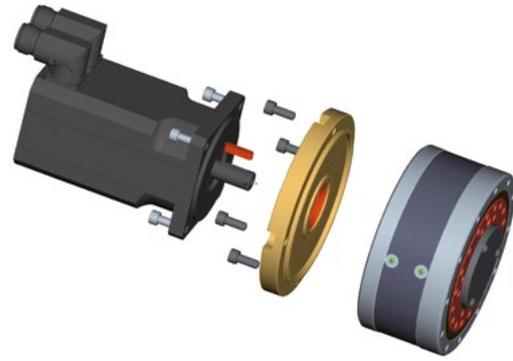
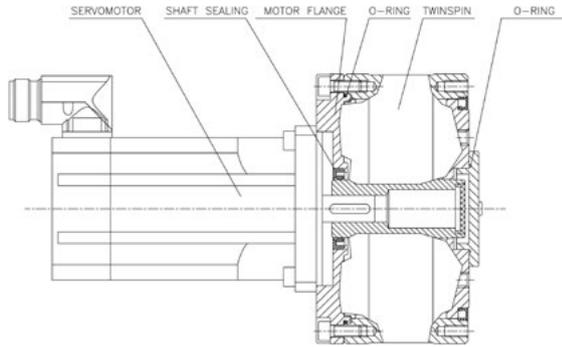


Fig. 5.1.2a:

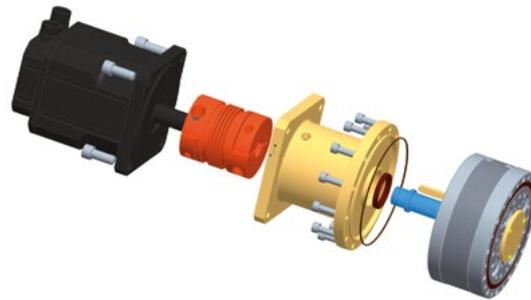
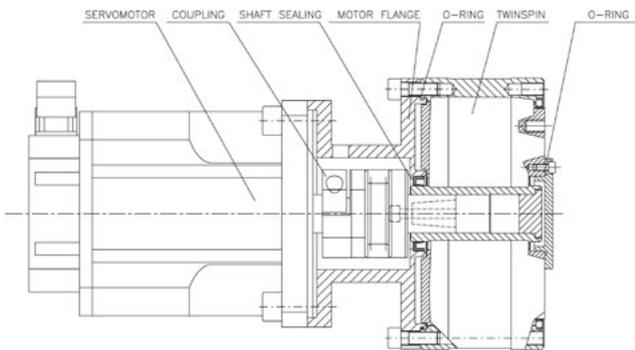


Fig. 5.1.2b:

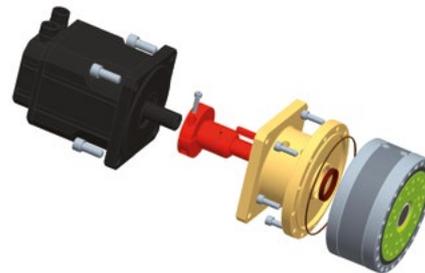
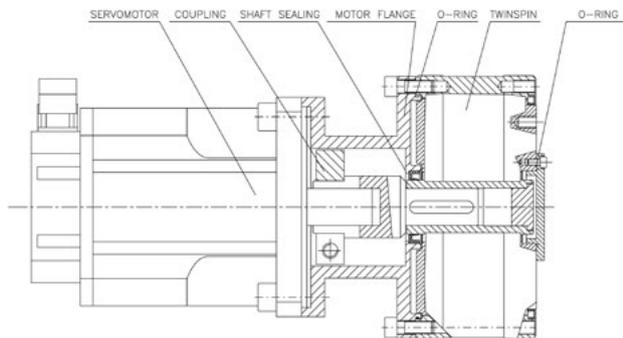


Fig. 5.1.2c:

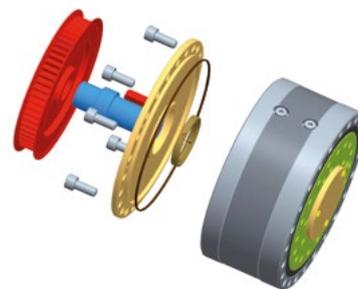
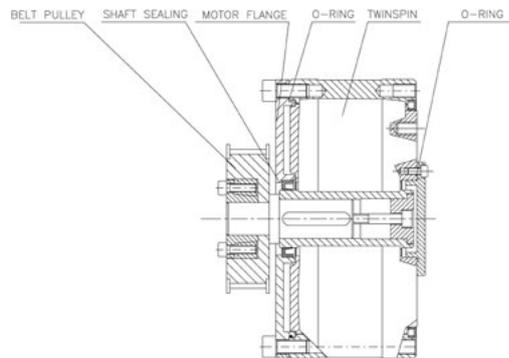


Fig. 5.1.2d:

Fig. 5.1.2: Most frequent connections

5.1.3 T series installation procedure

Prior to the installation, wipe off the protective oil film from from the reduction gear surface with a clean and dry cloth. Degrease the contact surfaces.

Please contact the sales department or your local sales representative for further information.

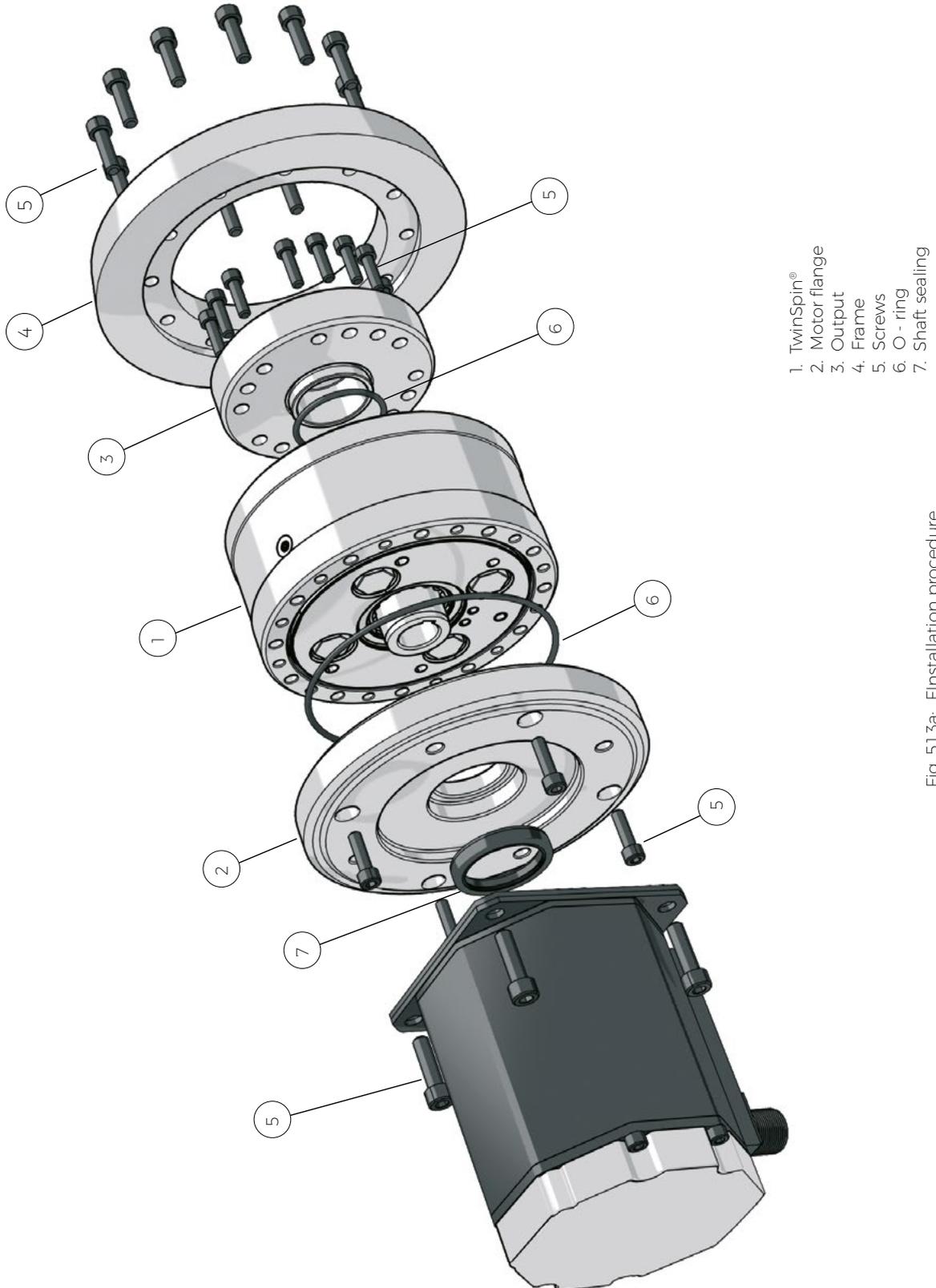


Fig. 5.1.3a: FInstallation procedure



5.1.4 Dimensions and tolerances of the T series connecting parts example

Tab. 5.1.4a: Dimension table of input and output flanges of the T series TwinSpin® reduction gears [in mm] Fig. 5.1.4a

Type	ØA g6	ØB2	ØB h9	ØC+0.1	ØD	ØE	ØF H8	ØG	ØH	ØJ j6	ØK+0.2	ØL
TS 60	-	69	49.2	-	-	-	-	57	12.5	15.5	18	42
TS 70	59.3	-	57.9	57.9	34	28	30	64	22	26	-	42
TS 80	-	86	65	-	-	-	-	73	18	22.3	25	69
TS 110	93	-	90	90	36	29	32	100	24	32	33	69
TS 140	119	-	116	112	48	39	42	127	34	42	43	92
TS 170	145	-	142	138	54	44	47	156	39	47	48	110
TS 200	170	-	167	167	62	48	52	183	43	52	53	131
TS 240	-	250	201.3	-	-	-	-	220	47	57	60	110
TS 300	-	312	249.6	-	-	-	-	274	50	60	66	131

Type	ØN	ØP H7	ØR	ØS	ØT	A1	A2	A3	A4	B1	B2	B3
TS 60	4.3	63	51	57	3.2	-	-	R 0.2	R 0.3	-	-	0.5x45°
TS 70	4.3	70	58	64	3.2	R 2	R 0.8	-	-	0.3x45°	0.3x45°	0.3x45°
TS 80	5.3	80	65	73	4.3	-	-	R 0.3	R 0.3	-	-	0.5x45°
TS 110	6.4	110	88	100	5.3	R 0.8	R 0.8	R 0.2	-	0.3x45°	0.5x45°	0.5x45°
TS 140	6.4	140	115	127	6.4	R 0.8	R 0.8	R 0.2	-	0.5x45°	0.5x45°	0.5x45°
TS 170	8.4	170	140	156	8.4	R 0.8	R 0.8	R 0.3	-	0.5x45°	0.5x45°	0.5x45°
TS 200	10.5	200	165	183	10.5	R 0.8	R 0.8	R 0.3	-	0.5x45°	0.5x45°	0.5x45°
TS 240	13	240	201	220	12	-	-	R 0.4	R 0.4	-	-	0.5x45°
TS 300	17	300	248	274	16	-	-	R 0.4	R 0.4	-	-	0.5x45°

Type	C1+0.2	C2	C3	E1 H12	E2	E3	F2	F3	G1-0.1	G2	G3+0.05	B3
TS 60	-	2	4	3.2	1.5	3	-	R 0.5	-	7.5	0.7	0.5x45°
TS 70	1.4	0.7	5	3.2	1.5	5	2.7	R 0.5	2.8	5	-	0.3x45°
TS 80	-	1.5	4	4.3	1.5	3	-	R 0.5	-	6	1.1	0.5x45°
TS 110	2	0.7	5	5.3	1.5	5	4.5	R 0.5	3.5	6	0.7	0.5x45°
TS 140	2	0.7	5	6.4	1.5	5	2	R 0.5	3.5	6	0.7	0.5x45°
TS 170	2	1	5	8.4	1.5	5	3.5	R 0.5	3.5	7	1.1	0.5x45°
TS 200	2.5	2	5	10.5	1.5	5	5.5	R 0.8	5.5	7.5	1.1	0.5x45°
TS 240	-	-	6	13	1.5	4.5	-	R 0.5	-	7.5	1.5	0.5x45°
TS 300	-	-	6	17	1.5	5	-	R 0.5	-	8.5	2.3	0.5x45°

Type	G5	H1	H5+0.1	M+0.2	V	K1. K5	S5+0.2	O-ring A*/ O-Ring A*				
TS 60	-	-	0.7	1.4	R 0.5	-	1.4	49x1	Viton-FPM70			
TS 70	2.8	5.5	-	-	R 0.2	0.2 x 45°	1.4	55x1	Viton-FPM70			
TS 80	-	-	0.7	1.4	R 0.5	-	1.4	65x1	Viton-FPM70			
TS 110	1.5	6	-	1.4	R 0.5	0.2 x 45°	-	88,62x1.78	Viton-FPM70			
TS 140	1.5	3.5	-	1.4	R 0.5	0.2 x 45°	-	114x1.78	Viton-FPM70			
TS 170	0	3.5	-	2.1	R 0.5	0.2 x 45°	-	140x1.78	Viton-FPM70			
TS 200	2.5	8	-	2.1	R 0.5	0.2 x 45°	-	165x2	Viton-FPM70			
TS 240	-	-	1.1	2.8	R 0.5	-	2.1	201.5x1.5	Viton-FPM70			
TS 300	-	-	1.5	3.9	R 0.5	-	2.8	250x2	Viton-FPM70			

Type	O-ring B*		Double lip oil sealing			
			"A"		"B"	
TS 60	18x1	Viton-FPM70	11x22x6	FPM 70	-	-
TS 70	-	Viton-FPM70	20x30x5	75FKM 595	-	-
TS 80	26x1.5	Viton-FPM70	15x30x7	75FKM 595	-	-
TS 110	33.5x1	Viton-FPM70	22x32x6	75FKM 595	22x32x6	75FKM 595
TS 140	43x1	Viton-FPM70	30x42x6	75FKM 595	30x42x6	75FKM 595
TS 170	48x1.5	Viton-FPM70	35x47x7	75FKM 595	35x47x7	75FKM 595
TS 200	54x1.5	Viton-FPM70	38x52x7	75FKM 595	38x52x7	75FKM 595
TS 240	60x2	Viton-FPM70	40x55x7	75FKM 595	-	-
TS 300	66x3	Viton-FPM70	42x55x8	75FKM 595	-	-

Note:

Dimensions and technical parameters of the sealings need to be observed according to the data contained in the table. Possible changes should be discussed with the manufacturer.

5.1.1 (a, b, c, d) shows examples of possible high precision reduction gear installations, their connections and sealing methods.

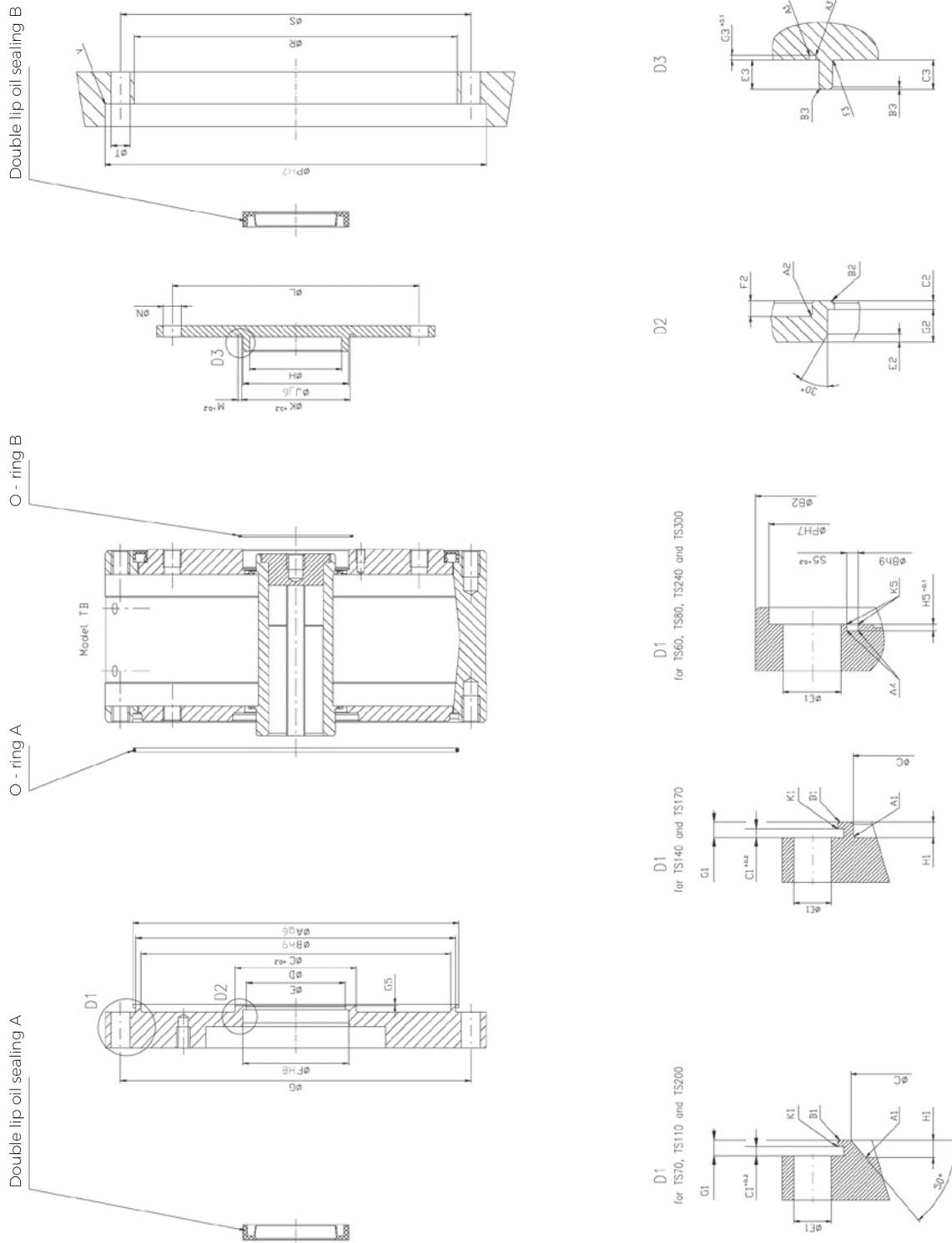


Fig. 5.1.4a: Dimensions of input and output flanges of the TwinSpin® T series reduction gear

5.1.5 T series connecting parts tolerances

According to the DIN 42955 R standard

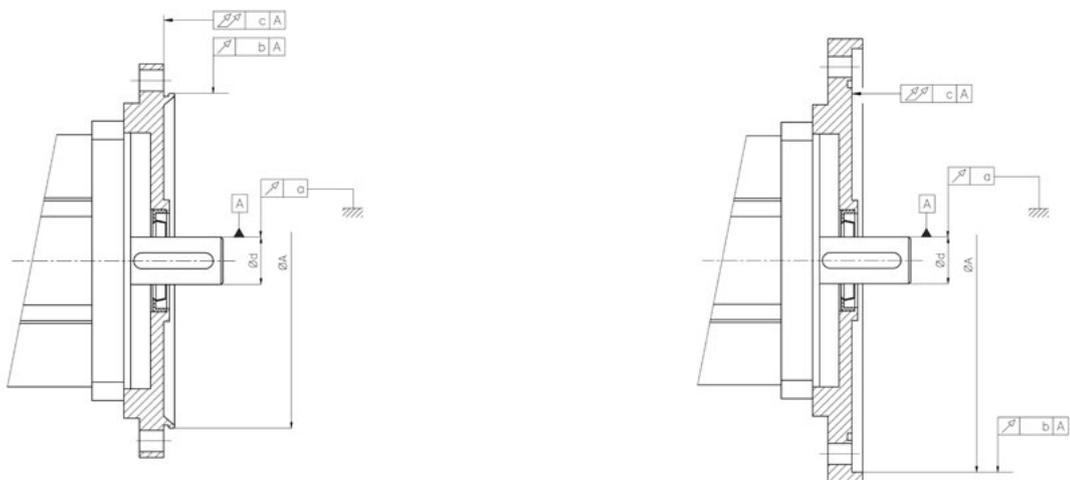


Fig. 5.1.5: Required tolerances of the T series
 a) valid for TS 70, TS 110, TS 140, TS 170, TS 200
 b) valid for TS 80, TS 240, TS 300

Tab. 5.1.5: T series - required tolerances [mm]

Size	a	b	c	Ød	ØA
TS 60	0,015	0,040	0,038	6 k6	63 H7
TS 70	0,018	0,040	0,038	11 k6	59,3 g6
TS 80	0,015	0,050	0,038	8 k6	80 H7
TS 110	0,018	0,050	0,044	14 k6	93 g6
TS 140	0,021	0,050	0,050	19 k6	119 g6
TS 170	0,021	0,050	0,050	24 k6	145 g6
TS 200	0,021	0,060	0,058	24 k6	170 g6
TS 240	0,021	0,063	0,058	28 k6	240 H7
TS 300	0,021	0,063	0,064	28 k6	300 H7

5.1.6 T series circumferential and face run-out values

Tab. 5.1.6: T series - circumferential and face runout values [mm]

Type	T	Z	R	A	C	D	Π	T2
TS 60	0,007	0,020	0,015	63 h7	15,5 H6	6 H7	0,05	0,05
TS 70	0,007	0,020	0,015	70 h7	26 H6	11 H7	0,05	0,05
TS 80	0,007	0,020	0,015	80 h7	22,3 H6	8 H7	0,06	0,05
TS 110	0,008	0,025	0,015	110 h7	32 H6	14 H7	0,07	0,06
TS 140	0,009	0,025	0,015	140 h7	42 H6	19 H7	0,07	0,06
TS 170	0,010	0,025	0,015	170 h7	47 H6	24 H7	0,07	0,06
TS 200	0,010	0,035	0,020	200 h7	52 H6	24 H7	0,08	0,06
TS 240	0,013	0,040	0,020	240 h7	57 H6	28 H7	0,08	0,06
TS 300	0,013	0,040	0,020	300 h7	60 H6	28 H7	0,08	0,06

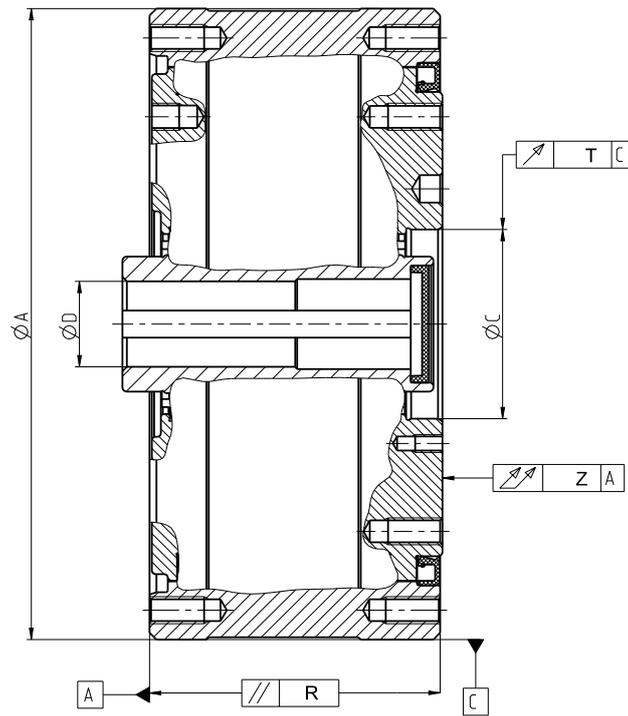


Fig. 5.1.6a: Tolerances of circumferential and face runout for direct connection of TwinSpin® high precision reduction gears with a servomotor in accordance with DIN 42955 R

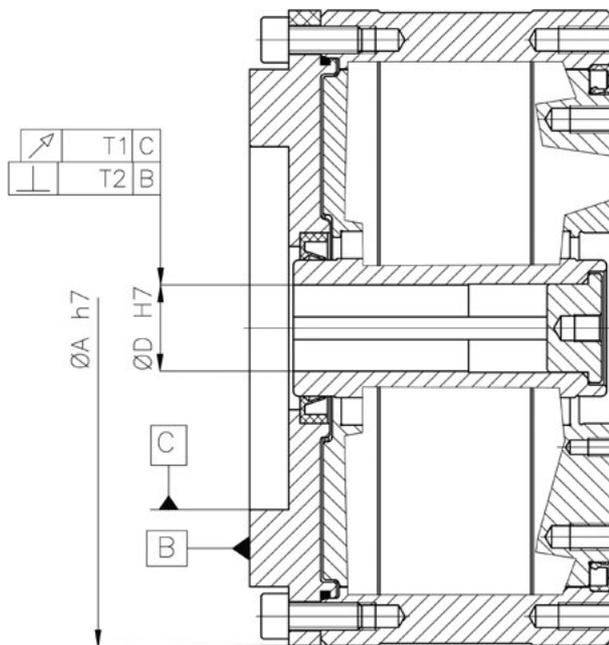


Fig. 5.1.6b: Circumferential and face runout values of the TwinSpin® T series

5.1.7 T series tightening torques

For the safe transmission of external loads applied to the TwinSpin® high precision reduction gear, it is required to use connecting screws of at least 10.9 grade and to degrease contact surfaces of friction joints before the installation. Tightening torques of screws are shown in Tab. 5.1.7a.

Allowable torques transmitted through connecting screws on flange and case are shown in Tab. 5.1.7b.

Tab. 5.1.7a: Tightening torques of screws

Screw	Tightening torque [Nm]	Clamping force [N]	Screw material class and specification
M3	1.9	3 100	ISO 898 T1 10.9 or 12.9
M4	4.3	5 300	
M5	8.4	8 800	
M6	14	12 400	
M8	35	22 750	
M10	70	36 200	
M12	122	52 900	

Tab. 5.1.7b: Allowable torques transmitted through connecting screws

Size	Number x screw	Pitch diameter [mm]	Transmitted torque [Nm]	Number x screw	Pitch diameter [mm]	Transmitted torque [Nm]
TS 60	8xM4	34	108	12xM3	57	160
TS 70	14xM4	42	233	16xM3	64	238
TS 80	8xM5	46	242	12xM4	73	348
TS 110	14xM6	69	898	12xM5	100	792
TS 140	14xM6	92	1 740	12xM6	127	1 410
	8xM6	74				
TS 170	14xM8	110	3 700	12xM8	156	3 200
	8xM8	80				
TS 200	14xM10	131	6 950	12xM10	183	5 900
	8xM10	95				
TS 240	14xM12	160	8 800	12xM12	220	10 400
TS 300	14xM16	200	21 000	12xM16	274	24 600

5.2 E series installation examples

5.2.1 E series installation examples - unsealed gears

Description of the E series installation:

Fig. 5.2.1a It is possible to use a direct connection of the TwinSpin® reduction gear with a motor, if the motor shaft has the same diameter as the hole in the reduction gear.

Fig. 5.2.1b It is possible to use a connection of two different shafts by flexible couplings, if the shafts have different diameters.

Fig. 5.2.1c Mounting of a toothed pulley on the input shaft of the TwinSpin® reduction gear.

Fig. 5.2.1 shows examples of TwinSpin® reduction gear installations, connections and sealing methods. In the case of direct connections of the reduction gear with a motor shaft, tolerances must be observed to avoid uncontrolled bending pressure and overload of the motor shaft. Tolerance values are shown in Tab. 5.2.3. When installing TwinSpin® reduction gears, observe dimensional tolerances of mounting diameters and avoid contamination of the high precision reduction gear and/or leakage of the lubricant.

Motors that meet the standard flange and keyway tolerances, as specified in the European DIN 42955 standard, are acceptable for standard use. In order to make use of the overall performance and durability of TwinSpin® and for high precision applications, the manufacturer recommends to choose motors that meet the European DIN 42955 R standard. Our sales department will be happy to provide you with additional information on the standards or technical assistance for your specific applications. More installation options can be found in the TwinSpin® Application and Service Manual. Please contact the sales department or your local sales representative.

Examples of drive connection with the input shaft

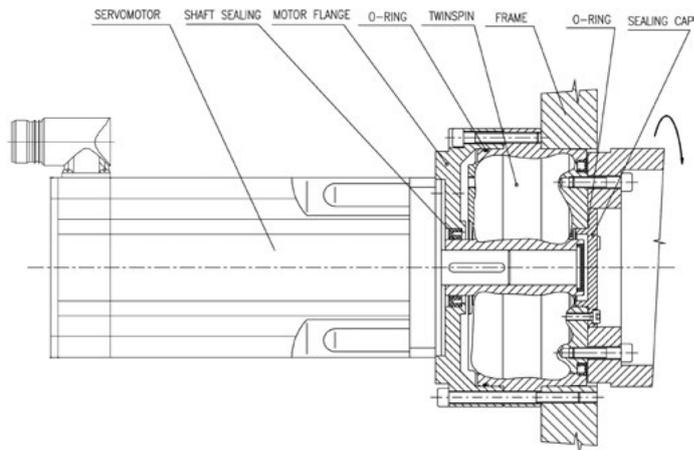


Fig. 5.2.1a: Direct connection of the reduction gear shaft with the motor shaft

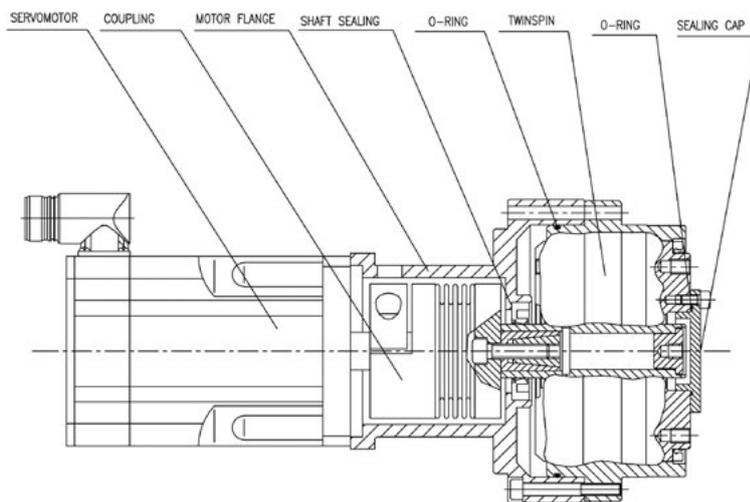
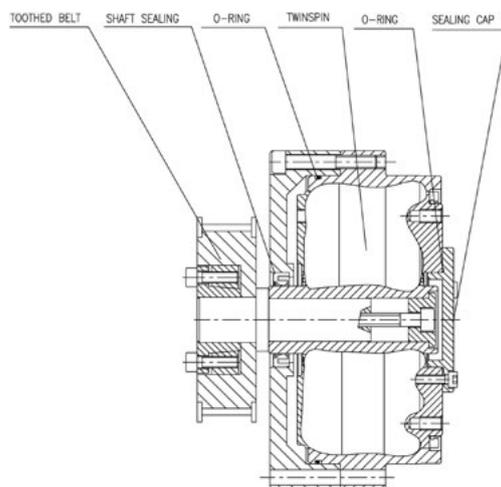


Fig. 5.2.1b: Connection of the motor with the reduction gear with a flexible coupling



Note: The sealing cap is used only with reduction gears TS 110, TS 140, TS 220

Fig. 5.2.1c: Connection of the reduction gear with a toothed pulley

Fig. 5.2.1: Most frequent connections



5.2.2 E series installation procedure

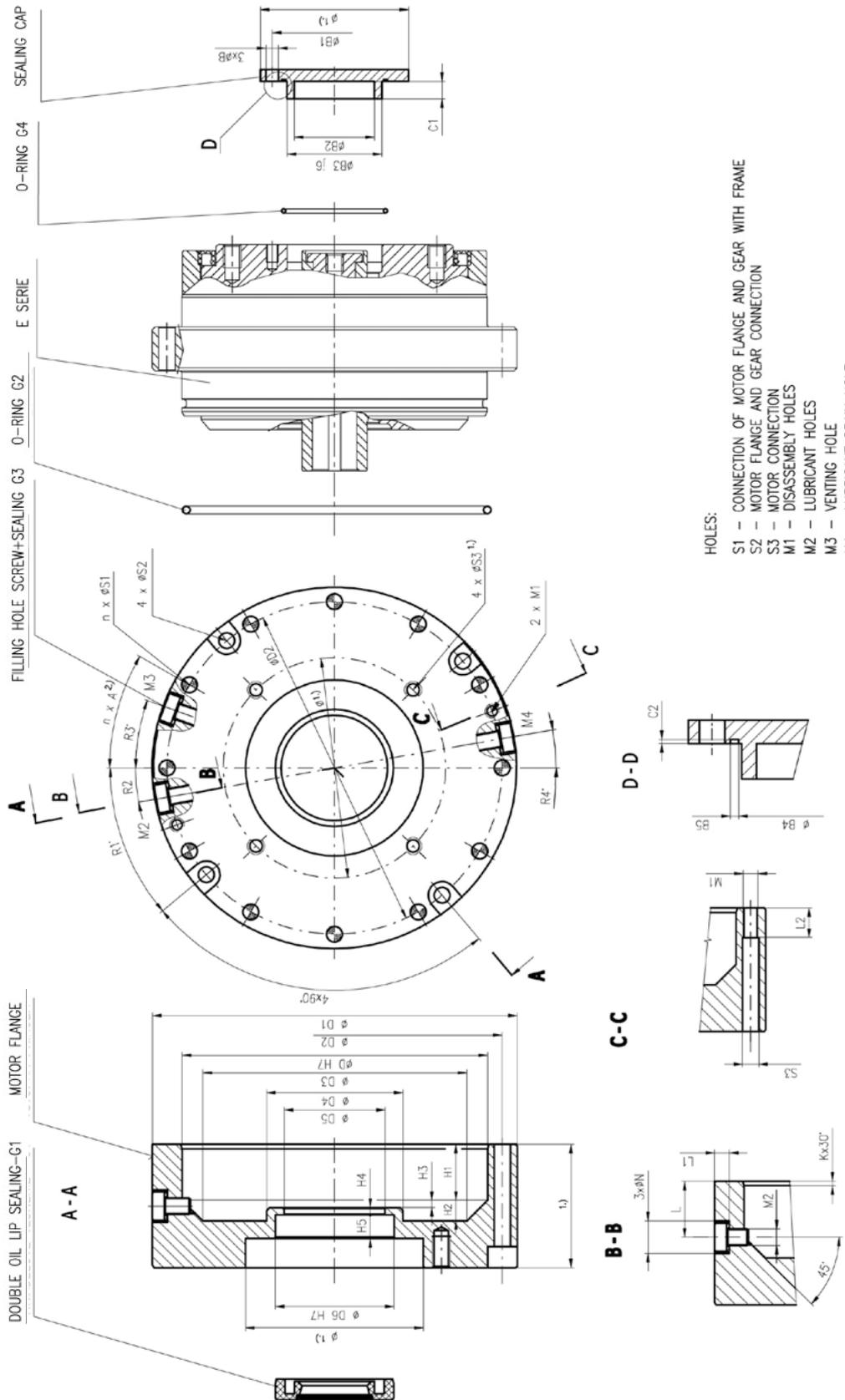
Prior to the installation, wipe off the protective oil film from the reduction gear's surface with a clean and dry cloth. TwinSpin® high precision reduction gears are not protected against corrosion. Please contact the sales department or your local sales representative for further information.

5.2.3 E series connecting parts dimensions and tolerances

Tab. 5.2.3: Dimensional data of the TwinSpin® high precision reduction gear input flange – E series [mm]									
Type	∅ D H7	∅ D1	∅ D2	∅ D3	∅ D4	∅ D5	∅ D6 H8	H1	H2
TS 70	67	85	76	56	36	26	30	11,5	6,5
TS 80	75	95	85	60	38	28	32	14,5	7,5
TS 110	103	123	113	89	46	36	40	19	7
TS 140	128	150	140	111,5	50	38	42	15	8
TS 170	160	190	175	139	65	46	50	23	11
TS 200	186	225	206	176	66	46	52	30	5
TS 220	198	238	220	178	-	46	52	30	10
Type	H3	H4	H5	Kx30°	L	L1	L2	2xM1	
TS 70	2,5	2,5	6,5	1x30	14,5	4,5	6	M4	
TS 80	2,5	2	8,5	1x30	16,5	5	8	M5	
TS 110	2,5	2,5	8	1,5x30	21	5,5	10	M5	
TS 140	5	2,5	9	1,5x30	21	6	10	M6	
TS 170	7,5	2,5	9	2x30	24	5,5	12	M8	
TS 200	0	3	9	2x30	27	6	12	M10	
TS 220	0	3	9	2x30	32	8	12	M8	
Type	M2, M3, M4	n x ∅N	R1°	R2°	R3°	R4°	n x S1	4 x S2	
TS 70	M4	3x10	30	12	15	-15	8x∅5,5	4x∅5,5	
TS 80	M5	2x10	48	15	-	15	10x∅5,5	4x∅5,5	
TS 110	M6	3x11	40	10	20	20	12x∅5,5	4x∅5,5	
TS 140	M10x1	3x15	40	10	20	10	12x∅6,5	4x∅5,5	
TS 170	M10x1	3x15	40	10	20	10	12x∅9	4x∅8,4	
TS 200	M10x1	3x15	40	15	15	15	12x∅11	4x∅8,4	
TS 220	M10x1	2x15	40	-	20	20	12x∅11	4x∅11	
Type	Seal G1 (FPM 70)	O-ring G2 (FPM 70)	Plug		Flat sealing G3 (DIN 7603 (cuprum))				
TS 70	20 x 30 x 5	62 x 2	M4 x 8	DIN 7984	4 x 8 x 1				
TS 80	16 x 32 x 7	70 x 2	M 5 x 8	DIN 7984	5 x 9 x 1				
TS 110	22 x 40 x 7	95 x 2	M6 x10	DIN 7984	6 x 10 x 1				
TS 140	30 x 42 x 6	122 x 2	M10x1	DIN 908	10 x 14 x 1,5				
TS 170	36 x 50 x 7	150 x 2	M10x1	DIN 908	10 x 14 x 1,5				
TS 200	38 x 52 x 7	175 x 2	M10x1	DIN 908	10 x 14 x 1,5				
TS 220	38 x 52 x 7	195 x 2	M10x1	DIN 908	10 x 14 x 1,5				
Type	n x ∅ B	∅ B1	∅ B2	∅ B3 j6	∅ B4	B5 + 0.2	C1	C2+0.05	O-ring G4
TS 110	3 x 4,3	42	27	32	33	1,4	6	0,7	33 x 1
TS 140	3 x 4,3	53	36	42	43	1,4	6,5	0,7	43 x 1
TS 220	3 x 5,3	75	69	110	-	-	4	-	110 x 3
Type	∅ D H7	∅ D1	∅ D2	∅ D3	∅ D4	∅ D5	∅ D6 H8	H1	H2
TS 70	67	85	76	56	36	26	30	11,5	6,5
TS 80	75	95	85	60	38	28	32	14,5	7,5
TS 110	103	123	113	89	46	36	40	19	7
TS 140	128	150	140	111,5	50	38	42	15	8
TS 170	160	190	175	139	65	46	50	23	11
TS 200	186	225	206	176	66	46	52	30	5
TS 220	198	238	220	178	-	46	52	30	10

Note:

The output flange of TwinSpin® high precision reduction gears TS 70-E, TS 80-E, TS 170-E and TS 200-E is sealed as a standard. No additional sealing cap is needed.



- HOLES:
- S1 - CONNECTION OF MOTOR FLANGE AND GEAR WITH FRAME
 - S2 - MOTOR FLANGE AND GEAR CONNECTION
 - S3 - MOTOR CONNECTION
 - M1 - DISASSEMBLY HOLES
 - M2 - LUBRICANT HOLES
 - M3 - VENTING HOLE
 - M4 - LUBRICANT DRAIN HOLE

- 1) CUSTOMIZED DIMENSIONS
- 2) PITCH DIAMETER ACCORDING GEAR SIZE
- 3) SIZES TS110, TS140 AND TS220 MUST BE SEALED.
- RESPECT DIMENSIONAL TOLERANCES

Dimensions and tolerances of the E series connecting components

5.2.4 E series mounting tolerances

The requirements for circumferential and face runout in the case of a direct connection of the high precision reduction gear with a servomotor with a shaft in accordance with DIN 42955R are specified in Fig. 5.2.4a. The tolerances are specified in Tab. 5.2.4

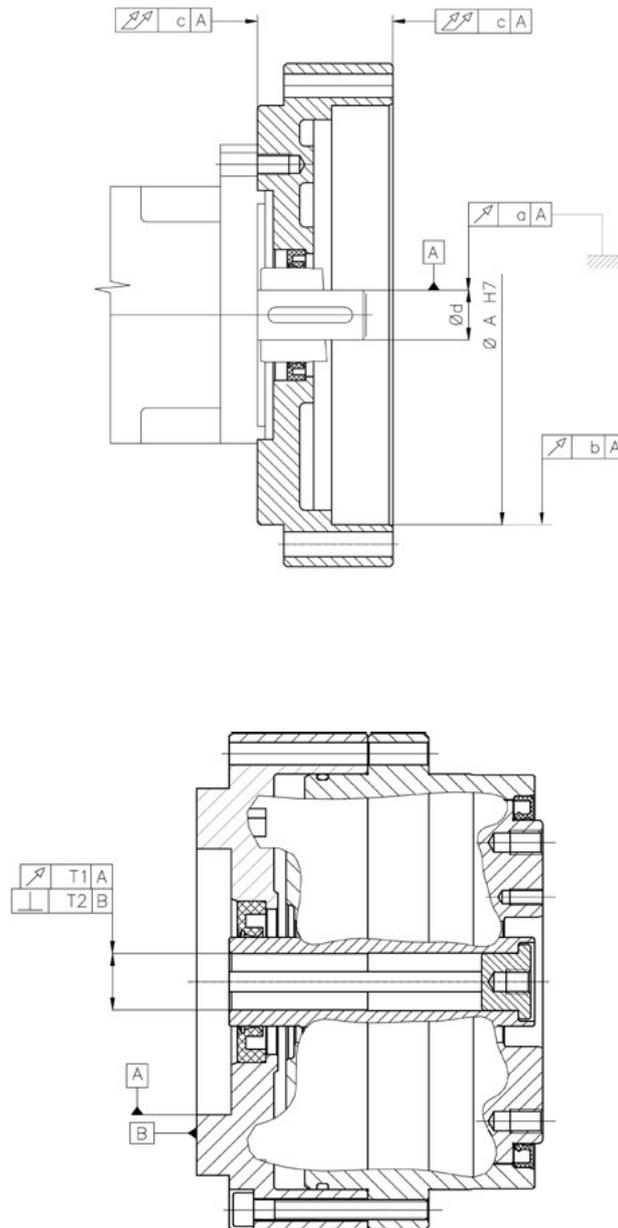


Fig. 5.2.4a: Geometric deviations for the connection of the E series TwinSpin® high precision reduction gear flange with a motor or of the TwinSpin® E series reduction gear

Tab. 5.2.4: Tolerances of circumferential and face runout in the case of a direct connection of TwinSpin® high precision reduction gears with a servomotor according to DIN 42955 R [mm]

Type	a	b	C	T1	T2	U	T	Z	V
TS 70	0,015	0,04	0,038	0,05	0,05	0,010	0,007	0,020	0,025
TS 80	0,015	0,05	0,038	0,06	0,05	0,010	0,007	0,020	0,025
TS 110	0,018	0,05	0,044	0,07	0,06	0,010	0,008	0,025	0,025
TS 140	0,021	0,05	0,05	0,07	0,06	0,010	0,009	0,025	0,030
TS 170	0,021	0,05	0,05	0,07	0,06	0,015	0,010	0,025	0,030
TS 200	0,025	0,05	0,058	0,07	0,06	0,015	0,010	0,035	0,030
TS 220	0,025	0,063	0,058	0,08	0,06	0,015	0,013	0,030	0,035

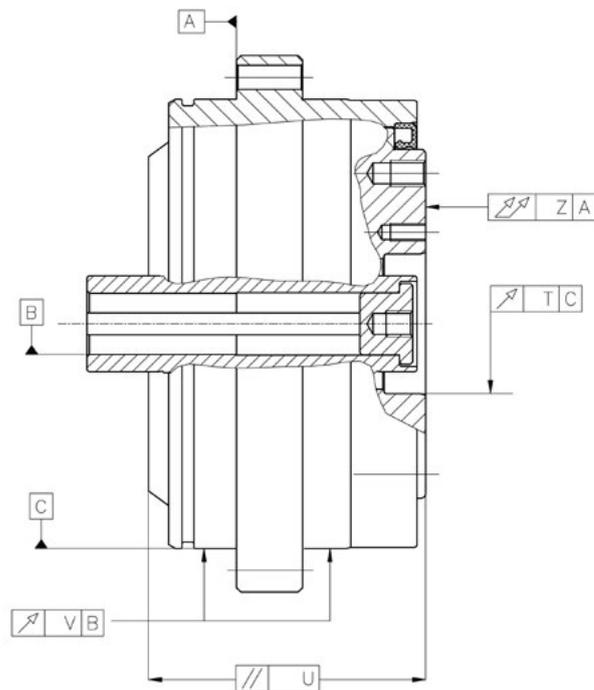


Fig. 5.2.4b: Tolerances of circumferential and face runout in the case of direct connection of TwinSpin® high precision reduction gears with a servomotor according to DIN 42955 R

5.2.5 E series tightening torques of connecting bolts

For the safe transmission of external loads applying on the TwinSpin® high precision reduction gear, it is required to use connecting screws of at least 10.9 grade and to degrease contact surfaces of friction joints before installation. Tightening torques of the screws are shown in Tab. 5.2.5b.

Allowable torque transmitted through the connecting screws on the flange and case are shown in Tab. 5.2.5b.

Tab. 5.2.5a: Tightening torques of screws

Screw	Tightening torque [Nm]	Clamping force [N]	Screw material class specification
M3	1.9	3 100	ISO 898 T1 10.9 or 12.9
M4	4.3	5 300	
M5	8.4	8 800	
M6	14	12 400	
M8	35	22 750	
M10	70	36 200	
M12	122	52 900	
M16	300	100 000	
M18	455	120 000	

Tab. 5.2.5b: Allowable torques transmitted through connecting screws

Size	Output flange			Case		
	Number x screw	Pitch diameter [mm]	Transmitted torque [Nm]	Number x screw	Pitch diameter [mm]	Transmitted torque [Nm]
TS 70	5xM6	40	186*	10xM5	76	500
TS 70	5xM6	40	254*	10xM5	76	500
	with pin Ø6	40				
TS 80	8xM5	46	242*	10xM5	85	560
TS 110	14xM6	69	890	14xM5	113	1040
TS 140	18xM6	92	2090	12xM6	140	1560
	8xM6	74				
TS 170	18xM8	110	4470	14xM8	175	4180
	8xM8	80				
TS 200	18xM12	129	9880	14xM10	206	7830
	8xM6	91				
TS220	20xM10	140	7600	14xM10	220	8350

* Safe transmission of the the torque requires glue to be applied on the friction surfaces (NICRO 20-10, NICRO 32-02; LOCTITE 603)

5.3 H series installation examples

5.3.1 H series mounting examples

The H series is completely sealed and filled with grease for its lifetime. Fig. 5.3.1a, Fig. 5.3.1b and Fig. 5.3.1c show examples of connections with motors.

The through input shaft of the H series high precision reduction gear with an enlarged diameter allows to pass energy supply or control cables through the axis of the reduction gear to devices mounted behind the output flange. The H series reduction gear is most often used in combination with a pre-stage, which may comprise gears or toothed belt drives. A typical example of the H series reduction gear drive through a toothed belt is shown in Fig. 5.3.1a. The driven pulley is attached to the shaft of the reduction gear with screws, which have to be tightened with a tightening torque according to Tab. 5.3.4a and Tab. 5.3.4b. The driving pulley with the motor must be shiftable to allow the tightening of the belt.

Fig. 5.3.1b shows the drive of the input shaft through gears. The gears are housed in a frame, which is part of the reduction gear input flange.

Fig. 5.3.1c shows a toothed pulley mounted on the input flange by means of friction rings.

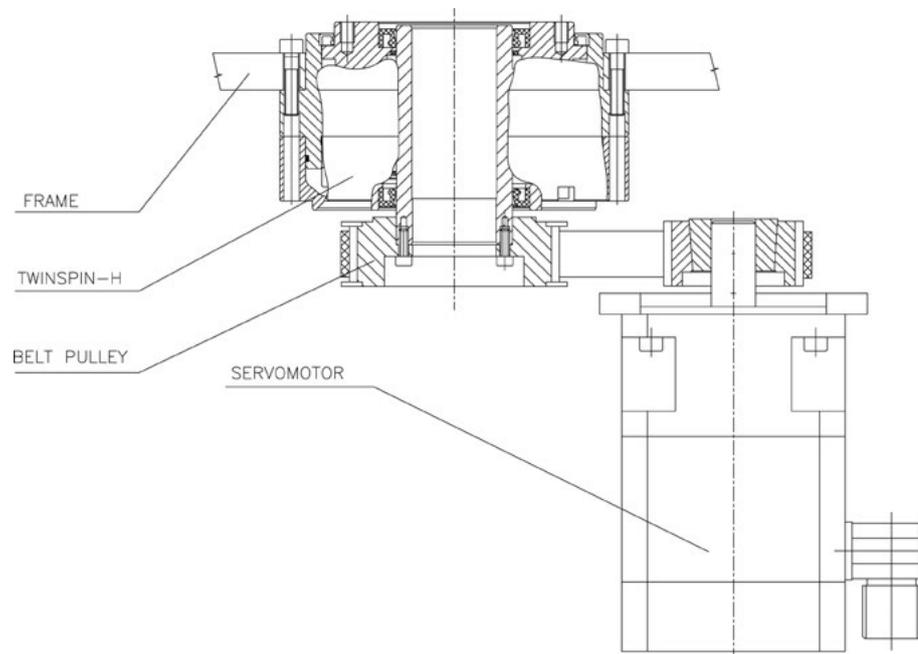


Fig. 5.3.1a: Connection of a toothed pulley with the reduction gear shaft by means of a screw connection

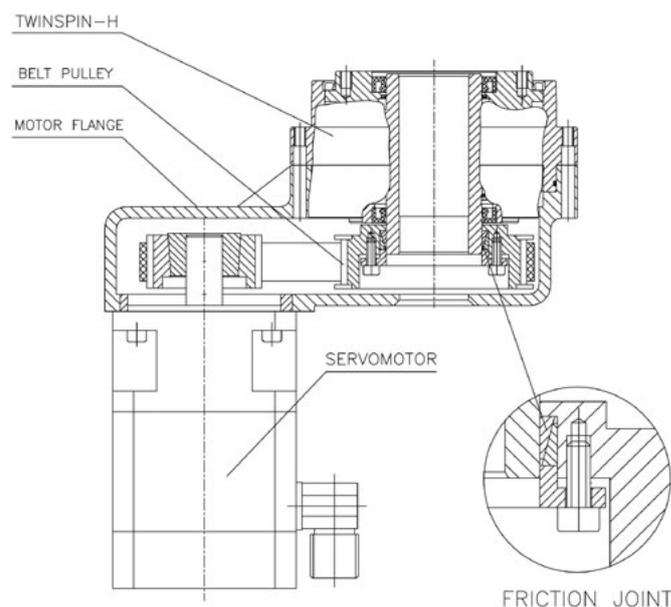


Fig. 5.3.1b: Connection of a toothed pulley with the reduction gear shaft by means of a friction connection

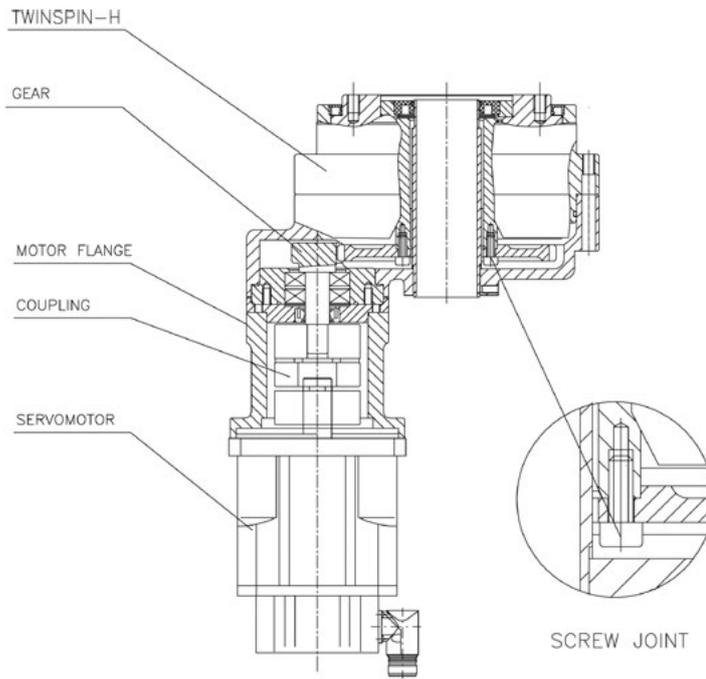


Fig. 5.3.1c: Connection of a gear wheel with the reduction gear shaft by means of a screw connection

5.3.2 H series installation procedure

Prior to the installation, wipe off the protective oil film from the reduction gear's surface with a clean and dry cloth. Degrease the contact surfaces of the friction-type of connections. TwinSpin® high precision reduction gears are not protected against corrosion. Please, contact the sales department or your local sales representative for further information.

5.3.3 H series mounting tolerances

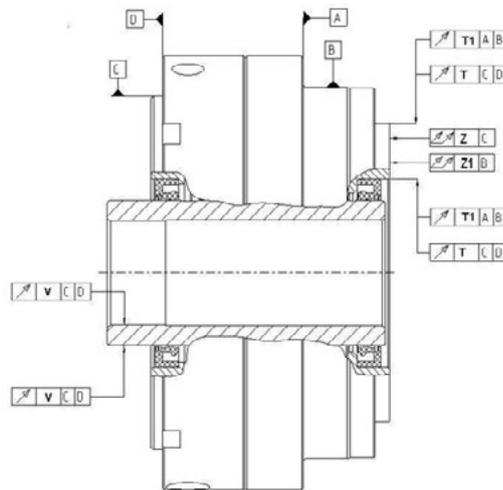


Fig. 5.3.3: Maximum geometric deviations for the H series reduction gear

Tab. 5.3.3a: Maximum geometric deviations for the H series reduction gear [mm]

	TS 140H	TS 170H	TS 200H	TS 220H
T	0,02	0,02	0,02	0,02
T1	0,013	0,015	0,015	0,015
Z	0,025	0,025	0,03	0,03
Z1	0,015	0,015	0,02	0,02
V	0,05	0,05	0,06	0,06

5.3.4 H connecting screws tightening torques

For the safe transmission of external loads applied to the TwinSpin® high precision reduction gear, it is required to use connecting screws of at least 10.9 grade and to degrease contact surfaces of friction joints before the installation. Tightening torques of screws are shown in Tab. 5.3.4a. Allowable torques transmitted through connecting screws on the flange and case are shown in Tab. 5.3.4b.

Tab. 5.3.4a: Tightening torques of screws

Screw	Tightening torque [Nm]	Clamping force [N]	Screw material class specification
M3	1.9	3 100	ISO 898 T1 10.9 or 12.9
M4	4.3	5 300	
M5	8.4	8 800	
M6	14	12 400	
M8	35	22 750	
M10	70	36 200	
M12	122	52 900	
M16	300	100 000	
M18	455	120 000	

Tab. 5.3.4b: Allowable torques transmitted through connecting screws

Size	Output flange			Case		
	Number x screw	Pitch diameter [mm]	Transmitted torque [Nm]	Number x screw	Pitch diameter [mm]	Transmitted torque [Nm]
TS 70	5xM6	40	186*	8xM5	76	400
TS 70	5xM6	40	254*	8xM5	76	400
	with pin Ø6	40				
TS 140	16xM6	92	1400	12xM6	140	1560
TS 170	18xM8	110	3300	12xM8	175	3580
TS 200	18xM12	131	6400	12xM10	206	6700
TS220	20xM10	140	7600	12xM10	220	7100

* Safe transmission of the the torque requires glue to be applied on the friction surfaces (NICRO 20-10, NICRO 32-02; LOCTITE 603)

5.4 M series installation examples

In order to achieve the maximum performance of the TwinSpin® high precision reduction gear, it is important to pay attention to the installation and accuracy of the assembly and lubrication. The M series high precision reduction gears are completely sealed. The modular design of the reduction gear allows the connection of different drive parts. Motor flanges and shaft couplings are required for this connection. We can design and supply such parts upon request together with a reduction gear.

5.4.1 M series installation examples

The most common cases of connections between the M series TwinSpin® high precision reduction gear and a servomotor are shown on Fig. 5.4.1a, Fig. 5.4.1b, Fig. 5.4.1c, and Fig. 5.4.1d. Direct connection of the shaft of the high precision reduction gear with a motor through a keyway. This connection requires that the motor shaft has the same diameter as the hole in the high precision reduction gear. In the case of direct connection of the reduction gear with a motor, all specified tolerances for the coupling flange must be met and only motors with shafts that meet the tolerances specified in the European DIN 42955 standard may be used. Our sales department will provide you with information on such standards or will provide technical assistance for your specific application.

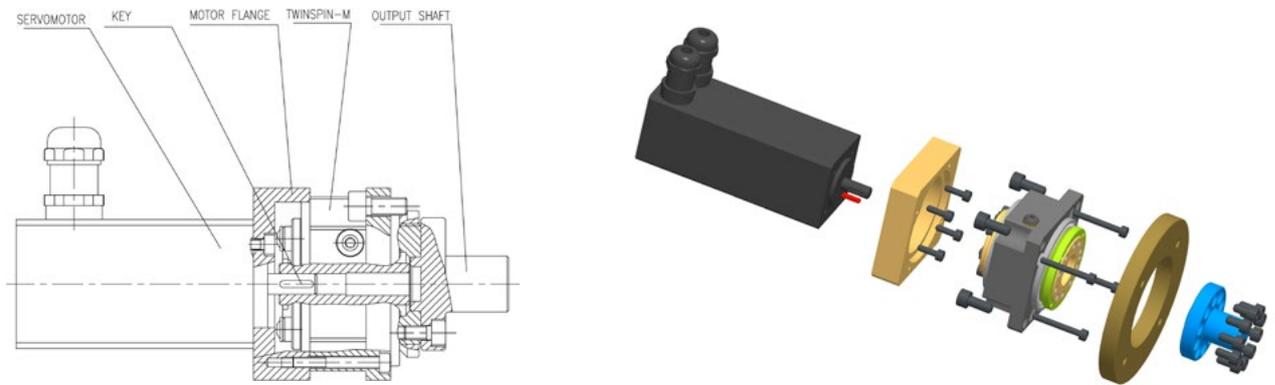


Fig. 5.4.1a: Shaft connection with a keyway

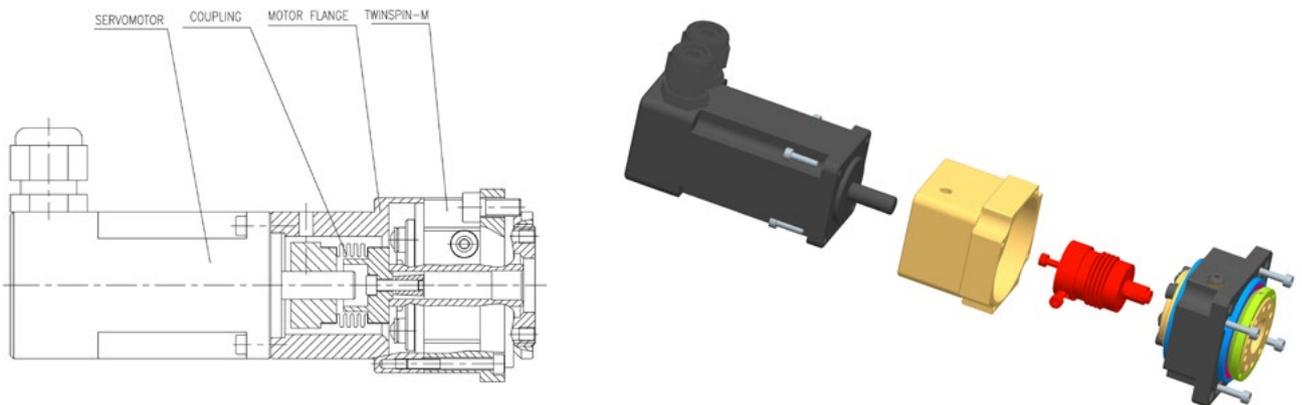


Fig. 5.4.1b: Shaft connection with a flexible coupling

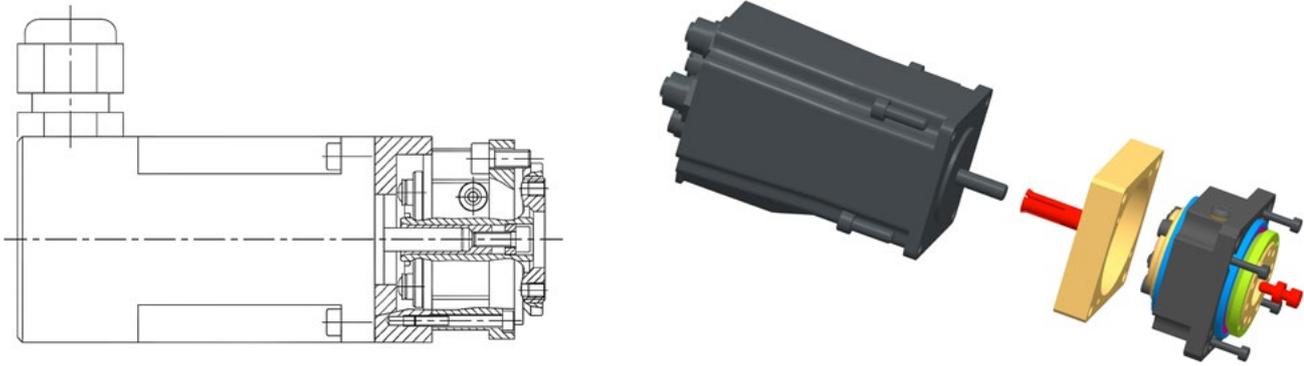


Fig. 5.4.1c: Shaft connection with a collet

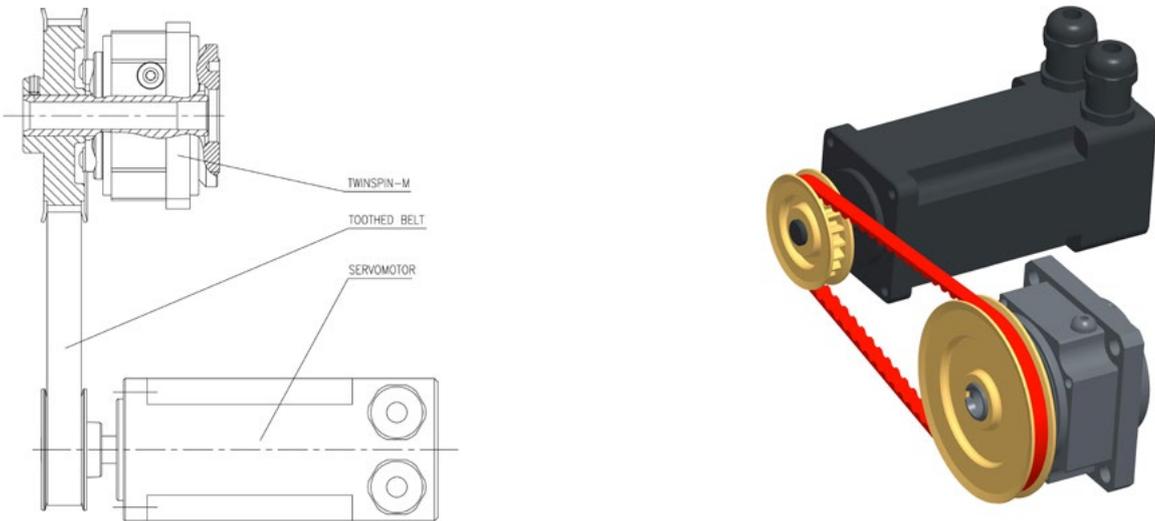


Fig. 5.4.1d: Example of the use of the hollow-shaft version of the reduction gear, driven through a toothed belt

5.4.2 M series installation procedure

A typical example of an assembly with TS 50 is shown on Fig. 5.4.2 Before the installation, it is desirable to wipe off the protective oil film from the surface of the reduction gear with a clean and dry cloth. Contact surfaces of friction joints must be degreased prior to the installation. When cleaning, make sure that the degreaser does not get into the reduction gear. During the installation, proceed with the following steps: first, fasten a coupling to the reduction gear, then the connecting motor flange to which the motor needs to be mounted and afterwards bolt the whole assembly to the frame.

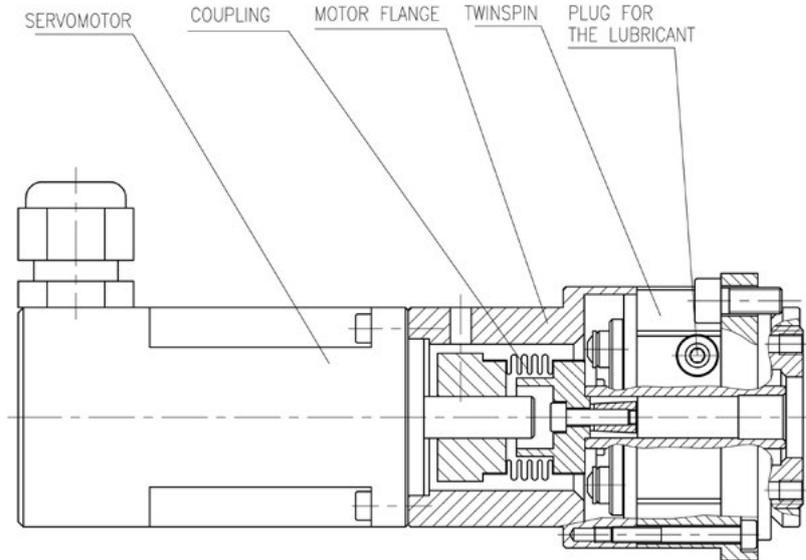


Fig. 5.4.2: Typical connection of a motor to the M series reduction gear

5.4.3 M series connecting parts tolerances

Tab. 5.4.3: Maximum geometric deviations for the M series reduction gear [mm]

Tolerance	TS 50
a	0.02
b	0.04
c	0.038
d	6 j6
A	47 H7

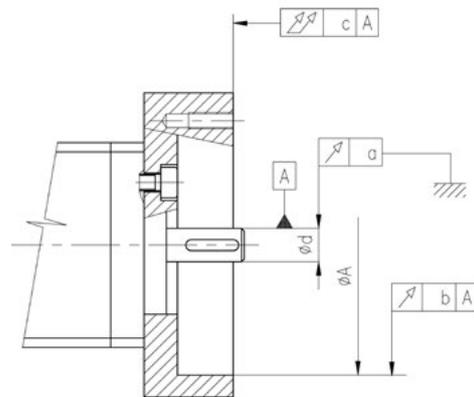


Fig. 5.4.3: Tolerances of M series connecting parts

5.4.4 M series connecting parts geometrical deviations

Tab. 5.4.4: M series reduction gear [mm]

Tolerance	TS 50
T	0.01
Z	0.02
φD H7	6.0
φC H7	15.5
φA h6	47.0

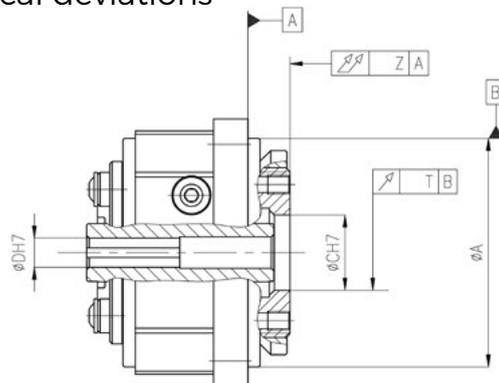


Fig. 5.4.4: Radial and axial runout of the output flange

5.4.5 M series connecting screws tightening torque

For the safe transmission of external loads applied to the TwinSpin® high precision reduction gear, it is required to use connecting screws of at least 10.9 grade and to degrease contact surfaces of friction joints before the installation. Tightening torques of screws are shown in Tab. 5.4.5a. Allowable torques transmitted through connecting screws on the flange and case are shown in Tab. 5.4.5b

Tab. 5.4.5a: Tightening torques of screws

Screw	Tightening torque [Nm]	Clamping force [N]	Screw material class specification
M3	1.9	3 100	ISO 898 T1 10.9 or 12.9
M4	4.3	5 300	
M5	8.4	8 800	
M6	14	12 400	
M8	35	22 750	

Tab. 5.4.5b: Allowable torques transmitted through connecting screws

Size	Output flange			Case		
	Number x screw	Pitch diameter [mm]	Transmitted torque [Nm]	Number x screw	Pitch diameter [mm]	Transmitted torque [Nm]
TS 50	10xM4	28	110	4xM5	63	165



5.5 Lubrication, cooling, preheating

The TwinSpin® reduction gear is lubricated as a standard with the Castrol TRIBOL GR 100-0 PD or TRIBOL GR TT 1 PD grease. Alternatively, the Castrol OPTIGEAR 150 oil may be used. More information is available on www.castrol.com. It is forbidden to mix the lubricant used for the lubrication of the reduction gear with other types of lubricants. The lubricant change interval highly depends on the individual operating conditions.

Grease and oil quantities for individual TwinSpin® reduction gears are specified in Tab. 5.5.a. These quantities, however, do not include the space between the reduction gear and the connected parts. If no rotary shaft seal is used, the user must fill it with the lubricant. The change interval of the lubricant inside the reduction gear depends mainly on the actual operating conditions and duty cycle.

High temperatures and high speeds and loading will reduce the service life of the lubricant. In many cases re-lubrication will not be necessary because the reduction gear is filled for a long life. The recommended interval for lubricant change is 20 000 operating hours.

T series - is not a completely sealed series of high precision reduction gears, however, this series is normally filled with grease Castrol TRIBOL GR 100-0 PD or TRIBOL GR TT 1 PD. The recommended amount of grease for each size of T series reduction gears is shown in Tab 5.5. These figures, however, do not include the space between the TwinSpin® reduction gear and sealing flanges. The user secures complete sealing and addition of the lubricant to the free space. It is recommended to fill up to 70 - 80% of the free sealed volume. On the basis of a request by the user, SPINEA can offer a complete sealed and grease-filled solution.

E series - is not a completely sealed series of high precision reduction gears, normally filled with oil Castrol OPTIGEAR or Castrol TRIBOL GR 100-0 PD or TRIBOL GR. The user will fill the reduction gear with grease after its complete sealing. It is recommended to fill up to 70 - 80% of the free sealed volume.

H series - is a completely sealed series of high precision reduction gears, normally filled with grease CASTROL TRIBOL GR TT 1 PD.

M series - is a completely sealed series of high precision reduction gears, normally filled with grease CASTROL TRIBOL GR TT 1 PD.

Size	Volume of the lubricant
TS 50	M series - 3
TS 60	T series - 5
TS 70	T, E, H series - 10
TS 80	T, E series - 15
TS 110	T, E, H series - 30
TS 140	T, E series - 70
TS 140	H series - 75
TS 170	T, E series - 120
TS 170	H series - 270
TS 200	T, E series - 180
TS 200	H series - 345
TS 220	E series - 200
TS 220	H series - 350
TS 240	T series - 300
TS 300	T series - 470

Note:

*The specified values represent 80% filling of the internal volume of the T series TwinSpin® high precision reduction gears. In the case of accessories of the reduction gear manufactured by the user, it is necessary to increase these values by the amount that represents 80% of the space between the reduction gear and the accessories. Lubrication levels in the horizontal and vertical positions are on Tab. 5.5.a.

**If other types of seals instead of rotary shaft seals are used on the reduction gear, or in the case of desired leakage of grease from the reduction gear, it is required from the customer to prescribe greasing intervals at his own risk or to consult the supplier for the confirmation of the warranty period.

When the reduction gear is in operation, the temperature of the lubricant should not exceed the maximum temperature defined by the lubricant manufacturer. Otherwise it is necessary to take into consideration the possible loss of lubricating properties of the used lubricant.

Tab. 5.5.d: Recommended lubricant quantities for the filling of the G series [cm³]

Size	Volume of the lubricant
TS 75	G series - 10
TS 85	G series - 20
TS 95	G series - 30
TS 115	G series - 40
TS 125	G series - 40
TS 135	G series - 65
TS 155	G series - 130
TS 185	G series - 230
TS 225	G series - 300
TS 245	G series - 350

Tab. 5.5.b: Range of use and lifetime of lubricants

Lubricant	Type	Range of use
Castrol TRIBOL GR 100-0 PD	Grease	-35°C - +140°C
Castrol TRIBOL GR TT 1 PD	Grease	-60°C - +120°C
Castrol OPTIGEAR 150	Oil	-10°C - +90°C

When these limits are exceeded, it is necessary to provide cooling or pre-heating of the reduction gears. In such cases please contact our sales department.

Attention: The temperatures stated in Tab. 5.5.b are the temperatures stated by the manufacturer for the determination of the lubricant lifetime in certain extreme conditions of its use, for the determination of re-lubrication intervals or its change. These temperatures are not identical with the temperatures inside or on the surface of the reduction gear. Since the thermal conditions inside the reduction gear and on its surface are less extreme in standard operation than the limit temperatures for the lubricant, the lifetime of the lubricant filling is higher than it is stated in the table.

Cooling

Cooling of the reduction gears is not necessary in most cases. But there are some cases when the temperature on the reduction gear surface becomes a limiting factor for a given duty cycle and relative ambient temperature. The reduction gear warming-up in extreme duty cycles should not be higher than by 40°C of the ambient temperature of 20°C - 25°C, whereas the general rule $n_a < n_{eff}$ (see Chapter 3) should be observed for extreme duty cycles.

Cooling is usually used in the following cases:

- special regulations applicable for explosive environments where a low temperature is requested
- ambient temperature higher than 40°C
- heat transmission between the electric motor and the reduction gear is too high

For the reason of the preservation of the proper functioning of the reduction gear (lubricant, sealing, pre-stress degree and material dilatation) during the guaranteed lifetime, the limit temperature expresses the limit temperature of the reduction gear, measured on its surface.

Tab. 5.5.c: Limit temperature of the reduction gear surface (measured on the gear surface)

Lubricant	Reduction gear limit temperature	
	TS50 - TS140	TS170 - TS300
Castrol TRIBOL GR 100-0 PD	65°C	70°C
Castrol TRIBOL GR TT 1 PD	65°C	70°C
Castrol OPTIGEAR 150	65°C	70°C

The stated temperatures represent a condition, when the reduction gear is not overloaded by speed with regard to lost motion. If the temperature is higher despite static (increasing of the surface for the heat dissipation) or dynamic (forced) cooling, it is necessary to decrease the speed or to use a reduction gear with higher LM (lost motion).

In such cases please contact our sales department for technical support.

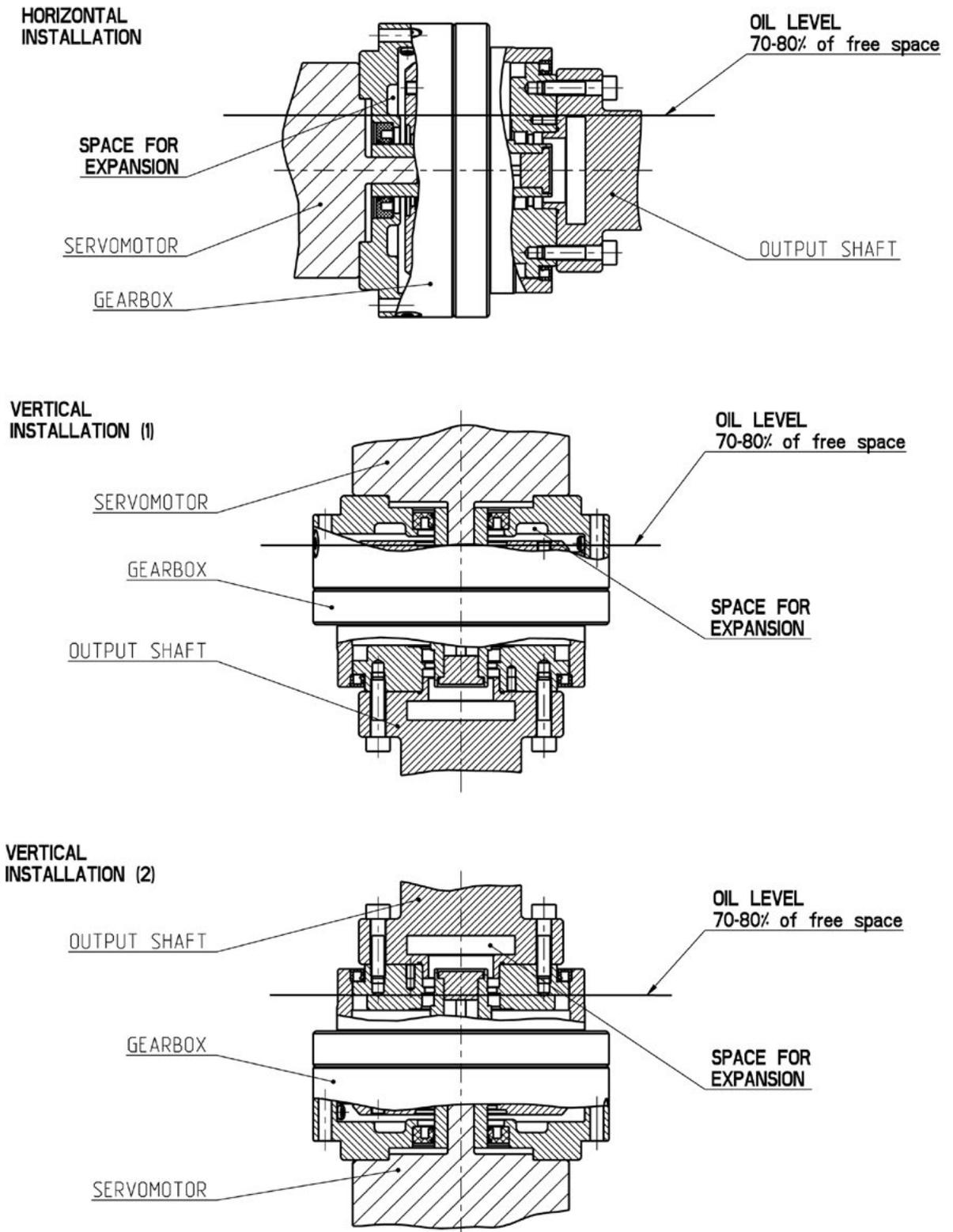


Fig. 5.5a: Lubricant levels in horizontal and vertical positions

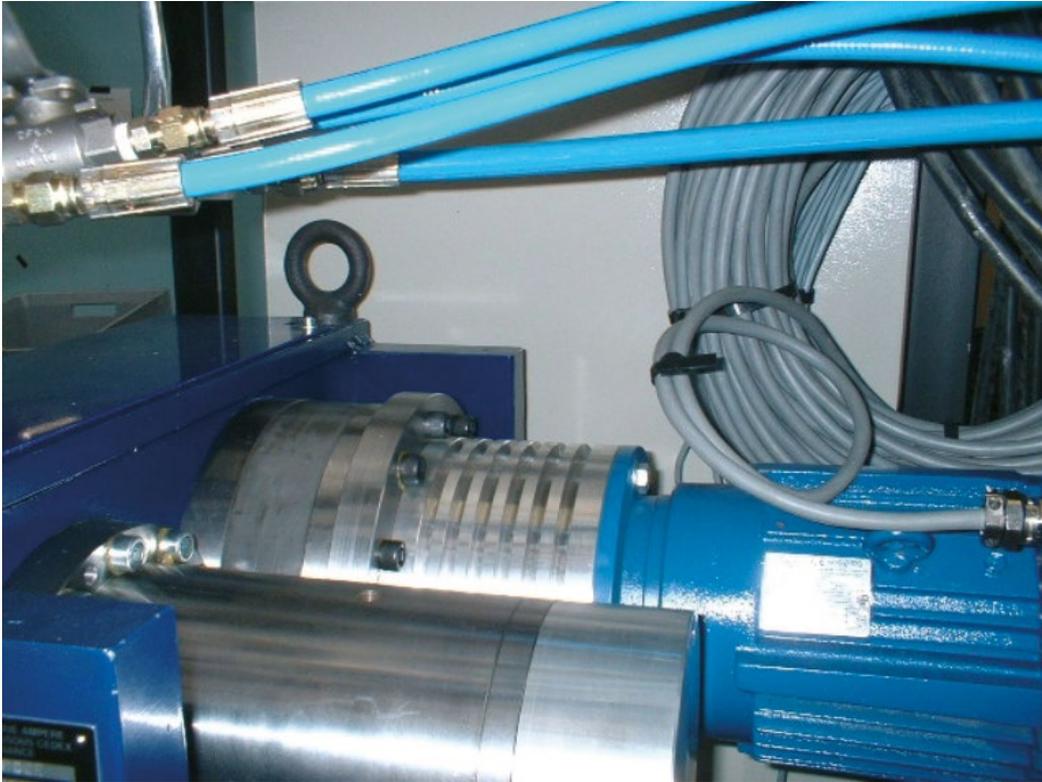


Fig. 5.5b: Lubricant levels in horizontal and vertical positions

Pro-heating

Pre-heating is only used in very rare cases when the reduction gear is run with a very low duty factor at extreme ambient temperature variations or at very low ambient temperatures.

The reduction gear should normally be pre-heated in temperatures lower than -10°C . This is not necessary if the temperatures are constant and not so low and the speed values as well as the values of the torque to be transmitted are low, but in any case a special run-in and pre-heating cycle is needed. At such temperatures it is necessary to count with a higher start-up torque and thus with a more generous sizing of the drive motor.

In such cases please contact our sales department for technical support.

5.6 Thermal conditions

The TwinSpin® reduction gears are designed for the ambient temperature range of -10°C to $+40^{\circ}\text{C}$. Applications for other thermal conditions should be consulted with the sales department or your local sales representative.

5.7 Motor flanges

Most motor adaptor flanges are available on request. Please contact the sales department or your local sales representative for further assistance.



6. General information

6.1 Maintenance

The reduction gear does not require any special maintenance. During its installation please observe the respective dimensional and positional tolerances of the centering diameters (Chapter 5.3). The reduction gear is a high-precision product, therefore it requires careful manipulation, installation, and demounting.

Any tampering with the reduction gear (disassembly, assembly) constitutes immediate loss of warranty. If a reduction gear fails due to a fault in its manufacturing or a material defect, please inform the manufacturer, who will carry out professional repair or replacement.

6.2 Delivery conditions

The reduction gear is delivered completely assembled, without fixing screws, filled with grease, and in a protective package. Not all series are fully sealed as a standard. Each reduction gear is identified with a type label, containing the following data:

- manufacturer
- product type and size
- reduction ratio
- model
- serial number

6.3 Transport and storage

The reduction gears should be transported in closed transport vehicles, in containers secured against movement or overturning. The mode of transport should follow the mutual agreement between the customer and the supplier. In addition, the product must be protected against the elements, aggressive vapours, dust, and mechanical damage. The manufacturer recommends to store TwinSpin® reduction gears in the original transport package.

The standard packaging in the original package ensures corrosion protection for the period of 6 months during storage in closed rooms with the ambient temperature from 5°C to 25°C and the relative humidity up to 60%. After 6 months it is necessary to preserve the reduction gear again.

6.4 Warranty

The warranty is specified in the General Delivery Terms of SPINEA, s.r.o.. For more information visit our website: www.spinea.com

6.5 Final statement

Any design changes, modifications and improvements, aimed at increasing the technological level of the reduction gear, which, however, do not change the main technical parameters, installation and connection dimensions, may be performed by the manufacturer without prior consent from the customer. Any design changes and/or modifications affecting the critical properties and parameters of the reduction gear are subject to an approval procedure.

6.6 Cautions concerning the application of the TwinSpin® high precision reduction gear

If the end user of the product works in the military field or if the product is to be used for the manufacturing of weapons, the product may be subject to trade controls and export regulations. Before the exporting of the product therefore please check the export and trade control terms and conditions and take the required actions.

- If a fault or a malfunction of the product may directly endanger human lives or if the product is used in devices that may damage the human health (nuclear, space, healthcare facilities, various security systems, etc.), regular checks are essential. In such a case please contact our sales agent or our nearest business office.
- Although this product has been manufactured under strict quality control, if it is to be used in machines that, in the event of a malfunction, may seriously endanger human lives or damage equipment, it is essential to adopt appropriate safety measures.
- If this product is to be used in a special environment (clean rooms, food industry, etc.), please contact our sales agent or our nearest business office.

For more information visit our website: www.spinea.com

6.7 FAQ

01. Q: Are reduction ratios between 20-30 possible with the TwinSpin® reduction gear?
 A: Transmission ratios less than 30:1 can be discussed if requested. Ratios that are not offered as standard bear a higher risk of transmission inaccuracies. Consult the technical and delivery conditions with the sales department or our local sales representative.
02. Q: What is the noise level of TwinSpin® during its operation?
 A: TwinSpin® runs extremely smoothly. Reference noise measurements of the reduction gear mounted on a servomotor are available on request.
03. Q: Do you have any information about the temperature increase during the continuous running of TwinSpin® with the rated load?
 A: Transmission ratios less than 30:1 can be discussed if requested. Ratios that are not offered as standard bear a higher risk of transmission inaccuracies. Consult the technical and delivery conditions with the sales department or our local sales representative.
04. Q: Does the input shaft have an axial play for the compensation of the heat growth from the connected servomotor?
 A: There is an axial clearance at the input shaft of the reduction gear that allows heat dilatation. Please pay attention to the adjustment of clearance when interfacing the reduction gear with a servomotor (see [Chapter 5](#)).
05. Q: Why are there grease and oil lubrication options?
 A: Grease is used for the standard applications. Oil is only used for special application requests where there is demand for very low viscous friction, for high-speed applications, for special conditions and users preferences (e.g. extremely cold environment for radar applications).
06. Q: Is it possible to use the TwinSpin® reduction gear independently of the installation position?
 A: The installation position may be vertical or horizontal. The manufacturer provides engineering support, including assembly drawings, on request.
07. Q: What does „nominal lifetime L_{10} “ mean?
 A: The nominal lifetime L_{10} means the time in hours when up to 10% of a batch fails due to material fatigue.
08. Q: Which duty cycle (load) determines the rated torque and the corresponding nominal life?
 A: The rated torque is a calculated value of the loading constant torque at the nominal constant input speed of the input shaft for the duty cycle when the calculated nominal lifetime is $L_{10} = 6.000$ hours and the duty factor $ED = 1$ (100%).
09. Q: Do you provide interface flanges and motor shaft connections for different servomotors?
 A: Yes. We are able to provide you with the necessary technical support. Regarding the flange interfacing, we have a database of typical drawings of connecting couplings and interface flanges. We are able to prepare the assembly and detail drawings for customers, if they exactly specify the type and size of motor. We are also able to manufacture the motor flange and coupling on request.
10. Q: The pair of flanges rotate at a reduced speed with respect to the case. Is there any radial-axial clearance on the output bearing with respect to the reduction gear case?
 A: There are two options. The first one is no clearance and prestressed in both directions as necessary. The second one is the axial and radial clearance of up to 10 microns.
11. Q: Why is TwinSpin® characterized as a zero-backlash reduction gear?
 A: TwinSpin® is a zero backlash reduction gear because there is no reversal clearance between the trochoid teeth of the gear wheels and the cylindrical rollers of the hollow gear wheels in the reduction gear case. This is reached by high-precision manufacturing of components and careful pairing during the assembly.
12. Q: Is TwinSpin® self-locking?
 A: No. Thanks to very good efficiency there is no self-locking effect. For back-driving torque values see [Chapter 3.13](#).
13. Q: Which part of TwinSpin® do you use to calculate the lifetime, i.e. which part of the reduction gear fails first?
 A: The nominal lifetime is limited by the roller bearing between the eccentric shaft and the gearwheels.

7. DriveSpin® - General information

The DriveSpin® (DS) is the combination of the TwinSpin® high precision reduction gear, featuring excellent mechanical properties, and the AC servomotor in a compact unit. The excellent parameters are guaranteed by more than 20-year experience in the manufacture of reduction gears by SPINEA, s.r.o.

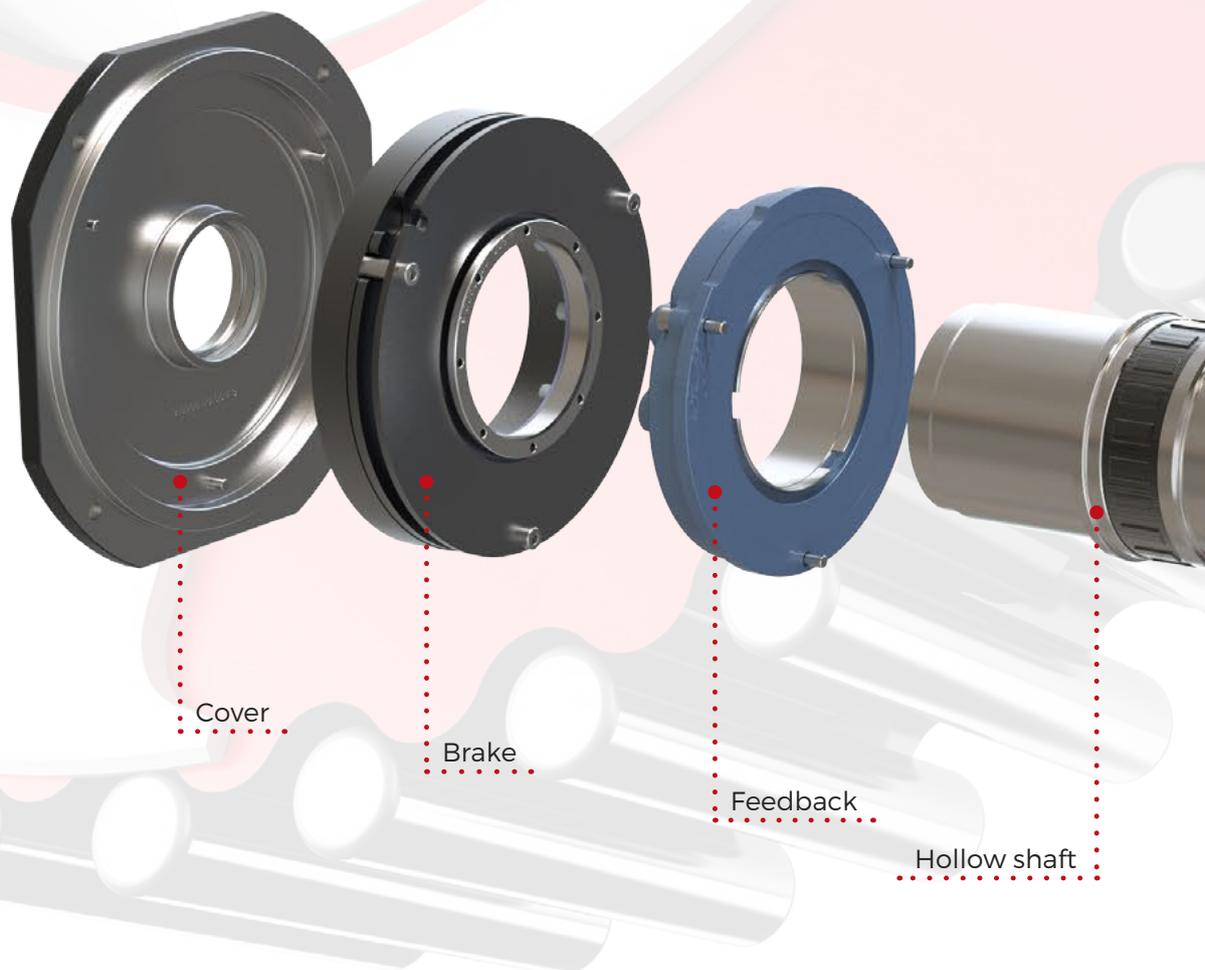
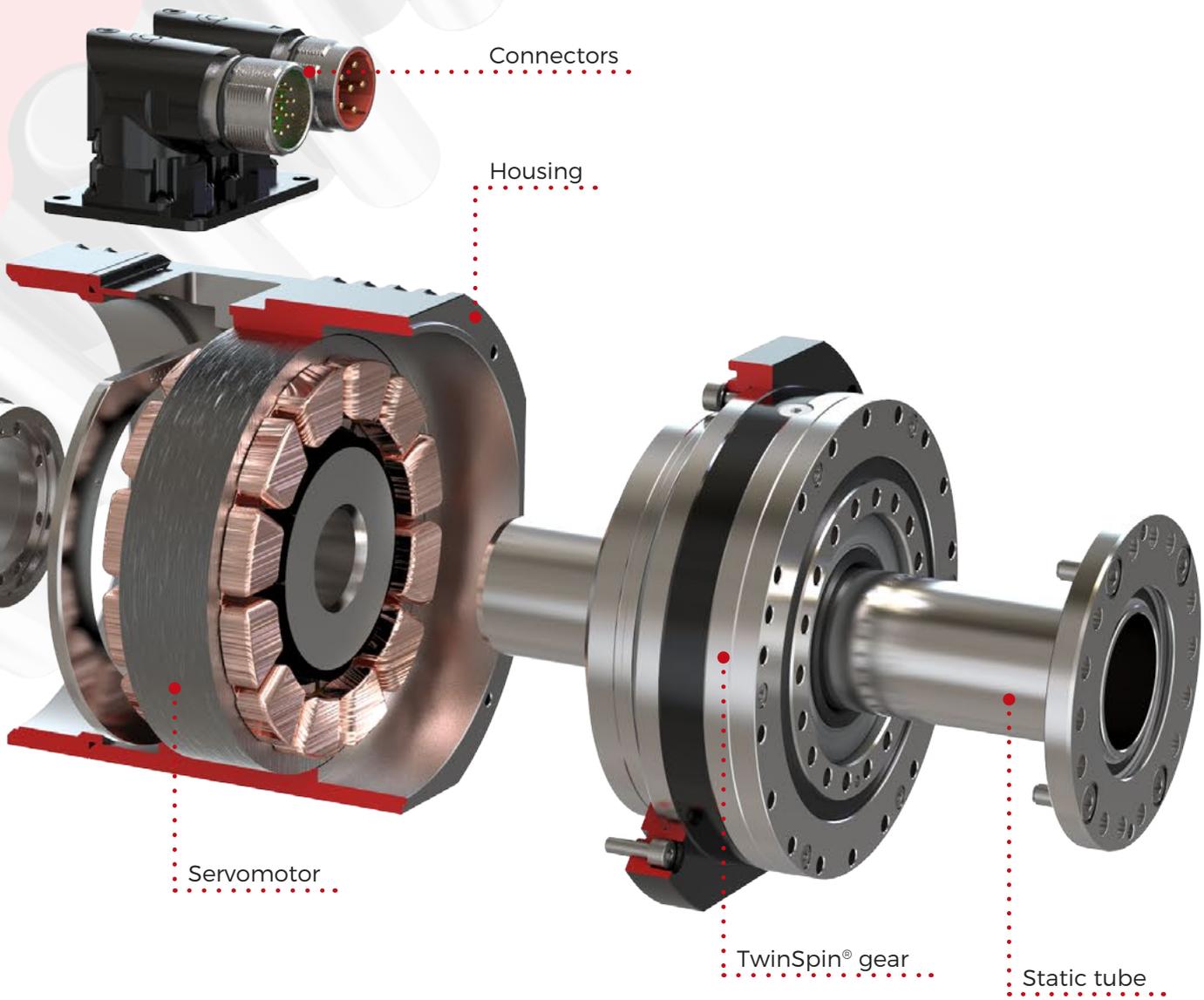


Fig. 7.a: DriveSpin® actuators components

The actuators feature:

- high precision and accuracy
- high tilting and torsional stiffness
- low vibrations
- compact dimensions
- low weight
- long service life
- easy installation



DS



Advantages

Actuators are sophisticated mechatronic drive nodes (devices) that combine a high-precision cycloid gearbox (bearing reducer), a servomotor, and feedback sensors. DriveSpin® electric actuators meet the most demanding customer requirements in all areas of industry. With optimum price/performance ratio, they reliably provide parameters such as high accuracy, high tilt, and torsional stiffness, low weight, compact design, low vibration, IP degree of protection, or a wide range of suitable technical solutions.

Uniquely balanced design

The DriveSpin® electric actuators feature a unique integration of a high-load-capacity reduction gear containing a unique reduction mechanism with an AC servomotor that meets even the most demanding requirements for dynamic performance.

Unique precision and accuracy

The DriveSpin® electric actuator, using a patented proprietary design of the bearing reduction gear, represents the most precise and accurate solution in its product category.

High moment capacity

The DriveSpin® actuators are outstanding for their high moment capacity, implemented in a zero-backlash design with an excellent power-to-size ratio and load capacity of the radial-axial bearings integrated in the DriveSpin® actuator.

Feedback sensor variability

The DriveSpin® electric actuators can be supplied with a wide range of feedback systems, such as EnDat®, HIPERFACE®, and Resolver.

Custom solution

Our technical and development department is prepared to adjust the DriveSpin® according to the customer specifications in terms of connectivity, mechanical design, motor characteristic, feedback systems as well as demands on the high IP protection class requirements.

Technical support

Our team of specialists is available for you to solve any issues. The use of first-class materials and the very process of the manufacturing of high precision DriveSpin® electric actuators are secured by ISO 9000 certificates.

DS series



DSH series



DSM series



DSF series



8. DriveSpin® series

Actuators known under the trademark DriveSpin® are most commonly used in automation, robotics, automotive industry as well as in general mechanical engineering, as part of various industrial equipment used for positioning in a variety of mechanical nodes.

The product portfolio is characterized by four basic type designs:

- DS** - Standard actuator
- DSH** - Hollow-shaft actuator (with hole)
- DSM** - Actuator in modular design
- DSF** - Flat, the shortest possible solution (reduced)

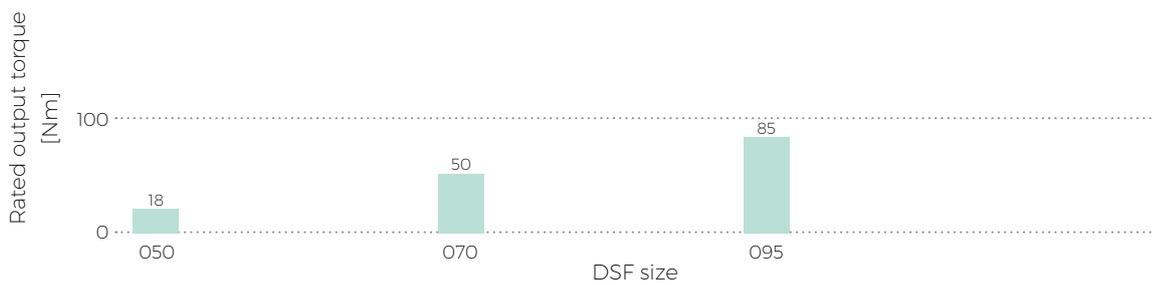
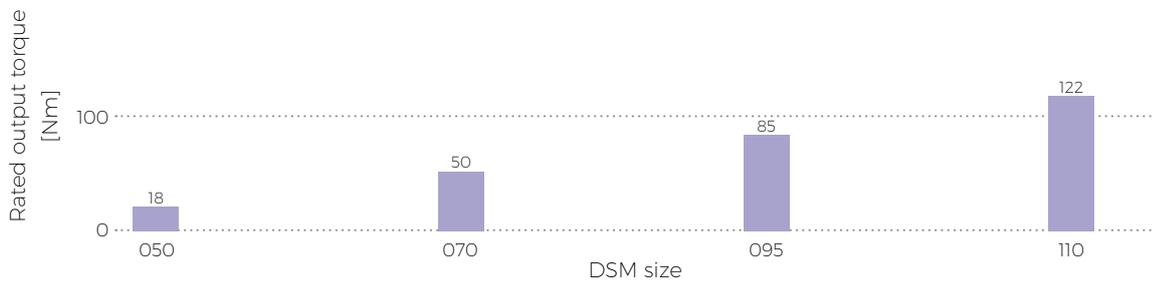
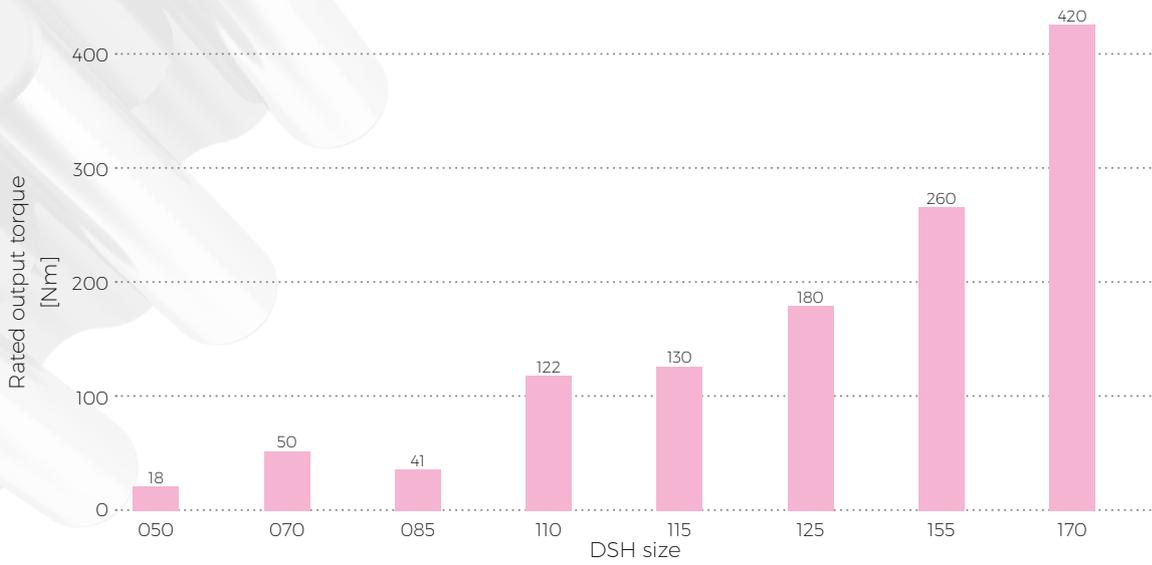
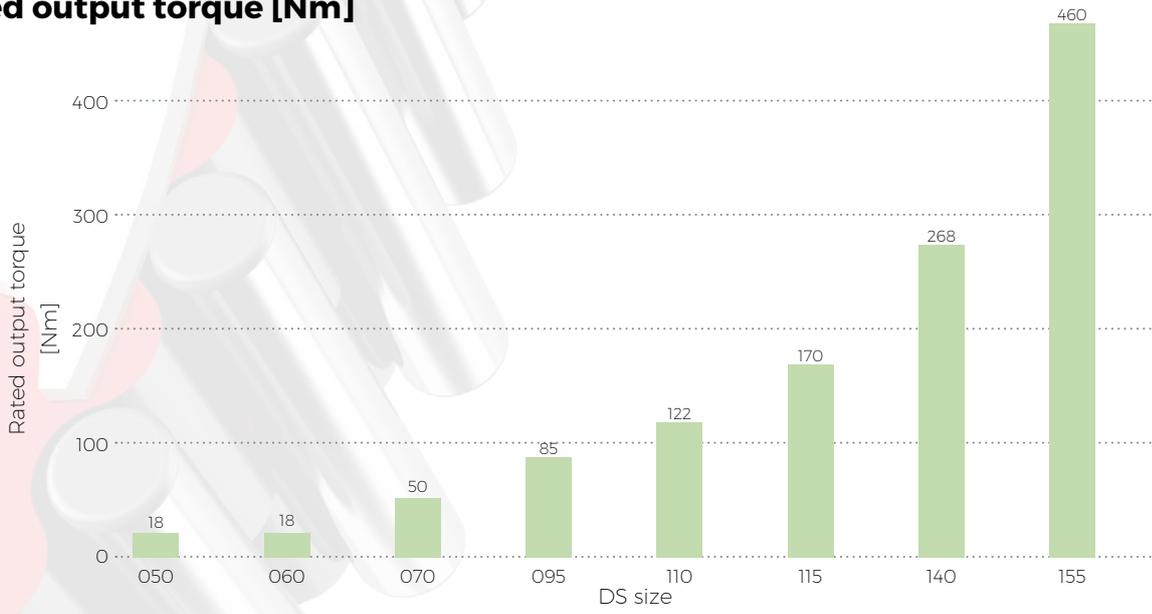


Product portfolio of DS/DSH/DSM/DSF actuators

Type	Size										
	050	060	070	085	095	110	115	125	140	155	170
DS (STANDARD)	✓	✓	✓	✗	✓	✓	✓	✗	✓	✓	✗
DSM (MODULAR)	✓	✗	✓	✗	✓	✓	✗	✗	✗	✗	✗
DSH (HOLLOWSHAFT)	✓	✗	✓	✓	✗	✓	✓	✓	✗	✓	✓
DSF (FLAT)	✓	✗	✓	✗	✓	✗	✗	✗	✗	✗	✗



Rated output torque [Nm]



Rated output torque [Nm]

All SPINEA actuators are determined by unique ordering code. This code specifies all necessary parameters of the actuator, like actuator size, transmission rate, voltage ratings, feedback type etc. If you are unable to specify a certain part of the ordering code, please provide a letter in the sense of the general code. This is also the case if you need advice regarding special requirements of your application. In both cases, our technical support will contact you to achieve the optimal solution. We are ready to produce separate cabling for your application requirements. The possible configurations are based on Tab. 10.a: Ordering code for Cable

Note:

When selecting the position sensor of the DS xxx-abcde-fg-xy, you can choose one of the basic feedback types. When creating a business-technical offer, the feedback type will be replaced with a more specific position sensor number.

Ordering code example

DSH 115-103-4500B0-AH-00

00 : Special modification - **Standard connector**

A- : Wiring diagram - **Power connection**

-H : Wiring diagram - **Signal connection**

4----- : DC bus voltage - **560 V**

-5----- : Temperature sensor - **PT 1000**

--0---- : Brake - **No**

---0B- : Feedback type - **Absolute Singleturn Encoder Hiperface**

-----0 : Type of electrical connection - **Straight connectors**

103: Reduction ratio - **103**

115: Actuator size - **115**

DSH: **DriveSpin® Hollowshaft**

Tab. 8.a: DriveSpin® ordering specifications

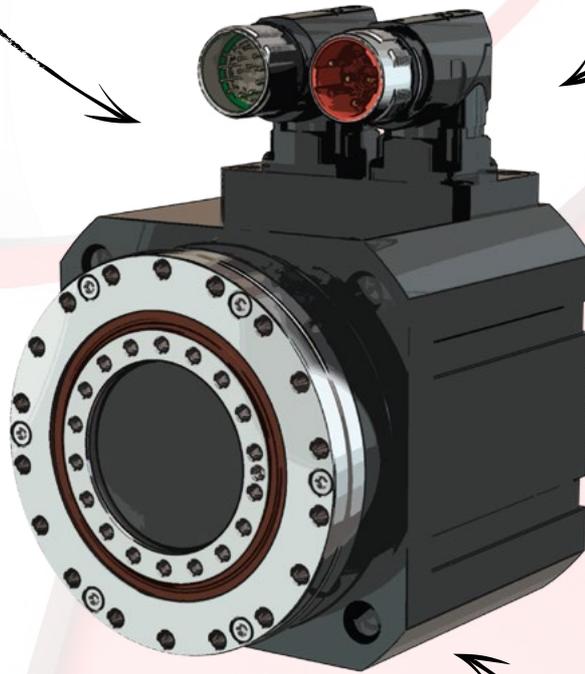
DS_ - 070-057 - 3 1 B 0A 4 - A J - 00											
Name	Size	i	a	b	c	d	e	f	g	x	y
Type	Actuator size	Ratio	DC bus voltage	Temperature sensor	Brake	Feedback type	Type of electrical connection	Wiring diagram		Special modification	
								Power	Signal		
DS standard DSH hollowshaft DSM modular DSF flat	050	063	1: 24 VDC 3: 320 VDC 4: 560 VDC S: Special upon request	1: PTC 111-K13 5: PT 1000 S: Special upon request	0: No B: Yes	0A Resolver 0B Absolute Singleturn Encoder Hiperface 0C Absolute Multiturn Encoder Hiperface 0D Absolute Singleturn Encoder EnDat 0E Absolute Multiturn Encoder EnDat 0F Absolute Singleturn Encoder EnDat + sin/cos 0G Absolute Multiturn Encoder EnDat + sin/cos 0H Incremental sin/cos Encoder + sin/cos Commutation 0J Incremental A/B/I Encoder + Block Commutation 0K: Absolute Singleturn Encoder Hiperface DSL 0L: Absolute Multiturn Encoder Hiperface DSL 0M: Absolute Singleturn Encoder BiSS 0N: Absolute Multiturn Encoder BiSS 0P: Absolute Singleturn Encoder DRIVE-CLiQ 0Q: Absolute Multiturn Encoder DRIVE-CLiQ 0R: Absolute Multiturn Fanuc 0S: Absolute Singleturn Fanuc	0: Straight connectors 1: Connector on terminal cable directed upward ⁷⁾ 2: Hybrid straight connector 3: Hybrid angled rotatable connector 4: Angled rotatable connectors 5: Terminal cable directed upward ⁷⁾ 6: Y-tec angular connector, rotatable 7: Terminal cable directed forward ⁷⁾ 8: Terminal cable directed backward ⁷⁾ B: Connector on terminal cable directed forward ⁷⁾ C: Connector on terminal cable directed backward ⁷⁾	For more information see page 228 - 231	Terminal cable length 00 Standard connector 10 Standard cable length L=1m xy Custom design Cable lengths and other modifications. For more information contact manufacturer.		
	060 ¹⁾	047									
	070	057, 075									
	085 ²⁾	047, 085									
	095 ⁵⁾	073, 095									
	110	067, 089, 119									
	115 ³⁾	055, 103									
	125 ²⁾	049, 099									
	140 ¹⁾	069, 115									
	155 ³⁾	063, 109, 133									
	170 ³⁾	069, 125									

¹⁾ only DS
²⁾ only DSH
³⁾ only DS, DSH
⁴⁾ only DS, DSH, DSM
⁵⁾ only DS, DSM, DSF
⁷⁾ The standard length (L=1m)



*Various combinations of voltages
and motor feedback systems*

Optimal price range



Very high power density

Zero-backlash reduction gear



DS series

STANDARD SOLUTION

DS

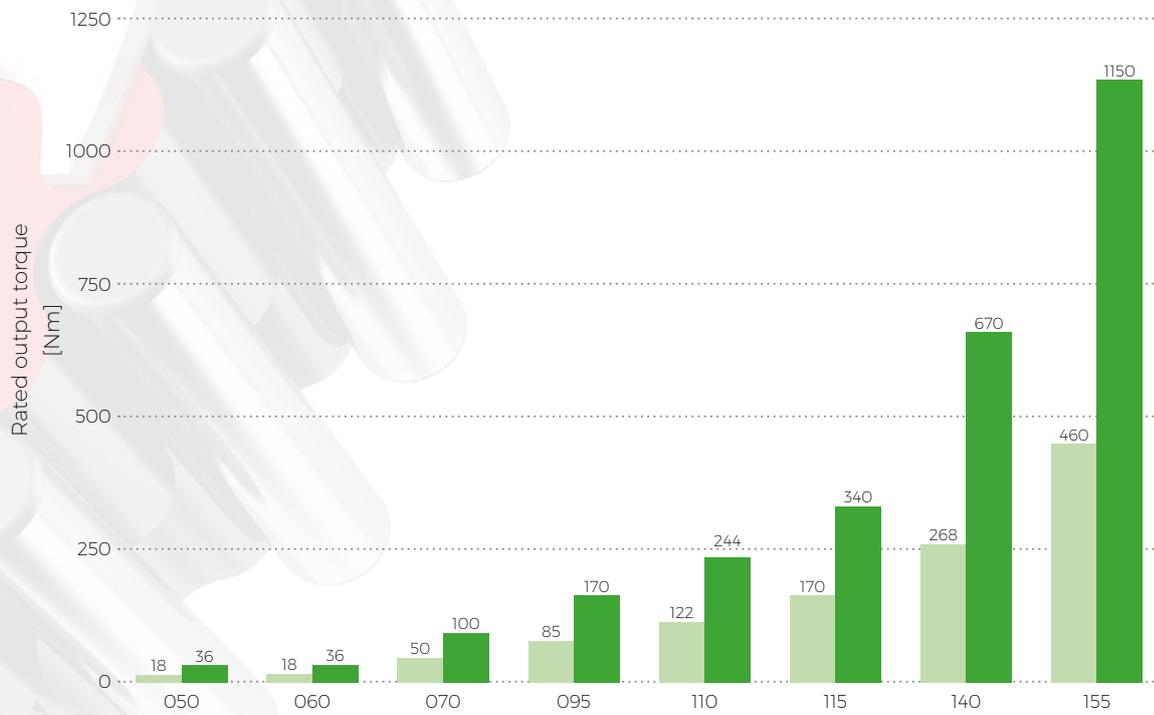
8.2 DS series



Advantages

- low lost motion
- low moment of inertia
- high reduction ratio
- high kinematic accuracy
- high moment overload capacity
- high capacity of the integrated radial-axial output bearings
- high dynamic performance

The **DriveSpin® DS** electric rotary actuators, as the basic type of actuators, provide rotary motion and the transfer of output torque with a high radial-axial load capacity and are the most accurate and precise solution in their category. The DS actuators are characterized by high dynamics, highly flexible drive solution, guaranteed by an AC servomotor, and high robustness and overload capacity of TwinSpin® reduction gear. DriveSpin® high variability of voltage, brake feedback and electrical connections will satisfy customer requirements in many cases. Rated output torque range of the DS is from 18 Nm to 460 Nm.

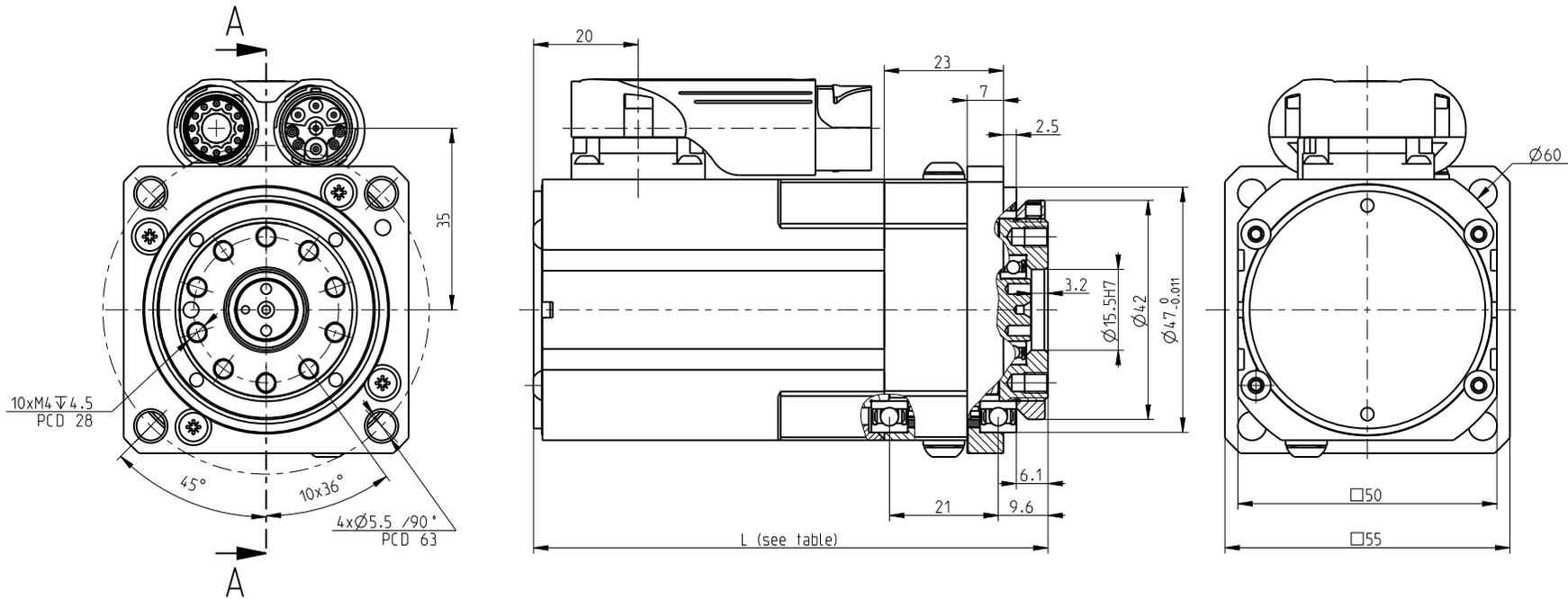


DS

Tab. 8.2a: Rated output torque

Size		050	060	070	095	110	115	140	155
Rated output torque	T_r [Nm]	18	18	50	85	122	170	268	460
Acceleration/ braking output torque	T_{max} [Nm]	36	36	100	170	244	340	670	1150

DS 050 - i - abcde-fg-xy

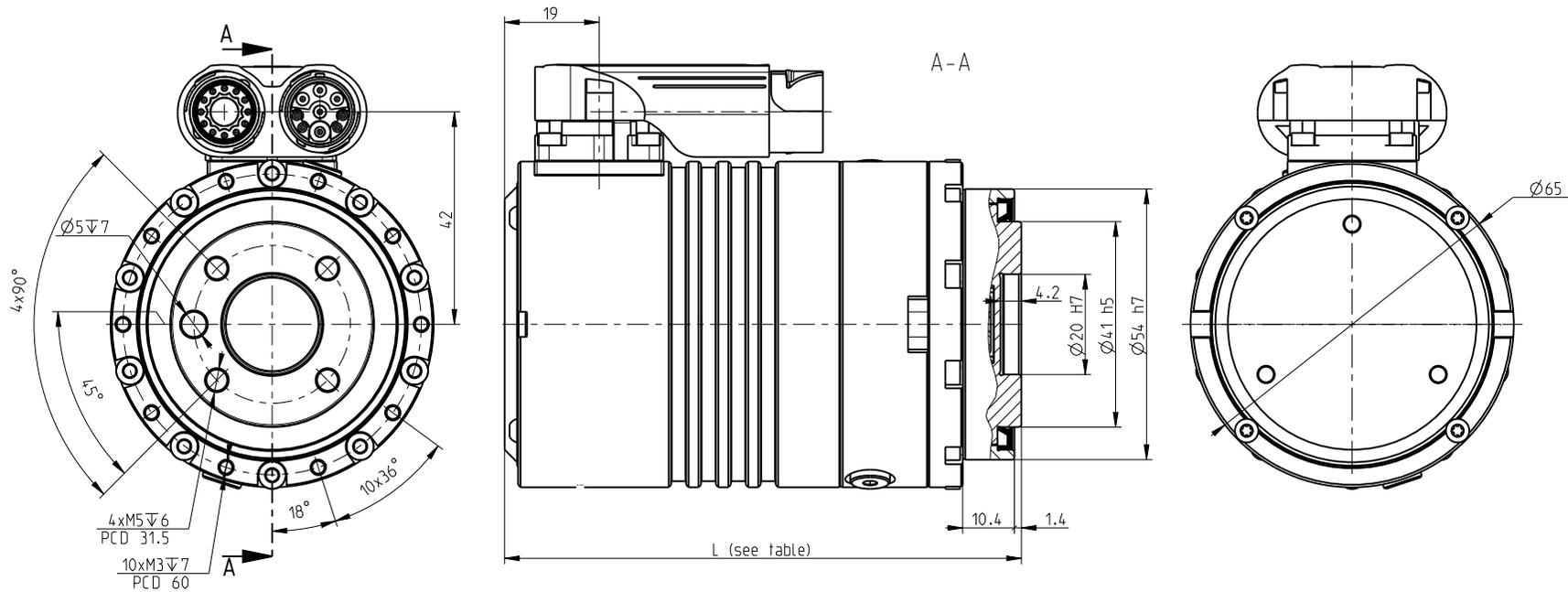


Drawings



Size	Feedback type (d)	Without brake		With brake	
		Dimension L \pm 0,5 [mm]	Weight m [kg] *	Dimension L \pm 0,5 [mm]	Weight m [kg] *
DS 050	OA	99	0,9	135	1,4
	OB,OC	107	1,2	138	1,4
	OD,DE	106	1,2	133	1,3
	OG	130	1,2	-	-
	OK,OL	144	1,2	155	1,4

DS 060 - i - abcde-fg-xy



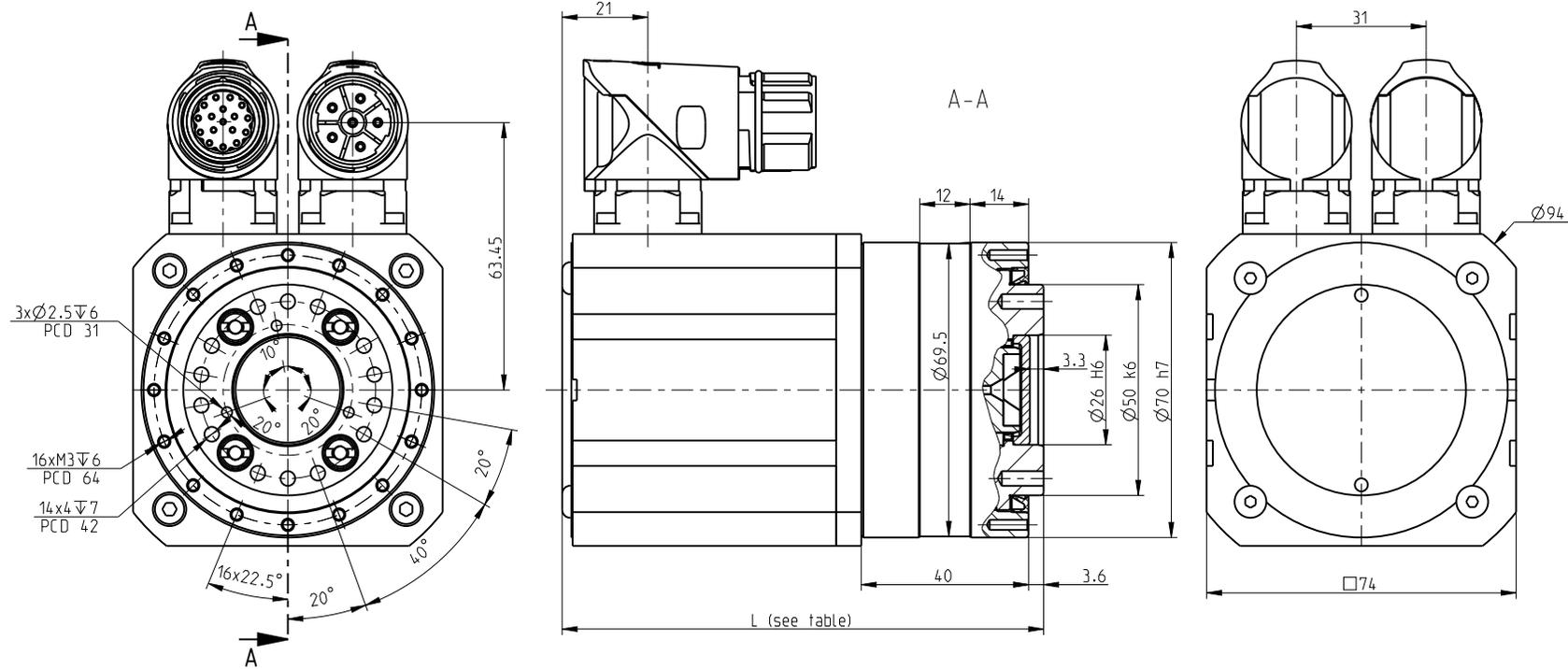
Size	Feedback type (d)	Without brake		With brake	
		Dimension L $\pm 0,5$ [mm]	Weight m [kg] *	Dimension L $\pm 0,5$ [mm]	Weight m [kg] *
DS 060	OA	104	1.3	119	1.4
	OB,OC	110	1.3	125	1.3
	OD,OE	115	1.3	130	1.4
	OJ	110	1.3	125	1.4

DS 060 - i - abcde-fg-xy

Drawings



DS 070 - i - abcde-fg-xy



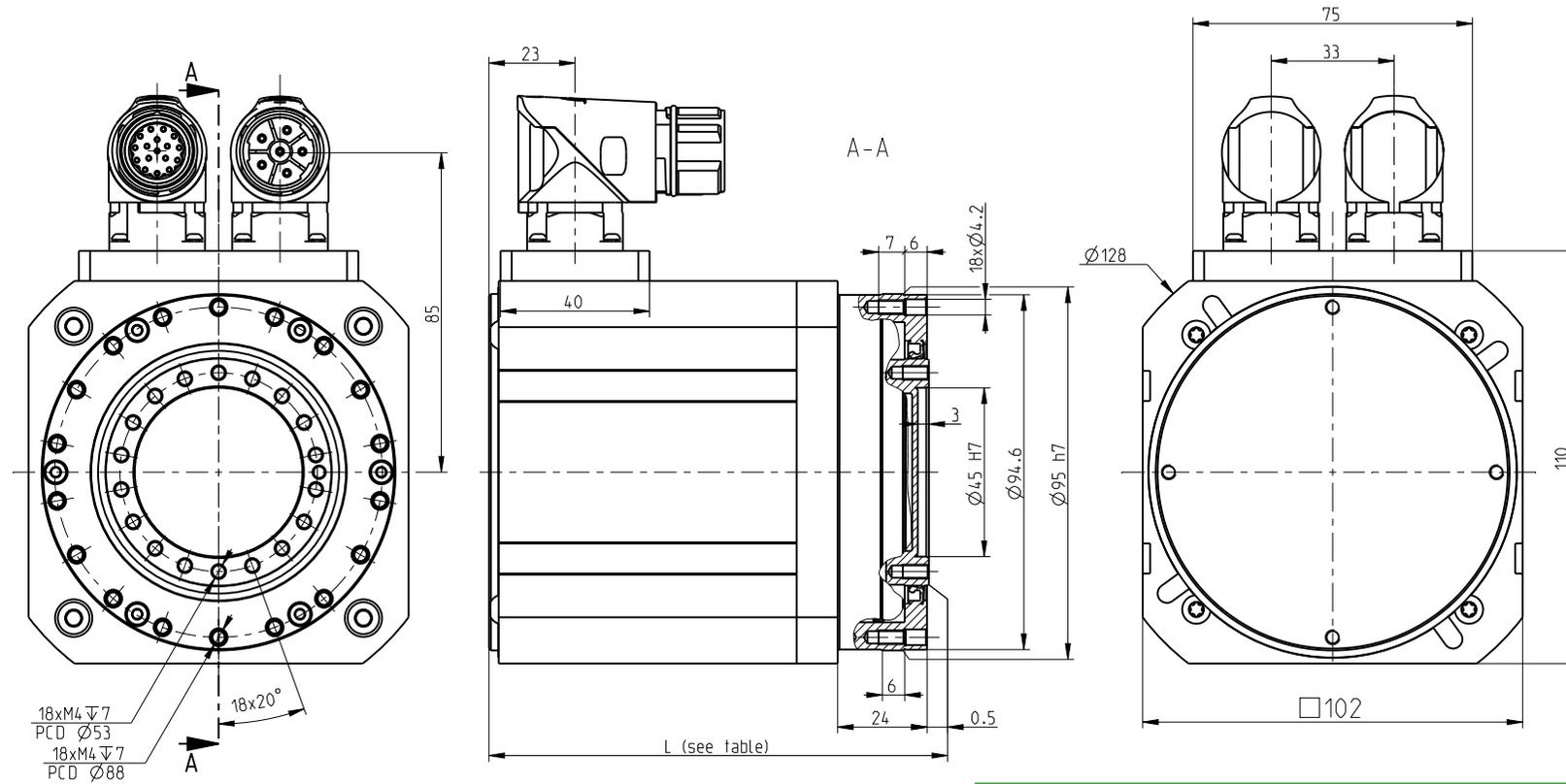
Drawings

DS 070 - i - abcde-fg-xy



Size	Feedback type (d)	Without brake		With brake	
		Dimension L $\pm 0,5$ [mm]	Weight m [kg] *	Dimension L $\pm 0,5$ [mm]	Weight m [kg] *
DS 070	OA	115	2.3	194	3.4
	OB,OC	137	2.4	178	3.4
	OD,OE	148	2.6	195	3.5
	OH	148	2.6	195	3.5
	OP,OQ	-	-	137	2.4

DS 095 - i - abcde-fg-xy

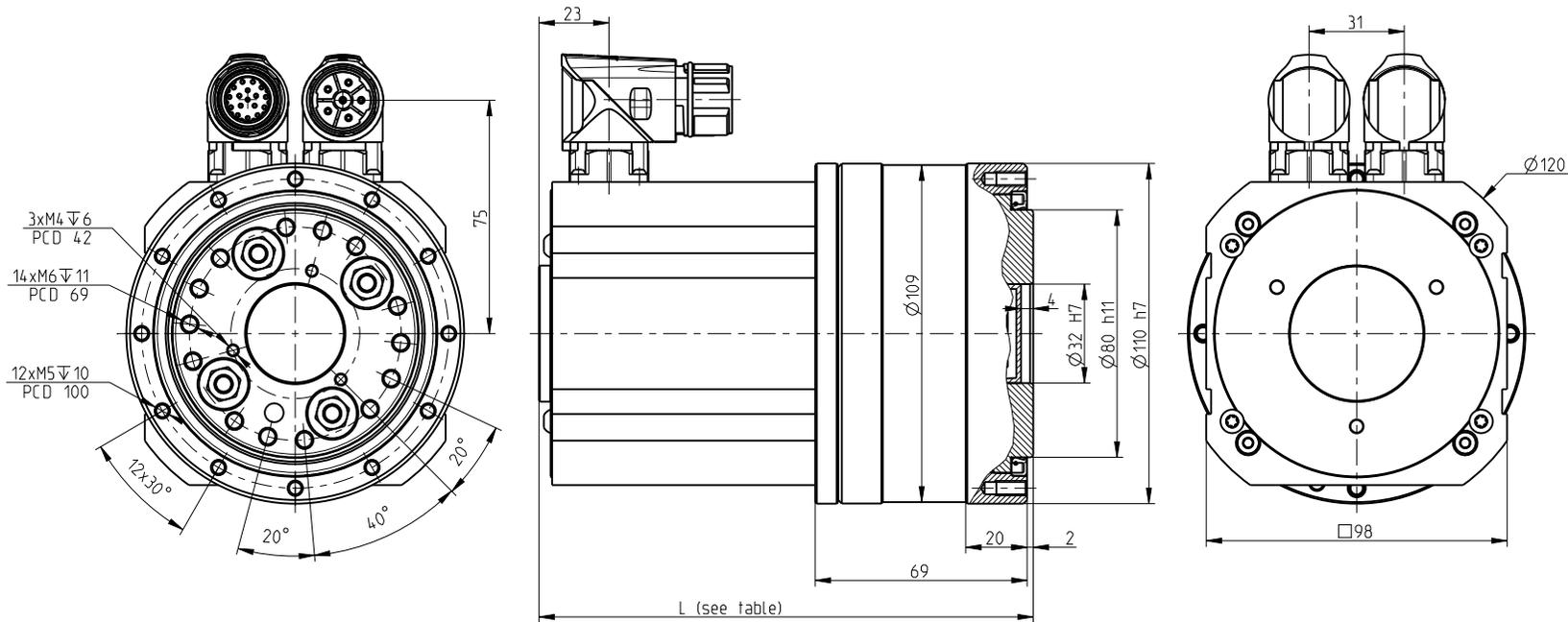


Size	Feedback type (d)	Without brake		With brake	
		Dimension L \pm 0.5 [mm]	Weight m [kg] *	Dimension L \pm 0.5 [mm]	Weight m [kg] *
DS 095	OA	118	4.9	138	5.8
	OH	146	5.4	161	6.2
	OB,OC	139	5.2	149	5.9
	OD,OE	127	5.0	141	5.8
	OG,OH,OF	146	5.4	161	6.2
	OD,OE	127	5.0	141	5.8
	OP,OQ	139	5.2	149	5.9
	OK,OL	139	5.2	149	5.9

DS 110 - i - abcde-fg-xy

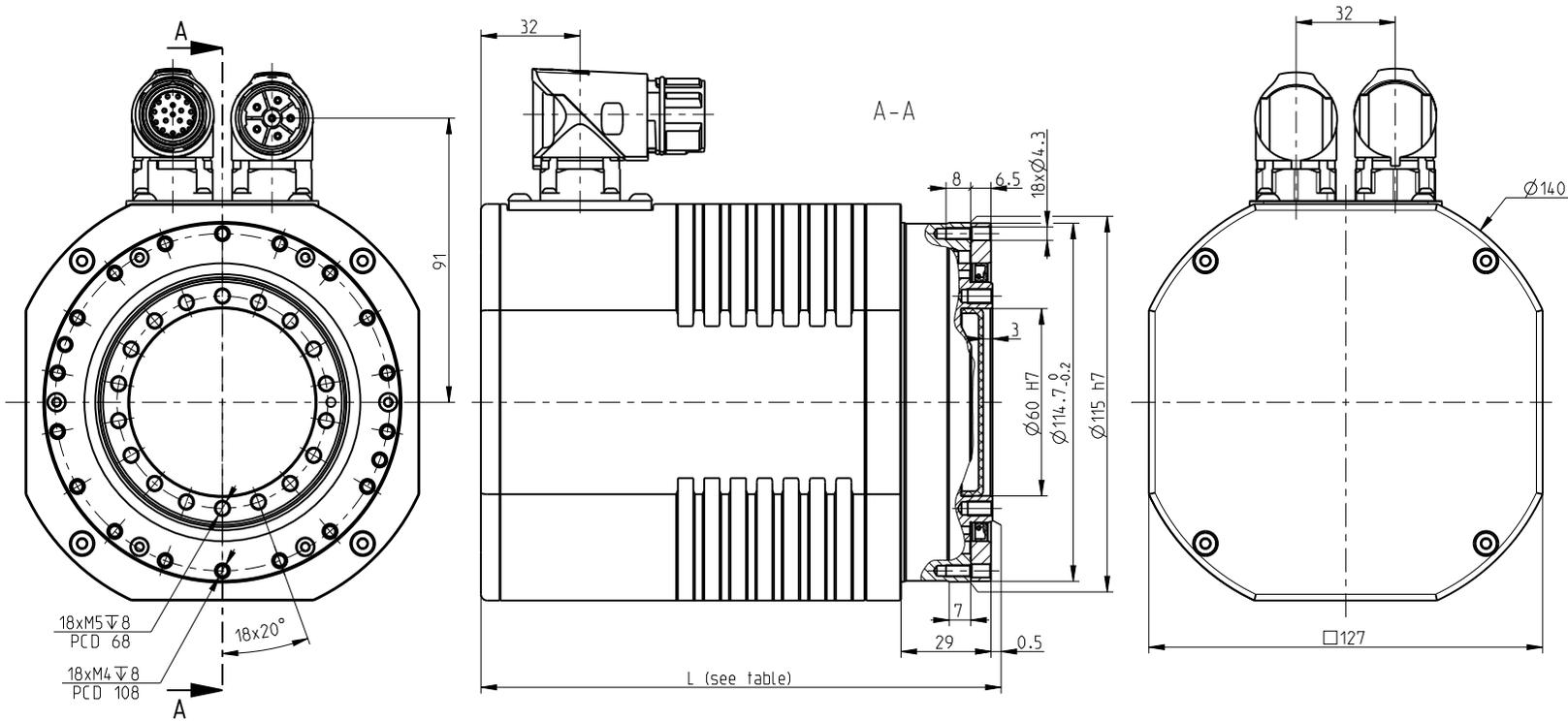


Drawings
DS 110 - i - abcde-fg-xy



Size	Feedback type (d)	Without brake		With brake	
		Dimension L \pm 0,5 [mm]	Weight m [kg] *	Dimension L \pm 0,5 [mm]	Weight m [kg] *
DS 110	OA	161	8.2	213	9.1
	OB,OC	193	8.8	245	9.7
	OD,OE	202	8.6	242	9.6
	OH	202	8.6	242	9.6

DS 115 - i - abcde-fg-xy

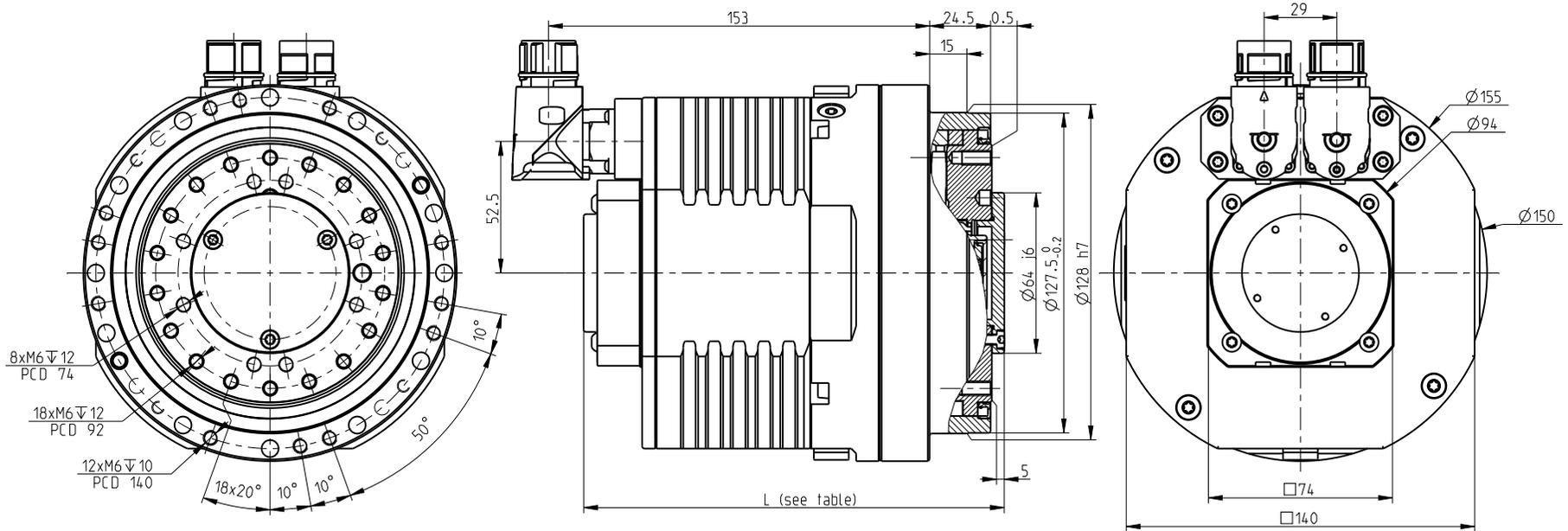


Size	Feedback type (d)	Without brake		With brake	
		Dimension L \pm 0,5 [mm]	Weight m [kg] *	Dimension L \pm 0,5 [mm]	Weight m [kg] *
DS115	OA	165	8.6	165	9.0
	OB,OC	165	8.6	165	9.0
	OD,OE	165	8.6	165	9.0
	OH	175	8.6	175	9.0
	OJ	165	8.6	165	9.0
	OK,OL	165	8.6	165	9.0
	ON	165	8.6	165	9.0

DS 140 - i - abcde-fg-xy



Projection



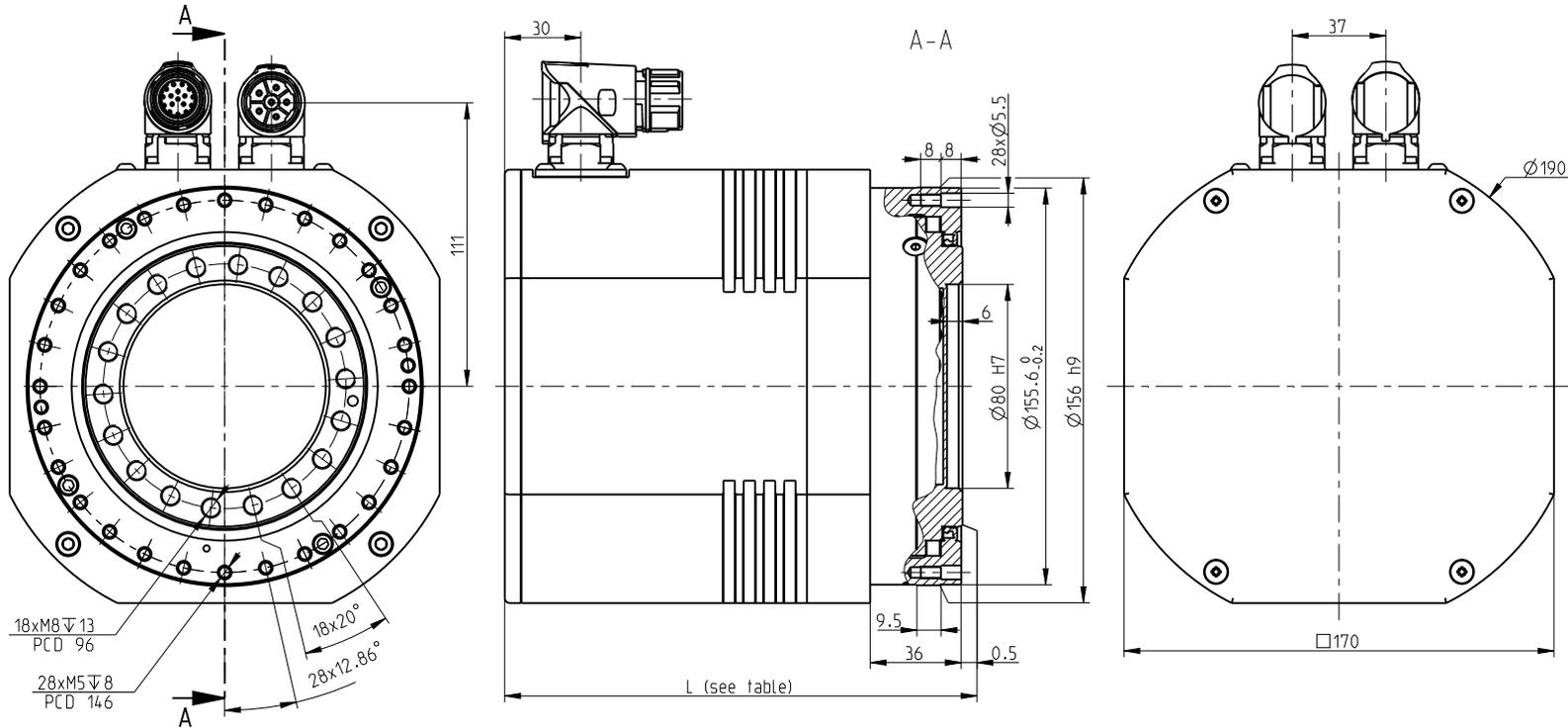
DS 140 - i - abcde-fg-xy

Drawings



Size	Feedback type (d)	Without brake		With brake	
		Dimension L $\pm 0,5$ [mm]	Weight m [kg] *	Dimension L $\pm 0,5$ [mm]	Weight m [kg] *
DS 140	OA	148	11	181	12,1
	OB,OC	165	11	208	12,1
	OD,OE	165	11	208	12,1
	OH	199	11	226	12,1

DS 155 - i - abcde-fg-xy



Size	Feedback type (d)	Without brake		With brake	
		Dimension L \pm 0,5 [mm]	Weight m [kg] *	Dimension L \pm 0,5 [mm]	Weight m [kg] *
DS 155	OA	181	14.2	181	16.2
	OB.OC	181	14.4	181	16.2
	OD.OE	181	14.4	181	16.2
	OH	181	14.7	181	16.5
	OK.OL	181	14.6	181	16.4
	ON	181	14.4	181	16.2

Tab. 8.2b: DS series technical data table

Reduction Gear parameters		Tolerance		DS 050		
Reduction ratio	i			63		
Rated output torque	T_r [Nm]			18		
Acceleration/braking output torque	T_{max} [Nm]			36		
Rated input speed	n_r [rpm]			2 000		
Maximum allowable input speed ⁹⁾	n_{max} [rpm]			5 000		
Allowable moment ²⁾³⁾	M_{cmax} [Nm]			44		
Tilting stiffness ¹⁾⁶⁾	M_t [Nm/arcmin]			4		
Torsional stiffness ¹⁾⁷⁾	k_t [Nm/arcmin]			2.5		
Lost motion	LM [arcmin]			< 1.5		
Hysteresis	H [arcmin]			< 1.5		
Rated radial force ²⁾	F_{rR} [kN]			1.44 ⁸⁾		
Maximum axial force ²⁾⁴⁾	$F_{a max}$ [kN]			1.9		
Gear lubrication				Grease Castrol TRIBOL GR TT 1 PD		
Reduction gear limit temperature	[°C]			65 °C		
Standard ambient temperature range	[°C]			-10 °C to +40 °C		
Motor parameters						
DC BUS voltage	U_{dc} [V _{dc}]	+/- 10%	24	320	560	
Motor rated speed	n_n [rpm]		3 500	3 500	3 500	
Motor rated torque	M_n [Nm]	+/- 10%	0.23	0.23	0.23	
Motor rated current	I_n [A _{rms}]		7.1	0.58	0.58	
Motor stall torque	M_o [Nm]	+/- 10%	0.24	0.24	0.24	
Motor stall current	I_o [A _{rms}]		7.4	0.6	0.6	
Motor peak torque	M_{max} [Nm]	+/- 10%	1	1	1	
Motor peak current	I_{max} [A]		30.8	2.5	2.5	
Motor back-EMF constant	K_E [V _{peak} /krpm]	+/- 10%	2.7	36	36	
Motor torque constant	K_T [Nm/A _{rms}]	+/- 10%	0.032	0.4	0.4	
Terminal resistance (L-L)	R_{2ph} [Ω]	+/- 10%	0.2	36	36	
Terminal inductance (L-L)	L_{2ph} [mH]	+/- 20%	0.2	36	36	
Number of poles	2p		6	6	6	
Electromagnetic brake DC supply	[V _{dc}]			24. Special		
Electromagnetic brake torque at input	[Nm]			0.4		
Protection class				IP 64		
Motor Insulation class				F		
Paint				RAL 9005		
Motor number of phases				3		
Motor type of connection				Y(star-configuration)		

1) Mean statistical value

2) Load at output speed 32 rpm for size 050, other sizes at 15 rpm

 3) Moment M_c max at $F_a=0$. If $F_a \neq 0$ see Glossary

 4) Axial force F_a max for $M_c=0$ (In case of size 050 also $F_r=0$ condition has to be fulfilled). If $M_c \neq 0$ see Glossary

5) 3 900 rpm for ratio 67 : 4 500 rpm for ratios 89, 119

6) The parameter depends on the version of high precision reduction gear.

7) The parameter depends on the version, ratio and lost motion of the high precision reduction gear.

 8) For size 050 this is value of MAXIMUM RADIAL FORCE $F_{r max}$ for $a_2=0$; $F_a=0$ and at 32 rpm output speed. For $a_2>0$; $F_a=0$ at 32 rpm output speed $F_{r max} = 44/(a_2+0.0305)$. a_2 represents the distance of the radial force centre from the front of the output flange in meters see Glossary

9) Instantaneous speed peak that may occur within the working cycle. Note please the temperature on the gear case that should not exceed significantly 60°C

10) 4 500 rpm for ratio 73 : 4 800 rpm for ratio 95

11) 4 000 rpm for ratio 55 : 4 500 rpm for ratio 103

12) 3 400 rpm for ratio 63 : 3 800 rpm for ratio 109 : 4 200 rpm for ratio 133

Tab. 8.2b: DS series technical data table - continued

DS 060			DS 070			DS 095		
47			57, 75			73, 95		
18			50			85		
36			100			170		
2 000			2 000			2 000		
5 000			5 000			4 500 / 4 800 ¹⁰⁾		
52			142			410		
19			35			120		
3.3			7			15		
< 1			< 1.5			< 1		
< 1			< 1.5			< 1		
2.4			2.8			3.5		
4.6			4.1			11.1		
Grease Castrol TRIBOL GR TT 1 PD			Grease Castrol TRIBOL GR TT 1 PD			Grease Castrol TRIBOL GR TT 1 PD		
60 °C			65 °C			60 °C		
-10 °C to +40 °C			-10 °C to +40 °C			-10 °C to +40 °C		
24	320	560	24	320	560	24	320	560
3 000	3 000	3 000	2 500	4 500	4 500	4 000	4 000	4 000
0.4	0.4	0.4	0.88	0.76	0.76	1.4	1.4	1.4
8.3	0.63	0.63	13	1.2	0.7	27	5.6	3.1
0.45	0.45	0.45	0.9	0.9	0.9	1.6	1.6	1.6
9.34	0.71	0.71	13.3	1.42	0.83	31	6.4	3.5
1.3	1.3	1.3	3	3	3	5.5	5.5	5.5
27	2	2	44.3	4.7	2.8	106.1	22	12.1
4.4	58	58	5.7	68.3	105.6	4.4	25	47
0.05	0.63	0.63	0.0677	0.63	1.09	0.052	0.25	0.46
0.2	32	32	0.13	17	40.5	0.052	1.2	4.36
0.3	51	51	0.25	34.4	87	0.11	2.84	8.71
6	6	6	10	10	10	10	10	10
24. Special			24. Special			24. Special		
4.5			4.5			2		
IP 64			IP 64			IP 64		
F			F			F		
RAL 9005			RAL 9005			RAL 9005		
3			3			3		
Y(star-configuration)			Y(star-configuration)			Y(star-configuration)		

IMPORTANT NOTES:

- Load values in the table are valid for the nominal lifetime $L_{10} = 6\ 000$ hours excluding DS 060. DS 095. DS 115 and DS 155 where values are valid for $L_{10} = 12\ 000$ hours. Service life for average torque T_a and average speed n_a other than rated n_r . T_r can be recalculated. Please contact manufacturer with estimated duty cycle.
- High precision reduction gears are preferred for intermittent duty cycles (S3-S8): the output speed in applications is inverted-variable. The S1 continuous duty cycle needs to be consulted with manufacturer
- Please consult the maximum speed in duty cycle with the manufacturer
- The values in the table refer to the ambient temperature of 20 °C to 25 °C
- For ambient temperatures lower than -10 °C pre-heating might be considered please consult manufacturer

Tab. 8.2b: DS series technical data table - continued

Reduction Gear parameters		Tolerance		DS 110		
Reduction ratio	i			67, 89, 119		
Rated output torque	T_r [Nm]			122		
Acceleration/braking output torque	T_{max} [Nm]			244		
Rated input speed	n_r [rpm]			2 000		
Maximum allowable input speed ⁹⁾	n_{max} [rpm]			3 900 / 4 500 ⁵⁾		
Allowable moment ²⁾³⁾	M_{cmax} [Nm]			740		
Tilting stiffness ¹⁾⁶⁾	M_t [Nm/arcmin]			150		
Torsional stiffness ¹⁾⁷⁾	k_t [Nm/arcmin]			22		
Lost motion	LM [arcmin]			< 1		
Hysteresis	H [arcmin]			< 1		
Rated radial force ²⁾	F_{rR} [kN]			9.3		
Maximum axial force ²⁾⁴⁾	$F_{a max}$ [kN]			13.1		
Gear lubrication				Grease Castrol TRIBOL GR TT 1 PD		
Reduction gear limit temperature	[°C]			65 °C		
Standard ambient temperature range	[°C]			-10 °C to +40 °C		
Motor parameters						
DC BUS voltage	U_{dc} [V _{dc}]	+/- 10%	24	320	560	
Motor rated speed	n_n [rpm]		2 500	3 000	3 000	
Motor rated torque	M_n [Nm]	+/- 10%	3.4	3.2	3.2	
Motor rated current	I_n [A _{rms}]		37	4.9	2.8	
Motor stall torque	M_o [Nm]	+/- 10%	3.8	3.8	3.8	
Motor stall current	I_o [A _{rms}]		41	6	3	
Motor peak torque	M_{max} [Nm]	+/- 10%	11	11	11	
Motor peak current	I_{max} [A]		120	17	10	
Motor back-EMF constant	K_E [V _{peak} /krpm]	+/- 10%	8	57	103	
Motor torque constant	K_T [Nm/A _{rms}]	+/- 10%	0.09	0.65	1.14	
Terminal resistance (L-L)	R_{2ph} [Ω]	+/- 10%	0.027	1.4	4.5	
Terminal inductance (L-L)	L_{2ph} [mH]	+/- 20%	0.15	7.4	24	
Number of poles	2p		10	10	10	
Electromagnetic brake DC supply	[V _{dc}]			24, Special		
Electromagnetic brake torque at input	[Nm]			4.5		
Protection class				IP 64		
Motor Insulation class				F		
Paint				RAL 9005		
Motor number of phases				3		
Motor type of connection				Y(star-configuration)		

1) Mean statistical value

2) Load at output speed 32 rpm for size 050, other sizes at 15 rpm

 3) Moment M_c max at $F_a=0$. If $F_a \neq 0$ see Glossary

 4) Axial force F_a max for $M_c=0$ (In case of size 050 also $F_r=0$ condition has to be fulfilled). If $M_c \neq 0$ see Glossary

5) 3 900 rpm for ratio 67 : 4 500 rpm for ratios 89, 119

6) The parameter depends on the version of high precision reduction gear.

7) The parameter depends on the version, ratio and lost motion of the high precision reduction gear.

 8) For size 050 this is value of MAXIMUM RADIAL FORCE $F_{r max}$ for $a_2=0$; $F_a=0$ and at 32 rpm output speed. For $a_2>0$; $F_a=0$ at 32 rpm output speed $F_{r max} = 44/(a_2+0.0305)$. a_2 represents the distance of the radial force centre from the front of the output flange in meters see Glossary

9) Instantaneous speed peak that may occur within the working cycle. Note please the temperature on the gear case that should not exceed significantly 60°C

10) 4 500 rpm for ratio 73 : 4 800 rpm for ratio 95

11) 4 000 rpm for ratio 55 : 4 500 rpm for ratio 103

12) 3 400 rpm for ratio 63 : 3 800 rpm for ratio 109 : 4 200 rpm for ratio 133

Tab. 8.2b: DS series technical data table - continued

DS 115			DS 140			DS 155			
55, 103			69, 115			63, 109, 133			
170			268			460			
340			670			1 150			
2 000			2 000			2 000			
4 000 / 4 500 ¹¹⁾			4 500			3 400 / 3 800 / 4 200 ¹²⁾			
550			1 160			1 640			
220			380			900			
32			62			87			
< 0.5			< 1			< 0.5			
< 1			< 1			< 1			
4			11.5			8.3			
12			17			26			
Grease Castrol TRIBOL GR TT 1 PD			Grease Castrol TRIBOL GR TT 1 PD			Grease Castrol TRIBOL GR TT 1 PD			
60 °C			65 °C			60 °C			
-10 °C to +40 °C			-10 °C to +40 °C			-10 °C to +40 °C			
24	320	560	24	320	560	On request	24	320	560
3 000	4 000	4 000	4 000	4 000	4 000		4 000	4 000	4 000
4	4	4	4	4	4		5	5	5
84	6.33	3.8	74.1	5.6	3.2		10	6	6
4	4	4	4.5	4.5	4.5		11	11	11
84	6.33	3.8	83.3	6.3	3.6		21.9	6	6
10	10	10	13.5	13.5	13.5		23	23	23
231	15.82	10.45	250	18.8	11		45.9	27.6	27.6
4.1	54.1	93.3	4.76	63	111		44	77	77
0.05	0.63	1.05	0.054	0.72	1.26		0.5	0.83	0.83
0.011	0.83	2.3	0.0055	1	3		0.15	0.4	0.4
0.02	3.65	10.5	0.04	7	22		0.57	1.7	1.7
10	10	10	10	10	10		24	24	24
24, Special			24, Special			24, Special			
4.5			4.5			2			
IP 64			IP 64			IP 64			
F			F			F			
RAL 9005			RAL 9005			RAL 9005			
3			3			3			
Y(star-configuration)			Y(star-configuration)			Y(star-configuration)			

IMPORTANT NOTES:

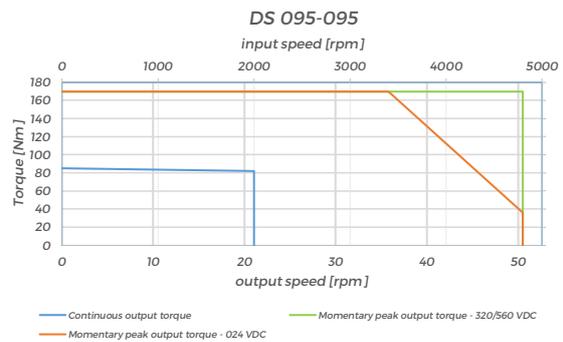
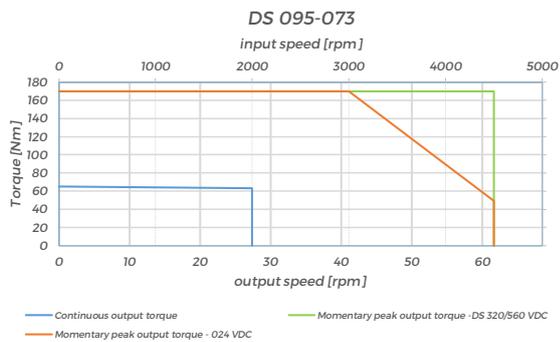
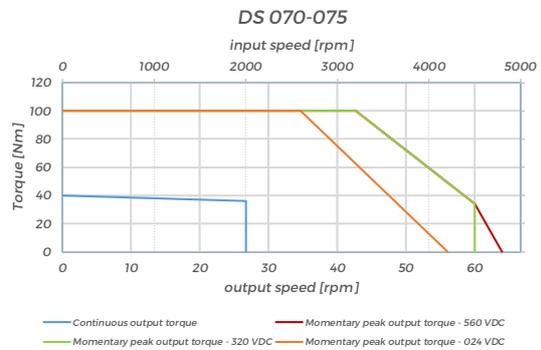
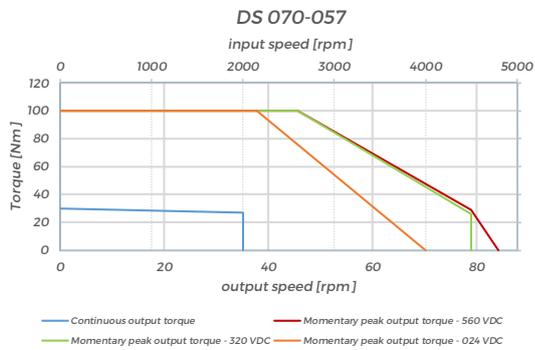
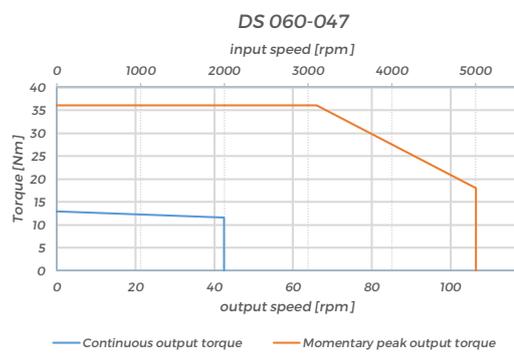
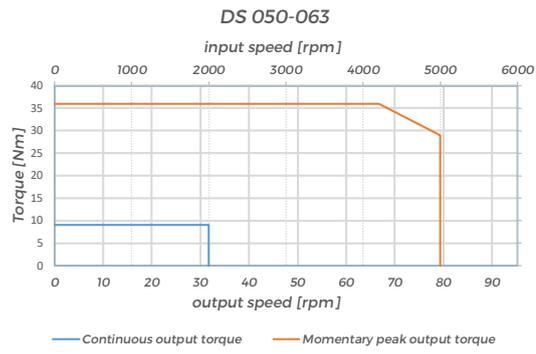
- Load values in the table are valid for the nominal lifetime $L_{10} = 6\,000$ hours excluding DS 060, DS 095, DS 115 and DS 155 where values are valid for $L_{10} = 12\,000$ hours. Service life for average torque T_a and average speed n_a other than rated n_r , T_r can be recalculated. Please contact manufacturer with estimated duty cycle.
- High precision reduction gears are preferred for intermittent duty cycles (S3-S8): the output speed in applications is inverted-variable. The S1 continuous duty cycle needs to be consulted with manufacturer
- Please consult the maximum speed in duty cycle with the manufacturer
- The values in the table refer to the ambient temperature of 20 °C to 25 °C
- For ambient temperatures lower than -10 °C pre-heating might be considered please consult manufacturer

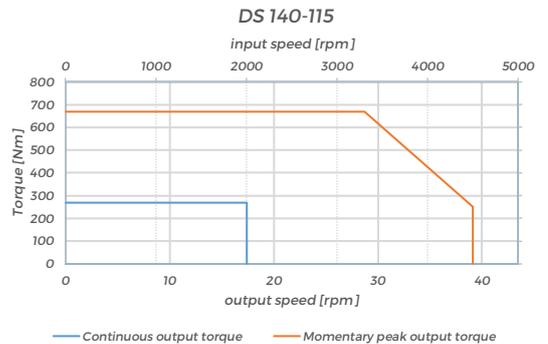
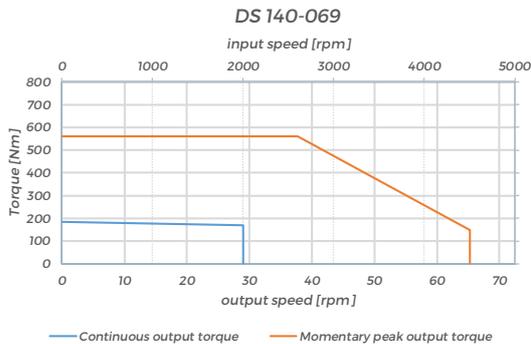
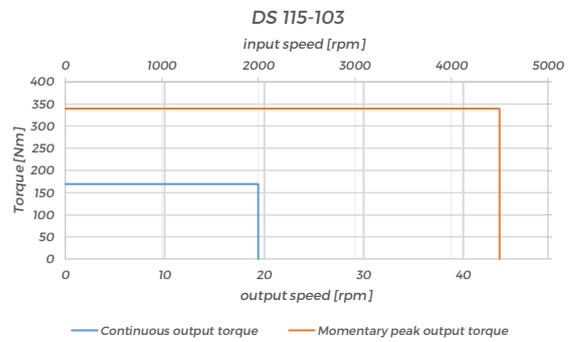
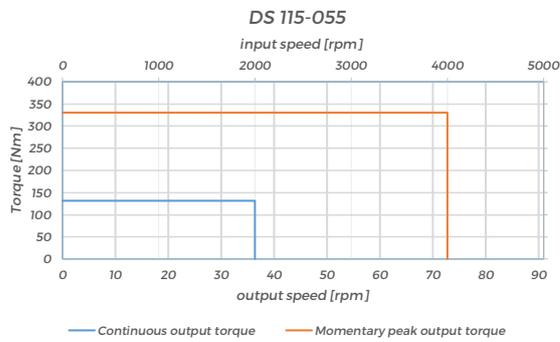
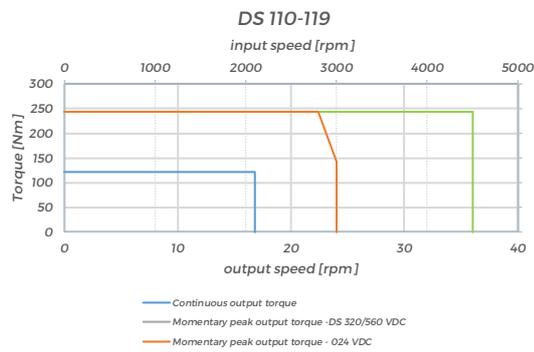
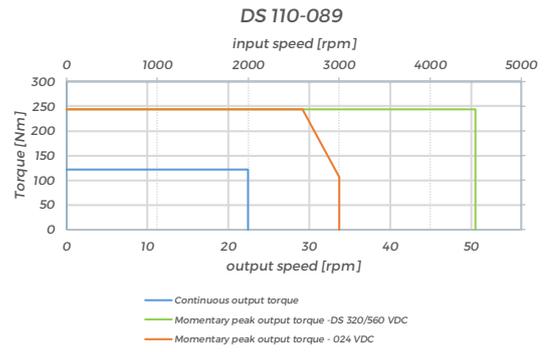
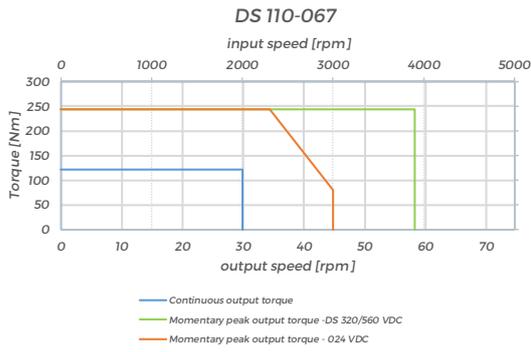
Tab. 8.2c: Inertia at input (DS actuator without brake)

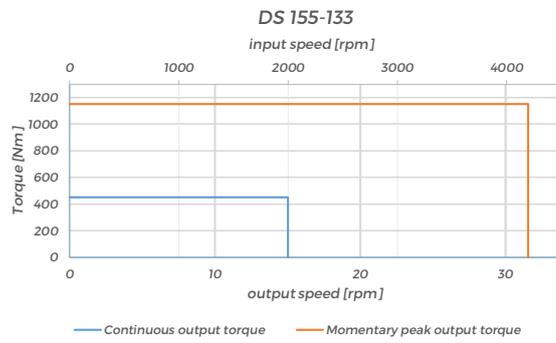
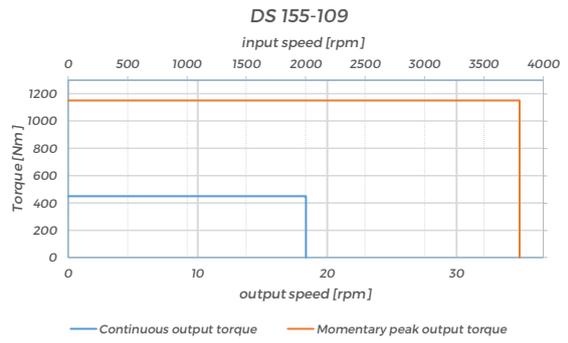
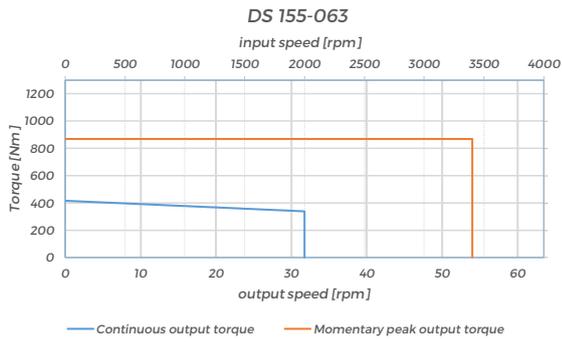
Feedback type (d)	$J_{w/o\ brake}$	DS 050	DS 060	DS 070	DS 095	DS 110	DS 115	DS 140	DS 155
OA	10^{-4} kgm^2	0.080	0.073	0.509	1.657	1.825	5.803	5.745	16.069
OB	10^{-4} kgm^2	0.061	0.073	0.488	1.646	1.814	5.784	5.736	16.039
OC	10^{-4} kgm^2	0.061	0.073	0.488	1.646	1.814	5.784	5.736	16.039
OD	10^{-4} kgm^2	0.062	0.074	0.504	1.640	1.830	5.780	5.728	16.085
OE	10^{-4} kgm^2	0.062	0.074	0.504	1.640	1.830	5.780	5.728	16.085
OF	10^{-4} kgm^2	–	–	–	1.661	–	–	–	–
OG	10^{-4} kgm^2	0.061	–	–	1.661	–	–	–	–
OH	10^{-4} kgm^2	–	–	0.504	1.661	1.830	5.903	5.770	16.085
OJ	10^{-4} kgm^2	–	0.073	–	–	–	5.903	–	–
OK	10^{-4} kgm^2	0.060	–	–	1.640	–	5.788	–	16.039
OL	10^{-4} kgm^2	0.060	–	–	1.640	–	5.788	–	16.039
ON	10^{-4} kgm^2	–	–	–	–	–	5.795	–	16.082
OP	10^{-4} kgm^2	–	–	0.484	1.640	–	–	–	–
OQ	10^{-4} kgm^2	–	–	0.484	1.640	–	–	–	–
OR	10^{-4} kgm^2	–	–	–	–	–	–	–	–
OS	10^{-4} kgm^2	–	–	–	–	–	–	–	–

Tab. 8.2d: Inertia at input (DS actuator with brake)

Feedback type (d)	$J_{w/brake}$	DS 050	DS 060	DS 070	DS 095	DS 110	DS 115	DS 140	DS 155
OA	10^{-4} kgm^2	0.121	0.083	0.878	1.707	2.193	5.926	12.100	16.210
OB	10^{-4} kgm^2	0.101	0.081	0.856	1.695	2.182	5.907	12.120	16.230
OC	10^{-4} kgm^2	0.101	0.081	0.856	1.695	2.182	5.907	12.120	16.230
OD	10^{-4} kgm^2	0.101	0.082	0.871	1.689	2.196	5.903	12.100	16.210
OE	10^{-4} kgm^2	0.101	0.082	0.871	1.689	2.196	5.903	12.100	16.210
OF	10^{-4} kgm^2	–	–	–	1.711	–	–	–	–
OG	10^{-4} kgm^2	–	–	–	1.711	–	–	–	–
OH	10^{-4} kgm^2	–	–	0.871	1.711	2.196	5.926	12.100	16.450
OJ	10^{-4} kgm^2	–	0.081	–	–	–	5.926	–	–
OK	10^{-4} kgm^2	0.100	–	–	1.690	–	5.901	–	16.360
OL	10^{-4} kgm^2	0.100	–	–	1.690	–	5.901	–	16.360
ON	10^{-4} kgm^2	–	–	–	–	–	5.918	–	16.180
OP	10^{-4} kgm^2	–	–	–	1.690	–	–	–	–
OQ	10^{-4} kgm^2	–	–	–	1.690	–	–	–	–
OR	10^{-4} kgm^2	–	–	–	–	–	–	–	–
OS	10^{-4} kgm^2	–	–	–	–	–	–	–	–



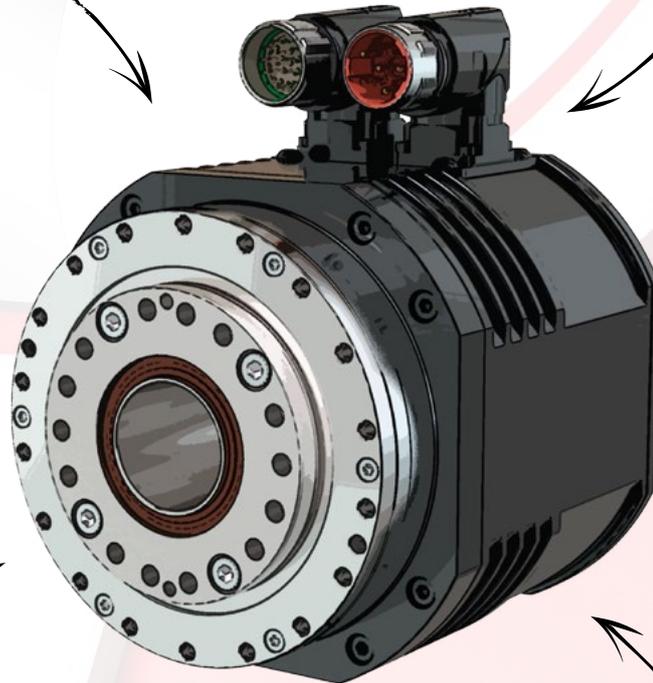






High torque overload capacity

Hollowshaft



Static tube

True hollow based on G series



DSH series

DSH

WHEN AIR IS BETTER THAN STEEL

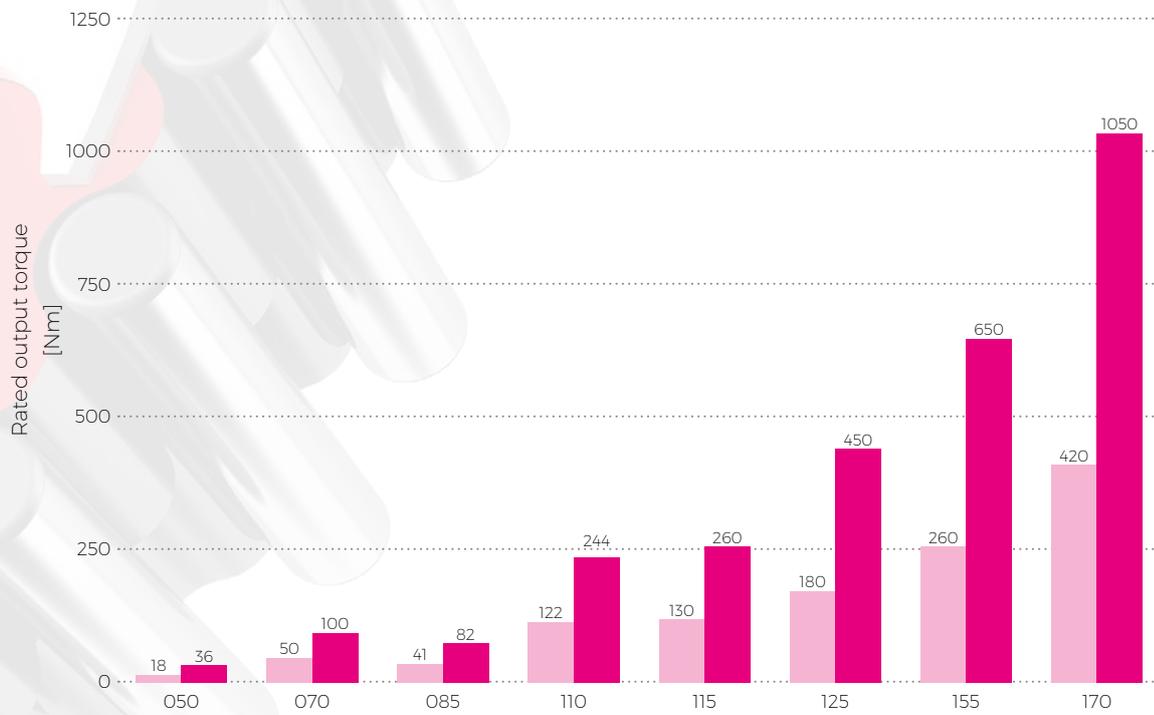
8.3 DSH series



Advantages

- low lost motion
- low moment of inertia
- high reduction ratio
- high kinematic accuracy
- high moment overload capacity
- high capacity of the integrated radial-axial output bearings
- high dynamic performance

The **DriveSpin® DSH** electric actuators are characterized by the short axial length and by the possibility to use a through hole for routing cables, pipes, and drive shafts. Fully sealed compact actuators equipped with zero-backlash reduction gears have high power density, large hole inner diameter, from 8 to 40mm. Excellent positioning accuracy and positioning repeatability, DSH maintaining radial-axial and torque load capacity and are characteristic with high overload capacity of reduction gear and of AC servomotor, featuring high dynamics. The voltage and feedback variability will widely satisfy all of customers requirements. This allows even demanding tasks such as exact positioning or fast movement of heavy loads to be performed with a high degree of repetitive accuracy. Rated output torque is from 18 Nm to 260 Nm.

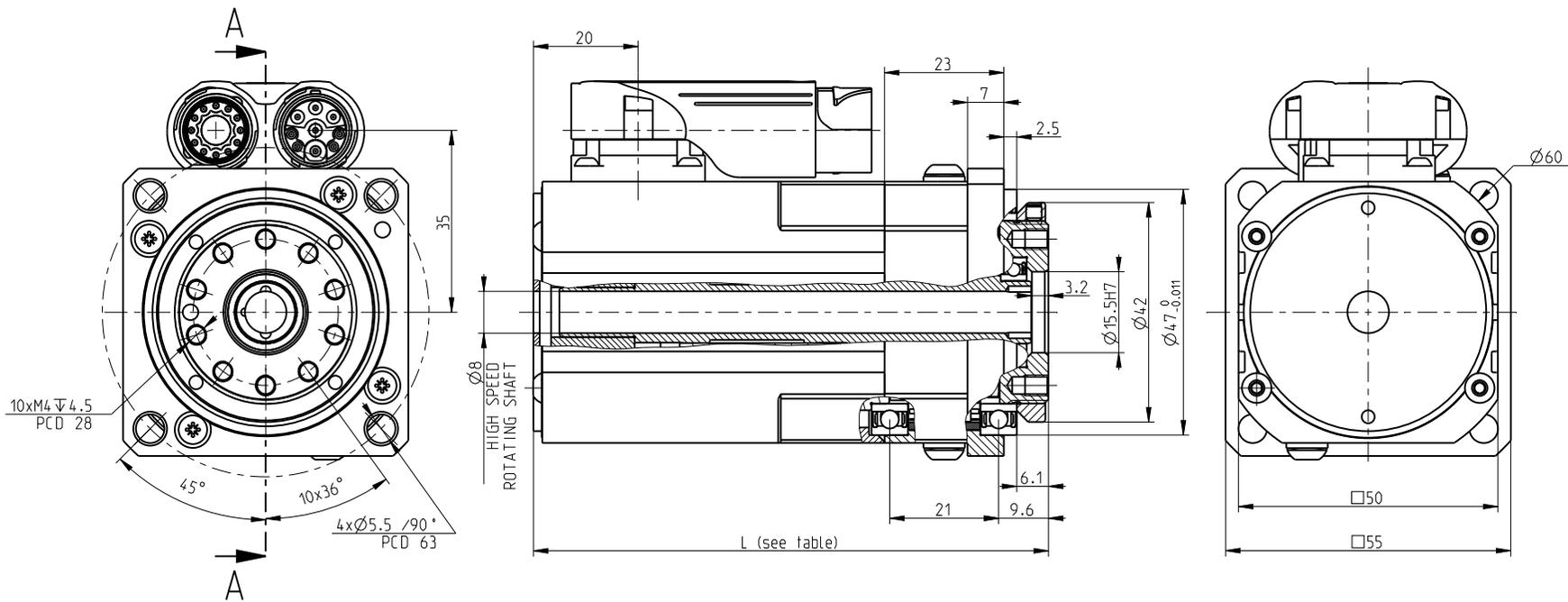


DSH

Tab. 8.3a: Rated output torque

Size		050	070	085	110	115	125	155	170
Rated output torque	T_r [Nm]	18	50	41	122	130	180	260	420
Acceleration/ braking output torque	T_{max} [Nm]	36	100	82	244	260	450	650	1050

DSH 050 - i - abcde-fg-xy



Drawings

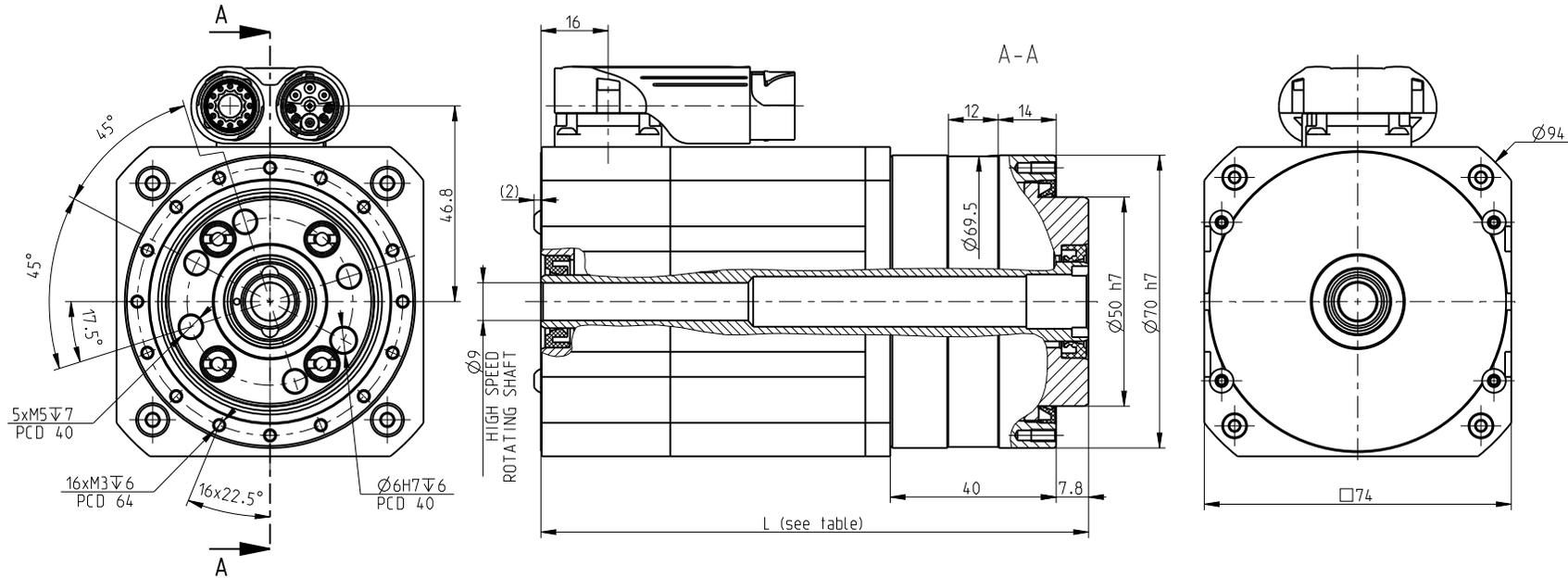
DSH 050 - i - abcde-fg-xy



Hollowshaft rotates at motor speed

Size	Feedback type (d)	Without brake		With brake	
		Dimension L $\pm 0,5$ [mm]	Weight m [kg] *	Dimension L $\pm 0,5$ [mm]	Weight m [kg] *
DSH 050	OA	107	1.2	-	-

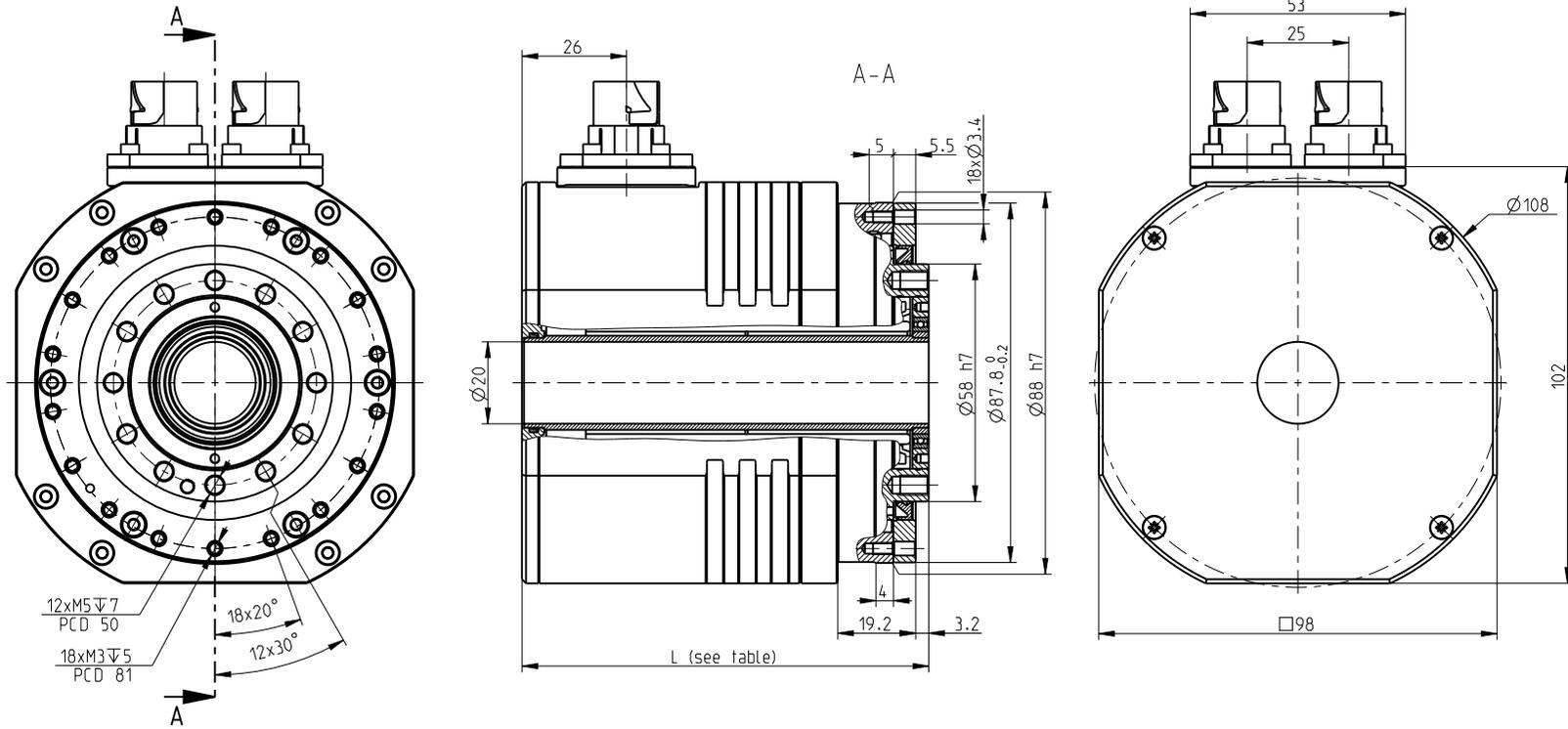
DSH 070 - i - abcde-fg-xy



Hollowshaft rotates at motor speed

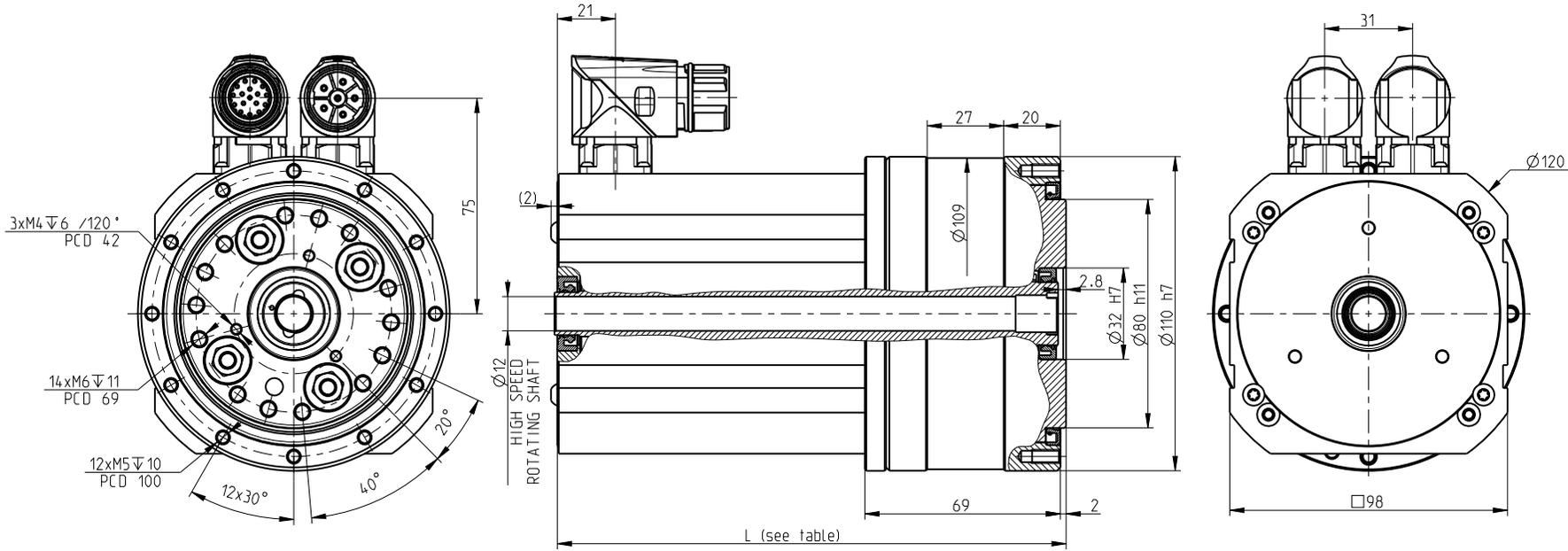
Size	Feedback type (d)	Without brake		With brake	
		Dimension L \pm 0,5 [mm]	Weight m [kg] *	Dimension L \pm 0,5 [mm]	Weight m [kg] *
DSH 070	OA	153	2.3		
	OB,OC	133	2.1		

DSH 085 - i - abcde-fg-xy



Size	Feedback type (d)	Without brake		With brake	
		Dimension L \pm 0,5 [mm]	Weight m [kg] *	Dimension L \pm 0,5 [mm]	Weight m [kg] *
DSH 085	OA	120	4.2	150	4.6
	OB,OC	120	3.8	150	4.4
	OD,OE	120	3.7	150	4.5
	ON	120	3.5	150	4.3

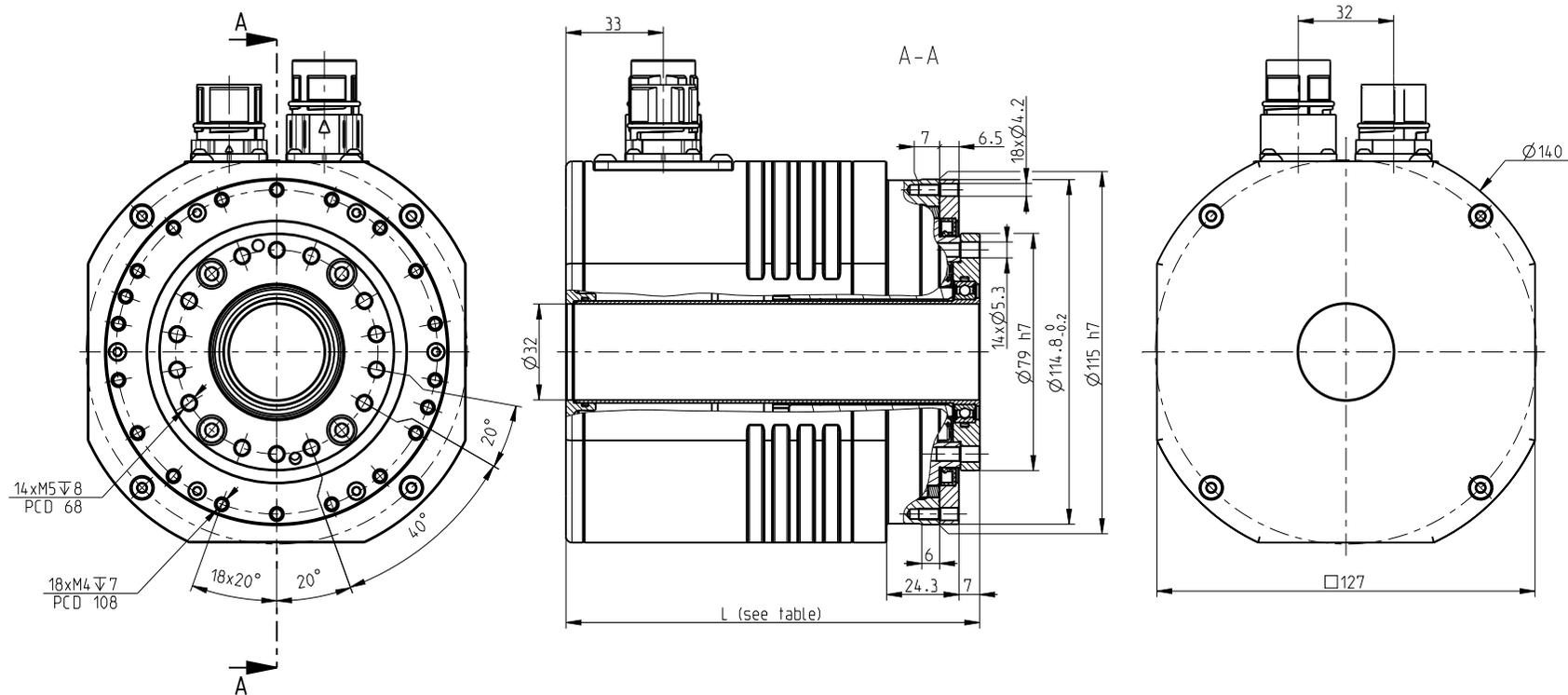
DSH 110 - i - abcde-fg-xy



Hollowshaft rotates at motor speed

Size	Feedback type (d)	Without brake		With brake	
		Dimension L ± 0,5 [mm]	Weight m [kg] *	Dimension L ± 0,5 [mm]	Weight m [kg] *
DSH 110	OA	181	8.7		

DSH 115 - i - abcde-fg-xy



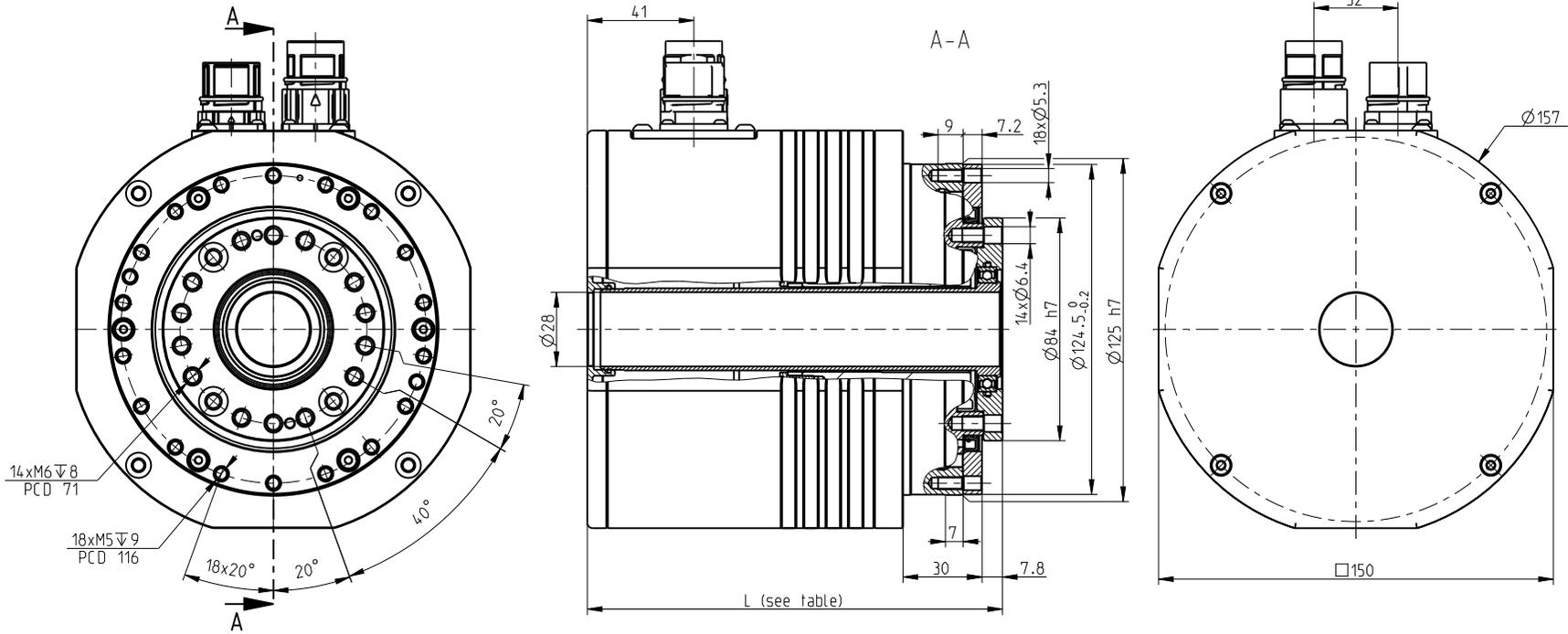
DSH 115 - i - abcde-fg-xy

Drawings



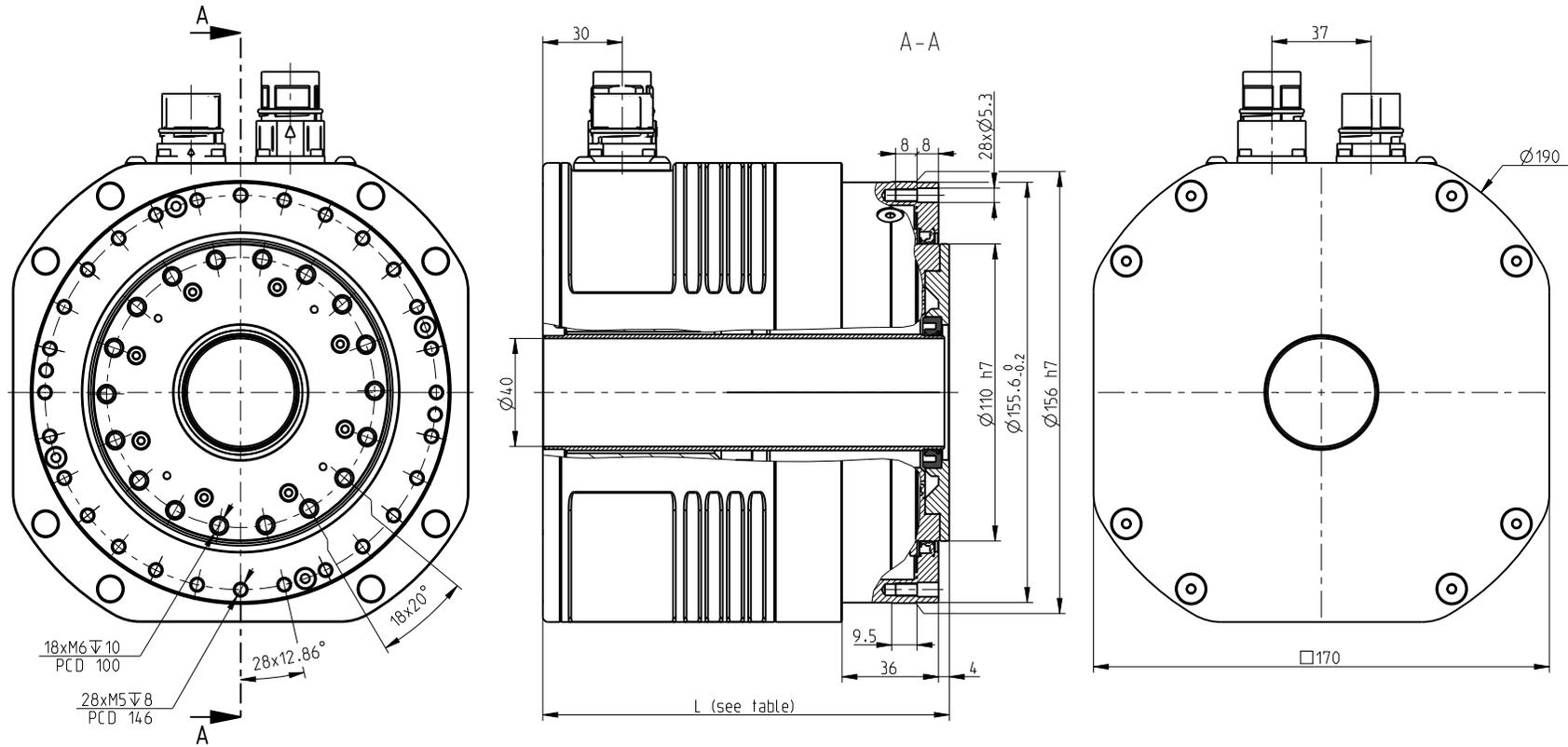
Size	Feedback type (d)	Without brake		With brake	
		Dimension L \pm 0,5 [mm]	Weight m [kg] *	Dimension L \pm 0,5 [mm]	Weight m [kg] *
DSH 115	OA	144	73	168	83
	OB	139	65	165	75
	OD,OE	139	65	165	75
	OF	139	65	165	75

DSH 125 - i - abcde-fg-xy



Size	Feedback type (d)	Without brake		With brake	
		Dimension L ± 0,5 [mm]	Weight m [kg] *	Dimension L ± 0,5 [mm]	Weight m [kg] *
DSH 125	OA	158	11.2	186	12.9
	OB,OC	158	10.4	186	11.7
	OD,OE	158	10.4	186	11.7
	ON	158	9.0	186	10.3

DSH 155 - i - abcde-fg-xy



Size	Feedback type (d)	Without brake		With brake	
		Dimension L ± 0,5 [mm]	Weight m [kg] *	Dimension L ± 0,5 [mm]	Weight m [kg] *
DSH 155	OA	152	13.1	175	14.3
	OB	152	11.8	175	13.0
	OD,OE	152	11.6	175	13.7
	OF	152	11.6s	175	13.7

Tab. 8.3b: DSH series technical data table

Reduction Gear parameters		Tolerance		DSH 050		
Reduction ratio	i			63		
Hollowshaft diameter	ϕd [mm]			8 ¹⁴⁾		
Rated output torque	T_r [Nm]			18		
Acceleration/braking output torque	T_{max} [Nm]			36		
Rated input speed	n_r [rpm]			2 000		
Maximum allowable input speed ⁹⁾	n_{max} [rpm]			5 000		
Allowable moment ²⁾³⁾	M_{cmax} [Nm]			44		
Tilting stiffness ¹⁾⁶⁾	M_t [Nm/arcmin]			4		
Torsional stiffness ¹⁾⁷⁾	k_t [Nm/arcmin]			2.5		
Lost motion	LM [arcmin]			< 1.5		
Hysteresis	H [arcmin]			< 1.5		
Rated radial force ²⁾	F_{rR} [kN]			1.44 ⁸⁾		
Maximum axial force ²⁾⁴⁾	$F_{a max}$ [kN]			1.9		
Gear lubrication				Grease Castrol TRIBOL GR TT 1 PD		
Reduction gear limit temperature	[°C]			65 °C		
Standard ambient temperature range	[°C]			-10 °C to +40 °C		
Motor parameters						
DC BUS voltage	U_{dc} [V _{dc}]	+/- 10%	24	320	560	
Motor rated speed	n_n [rpm]		3 500	3 500	3 500	
Motor rated torque	M_n [Nm]	+/- 10%	0.23	0.23	0.23	
Motor rated current	I_n [A _{rms}]		7.1	0.58	0.58	
Motor stall torque	M_o [Nm]	+/- 10%	0.24	0.24	0.24	
Motor stall current	I_o [A _{rms}]		7.4	0.6	0.6	
Motor peak torque	M_{max} [Nm]	+/- 10%	1	1	1	
Motor peak current	I_{max} [A]		30.8	2.5	2.5	
Motor back-EMF constant	K_E [V _{peak} /krpm]	+/- 10%	2.7	36	36	
Motor torque constant	K_T [Nm/A _{rms}]	+/- 10%	0.032	0.4	0.4	
Terminal resistance (L-L)	R_{2ph} [Ω]	+/- 10%	0.2	36	36	
Terminal inductance (L-L)	L_{2ph} [mH]	+/- 20%	0.2	36	36	
Number of poles	2p		6	6	6	
Electromagnetic brake DC supply	[V _{dc}]			24. Special		
Electromagnetic brake torque at input	[Nm]			0.4		
Protection class				IP 64		
Motor Insulation class				F		
Paint				RAL 9005		
Motor number of phases				3		
Motor type of connection				Y(star-configuration)		

1) Mean statistical value

2) Load at output speed 32 rpm for size 050, other sizes at 15 rpm

 3) Moment M_c max at $F_a=0$. If $F_a \neq 0$ see Glossary

 4) Axial force F_a max for $M_c=0$ (In case of size 050 also $F_r=0$ condition has to be fulfilled). If $M_c \neq 0$ see Glossary

5) 3 900 rpm for ratio 67 ; 4 500 rpm for ratios 89, 119

6) The parameter depends on the version of high precision reduction gear.

7) The parameter depends on the version, ratio and lost motion of the high precision reduction gear.

 8) For size 050 this is value of MAXIMUM RADIAL FORCE $F_{r,max}$ for $a_2=0$; $F_a=0$ and at 32 rpm output speed. For $a_2>0$; $F_a=0$ at 32 rpm output speed $F_{r,max} = 44/(a_2+0.0305)$. a_2 represents the distance of the radial force centre from the front of the output flange in meters see Glossary

9) Instantaneous speed peak that may occur within the working cycle. Note please the temperature on the gear case that should not exceed significantly 60°C

10) 3 200 rpm for ratio 69 ; 3 700 rpm for ratio 125

11) 3 800 rpm for ratio 47 ; 4 500 rpm for ratio 85

12) 2 500 rpm for ratio 55 ; 3 400 for ratio 103

13) 2 400 rpm for ratio 49 ; 3 800 rpm for ratio 99

14) Hollowshaft rotates at motor speed

1) Hollowshaft rotates at motor speed

Tab. 8.3b: DSH series technical data table - continued

DSH 070			DSH 085			DSH 110		
57, 75			47, 85			67, 89, 119		
9 or 12 ¹⁴⁾			14 or 20			12 ¹⁴⁾		
50			41			122		
100			82			244		
2 000			2 000			2000		
5 000			3 800 / 4 500 ¹¹⁾			3900 / 4500 ⁵⁾		
142			220			740		
35			85			150		
7			10			22		
< 1.5			< 1			< 1		
< 1.5			< 1			< 1		
2.8			2			9.3		
4.1			6					
Grease Castrol TRIBOL GR TT 1 PD			Grease Castrol TRIBOL GR TT 1 PD			Grease Castrol TRIBOL GR TT 1 PD		
65 °C			60 °C			65 °C		
-10 °C to +40 °C			-10 °C to +40 °C			-10 °C to +40 °C		
24	320	560	24	320	560	24	320	560
2 500	4 500	4 500	2 500	3 000	3 000	2 500	3 000	3 000
0.88	0.76	0.76	2.1	2.1	2.1	3.4	3.2	3.2
13	1.2	0.7	42	4.2	2.1	37	4.9	2.8
0.9	0.9	0.9	2.3	2.3	2.3	3.8	3.8	3.8
13.3	1.42	0.83	46	4.6	2.3	41	6	3
3	3	3	5.8	5.8	5.8	11	11	11
44.3	4.7	2.8	130	13.03	6.52	120	17	10
5.7	68.3	105.6	4.37	49.1	87.4	8	57	103
0.0677	0.63	1.09	0.05	0.5	1	0.09	0.65	1.14
0.13	17	40.5	0.017	2.1	6.7	0.027	1.4	4.5
0.25	34.4	87	0.04	5.2	17	0.15	7.4	24
10	10	10	16	16	16	10	10	10
24. Special			24. Special			24. Special		
4.5			1.5			4.5		
IP 64			IP 64			IP 64		
F			F			F		
RAL 9005			RAL 9005			RAL 9005		
3			3			3		
Y (star-configuration)			Y (star-configuration)			Y (star-configuration)		

IMPORTANT NOTES:

- Load values in the table are valid for the nominal lifetime $L_{10} = 6\ 000$ hours excluding DSH 085, DSH 115, DSH 125 and DSH 155 where values are valid for $L_{10} = 12\ 000$ hours. Service life for average torque T_a and average speed n_a other than rated n_r , T_r can be recalculated. Please contact manufacturer with estimated duty cycle.
- High precision reduction gears are preferred for intermittent duty cycles (S3-S8): the output speed in applications is inverted-variable. The S1 continuous duty cycle needs to be consulted with manufacturer
- Please consult the maximum speed in duty cycle with the manufacturer
- The values in the table refer to the ambient temperature of 20°C to 25°C
- For ambient temperatures lower than -10°C pre-heating might be considered please consult manufacturer

Tab. 8.3b: DSH series technical data table - continued

Reduction Gear parameters		Tolerance		DSH 115		
Reduction ratio	i			55, 103		
Hollowshaft diameter	ϕd [mm]			32		
Rated output torque	T_r [Nm]			130		
Acceleration/braking output torque	T_{max} [Nm]			260		
Rated input speed	n_r [rpm]			2 000		
Maximum allowable input speed ⁹⁾	n_{max} [rpm]			2 500 / 3 400 ¹⁴⁾		
Allowable moment ²⁾³⁾	M_{cmax} [Nm]			550		
Tilting stiffness ¹⁾⁶⁾	M_t [Nm/arcmin]			220		
Torsional stiffness ¹⁾⁷⁾	k_t [Nm/arcmin]			23		
Lost motion	LM [arcmin]			< 1		
Hysteresis	H [arcmin]			< 1		
Rated radial force ²⁾	F_{rR} [kN]			4		
Maximum axial force ²⁾⁴⁾	$F_{a max}$ [kN]			12.5		
Gear lubrication				Grease Castrol TRIBOL GR TT 1 PD		
Reduction gear limit temperature	[°C]			60 °C		
Standard ambient temperature range	[°C]			-10 °C to +40 °C		
Motor parameters						
DC BUS voltage	U_{dc} [V _{dc}]	+/- 10%	24	320	560	
Motor rated speed	n_n [rpm]		3 500	3 500	3 500	
Motor rated torque	M_n [Nm]	+/- 10%	2.9	2.9	2.9	
Motor rated current	I_n [A _{rms}]		46	3.5	2	
Motor stall torque	M_o [Nm]	+/- 10%	3	3	3	
Motor stall current	I_o [A _{rms}]		47.6	3.6	2	
Motor peak torque	M_{max} [Nm]	+/- 10%	8.5	8.5	8.5	
Motor peak current	I_{max} [A]		135	10.1	5.8	
Motor back-EMF constant	K_E [V _{peak} /krpm]	+/- 10%	5.6	75	131	
Motor torque constant	K_T [Nm/A _{rms}]	+/- 10%	0.06	0.84	1.47	
Terminal resistance (L-L)	R_{2ph} [Ω]	+/- 10%	0.011	2	6	
Terminal inductance (L-L)	L_{2ph} [mH]	+/- 20%	0.03	5	16	
Number of poles	2p		20	20	20	
Electromagnetic brake DC supply	[V _{dc}]			24. Special		
Electromagnetic brake torque at input	[Nm]			5		
Protection class				IP 64		
Motor Insulation class				F		
Paint				RAL 9005		
Motor number of phases				3		
Motor type of connection				Y (star-configuration)		

1) Mean statistical value

2) Load at output speed 32 rpm for size 050, other sizes at 15 rpm

 3) Moment M_c max at $F_a=0$. If $F_a \neq 0$ see Glossary

 4) Axial force F_a max for $M_c=0$ (In case of size 050 also $F_r=0$ condition has to be fulfilled). If $M_c \neq 0$ see Glossary

5) 3 900 rpm for ratio 67 ; 4 500 rpm for ratios 89, 119

6) The parameter depends on the version of high precision reduction gear.

7) The parameter depends on the version, ratio and lost motion of the high precision reduction gear.

 8) For size 050 this is value of MAXIMUM RADIAL FORCE $F_{r,max}$ for $a_2=0$; $F_a=0$ and at 32 rpm output speed. For $a_2>0$: $F_a=0$ at 32 rpm output speed $F_{r,max} = 44/(a_2+0.0305)$. a_2 represents the distance of the radial force centre from the front of the output flange in meters see Glossary

9) Instantaneous speed peak that may occur within the working cycle. Note please the temperature on the gear case that should not exceed significantly 60°C

10) 3 200 rpm for ratio 69 ; 3 700 rpm for ratio 125

11) 3 800 rpm for ratio 47 ; 4 500 rpm for ratio 85

12) 2 500 rpm for ratio 55 ; 3 400 for ratio 103

13) 2 400 rpm for ratio 49 ; 3 800 rpm for ratio 99

14) Hollowshaft rotates at motor speed

Tab. 8.3b: DSH series technical data table - continued

DSH 125			DSH 155			DSH 170		
49,99			109			69,125		
27			40			40		
180			260			420		
450			650			1 050		
2 000			2 000			2 000		
2 400 / 3 800 ¹⁴⁾			3 000			3 200 / 3 700 ¹⁴⁾		
880			1 640			2 000		
280			900			1 100		
29			67			110		
<1			<1			<1		
<1			<1			<1		
4.4			8			19.2		
13.8			26			27.9		
Grease Castrol TRIBOL GR TT 1 PD			Grease Castrol TRIBOL GR TT 1 PD			Grease Castrol TRIBOL GR TT 1 PD		
60 °C			60 °C			65 °C		
-10 °C to +40 °C			-10 °C to +40 °C			-10 °C to +40 °C		
24	320	560	24	320	560	24	320	560
4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000
4	4	4	3.8	3.8	3.8	5	5	5
74.1	5.6	3.2	67.2	5	3	133	10	6
4.5	4.5	4.5	5	5	5	11	11	11
83.3	6.3	3.6	88	6.6	4	293	21.9	6
13.5	13.5	13.5	16	16	16	23	23	23
250	18.8	11	283	21.2	14	612	45.9	27.6
4.76	63	111	5	67	112	3.3	44	77
0.054	0.72	1.26	0.057	0.75	1.27	0.038	0.5	0.83
0.0055	1	3.3	0.005	1	2.5	0.00085	0.15	0.4
0.04	7	22	0.014	2	7	0.0032	0.57	1.7
10	10	10	24	24	24	24	24	24
24, Special			24, Special			24, Special		
5			5			19		
IP 64			IP 64			IP 64		
F			F			F		
RAL 9005			RAL 9005			RAL 9005		
3			3			3		
Y (star-configuration)			Y (star-configuration)			Y (star-configuration)		

IMPORTANT NOTES:

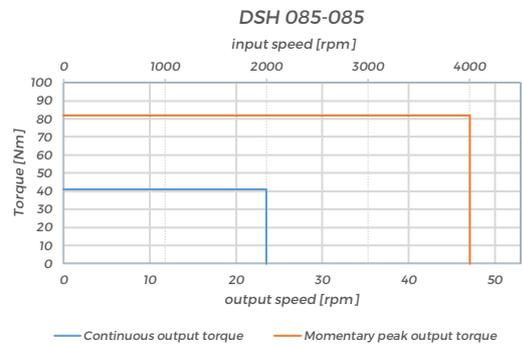
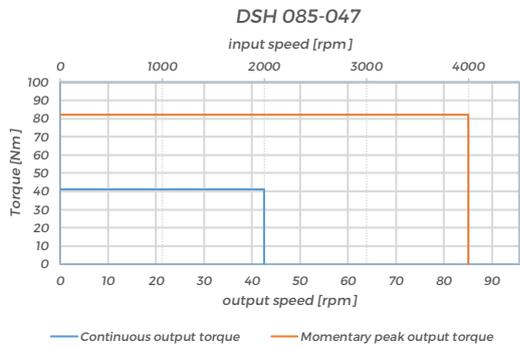
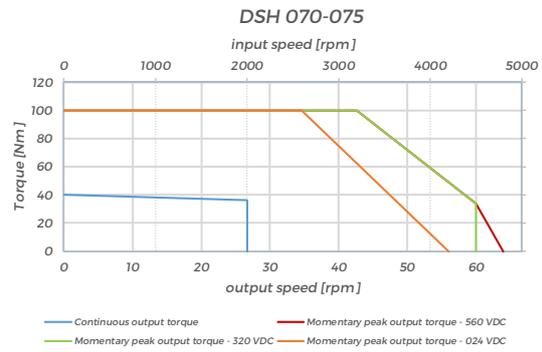
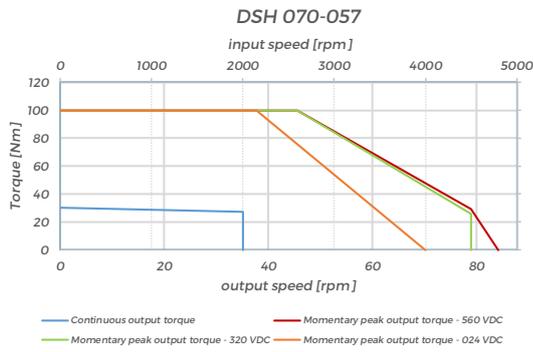
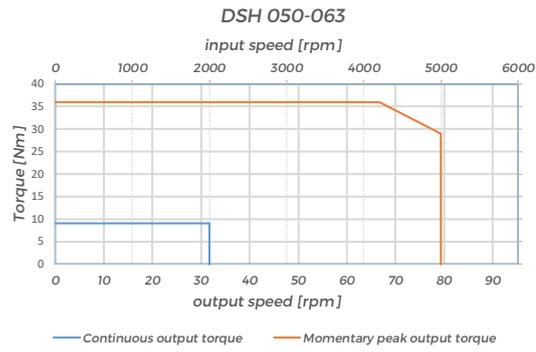
- Load values in the table are valid for the nominal lifetime $L_{10} = 6\,000$ hours excluding DSH 085, DSH 115, DSH 125 and DSH 155 where values are valid for $L_{10} = 12\,000$ hours. Service life for average torque T_a and average speed n_a other than rated n_r , T_r can be recalculated. Please contact manufacturer with estimated duty cycle.
- High precision reduction gears are preferred for intermittent duty cycles (S3-S8): the output speed in applications is inverted-variable. The S1 continuous duty cycle needs to be consulted with manufacturer
- Please consult the maximum speed in duty cycle with the manufacturer
- The values in the table refer to the ambient temperature of 20°C to 25°C
- For ambient temperatures lower than -10°C pre-heating might be considered please consult manufacturer

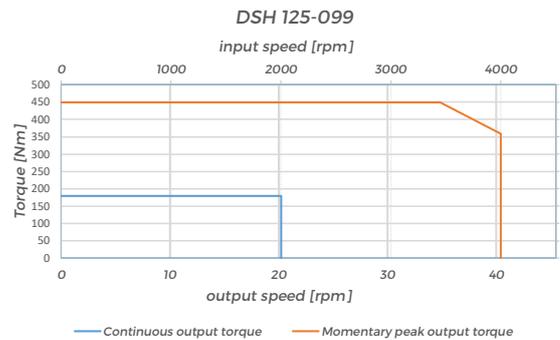
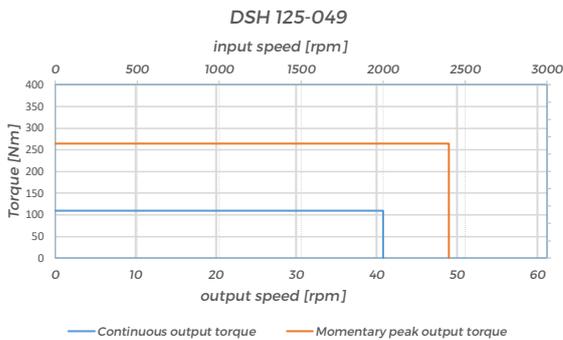
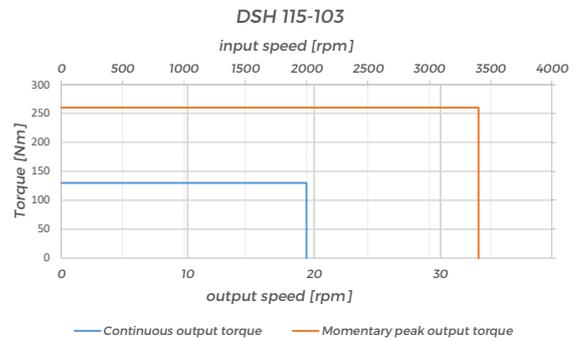
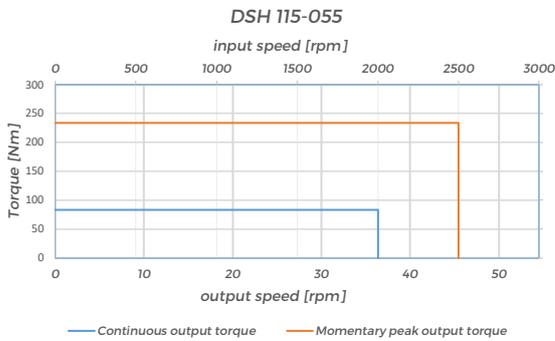
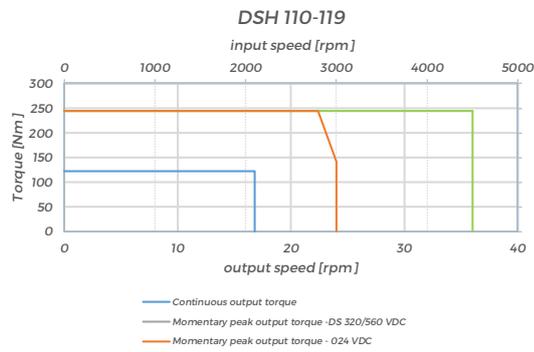
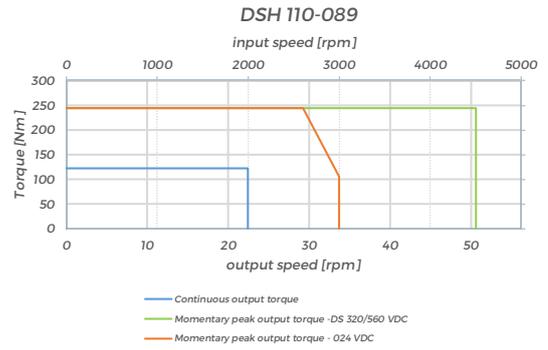
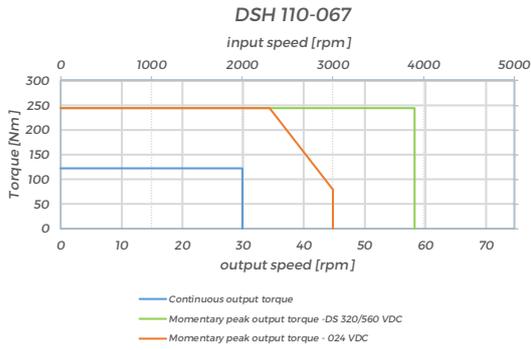
Tab. 8.3c: Inertia at input (DSH actuator without brake)

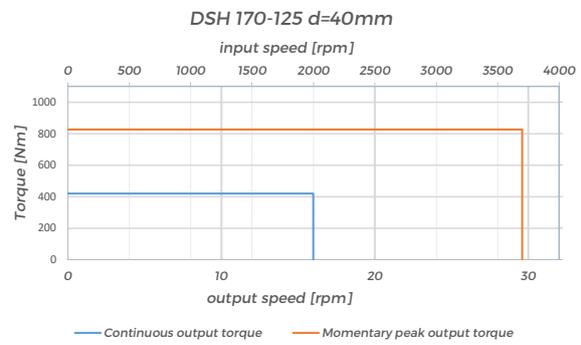
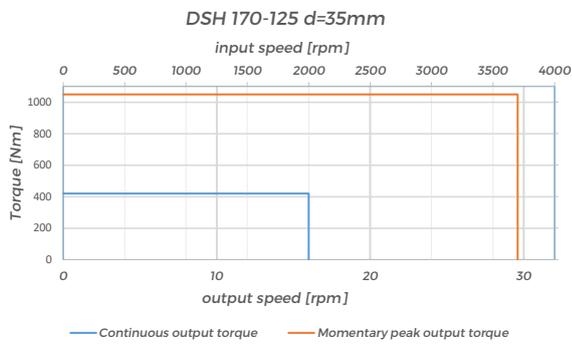
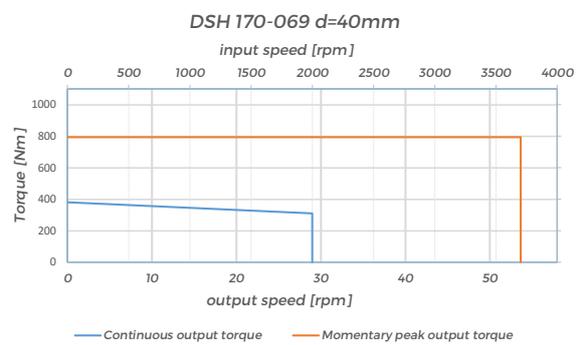
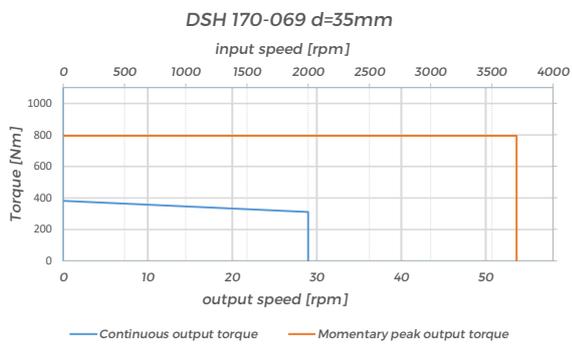
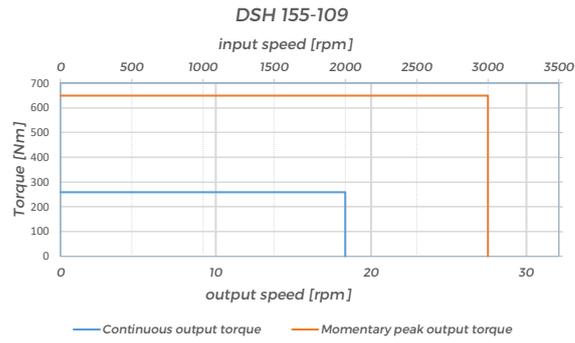
Feedback type (d)	$J_{w/o\ brake}$	DSH 050	DSH 070	DSH 085	DSH 110	DSH 115	DSH 125	DSH 155	DSH 170
OA	10^{-4} kgm^2	0.110	0.630	1.960	2.040	13.977	14.516	19.340	6.370
OB	10^{-4} kgm^2	–	0.483	1.840	–	8.757	9.336	10.600	6.300
OC	10^{-4} kgm^2	–	0.483	1.840	–	8.757	9.336	10.600	6.300
OD	10^{-4} kgm^2	–	–	2.360	–	9.097	9.636	10.460	6.280
OE	10^{-4} kgm^2	–	–	2.360	–	9.097	9.636	10.460	6.280
OF	10^{-4} kgm^2	–	–	–	–	9.097	9.636	10.460	–
OJ	10^{-4} kgm^2	0.091	–	–	–	–	–	–	–
ON	10^{-4} kgm^2	0.105	–	2.060	–	–	10.624	–	6.270

Tab. 8.3d: Inertia at input (DSH actuator with brake)

Feedback type (d)	$J_{w/o\ brake}$	DSH 050	DSH 070	DSH 085	DSH 110	DSH 115	DSH 125	DSH 155	DSH 170
OA	10^{-4} kgm^2	0.143	–	2.380	–	15.080	15.937	24.428	6.430
OB	10^{-4} kgm^2	–	–	2.200	–	9.860	15.757	15.249	6.430
OC	10^{-4} kgm^2	–	–	2.200	–	9.860	10.757	15.249	6.430
OD	10^{-4} kgm^2	–	–	2.810	–	10.200	11.057	15.550	6.430
OE	10^{-4} kgm^2	–	–	2.810	–	10.200	11.057	15.550	6.430
OF	10^{-4} kgm^2	–	–	–	–	10.200	11.057	15.550	–
OJ	10^{-4} kgm^2	0.125	–	–	–	–	–	–	–
ON	10^{-4} kgm^2	0.138	–	2.520	–	–	12.044	–	6.420



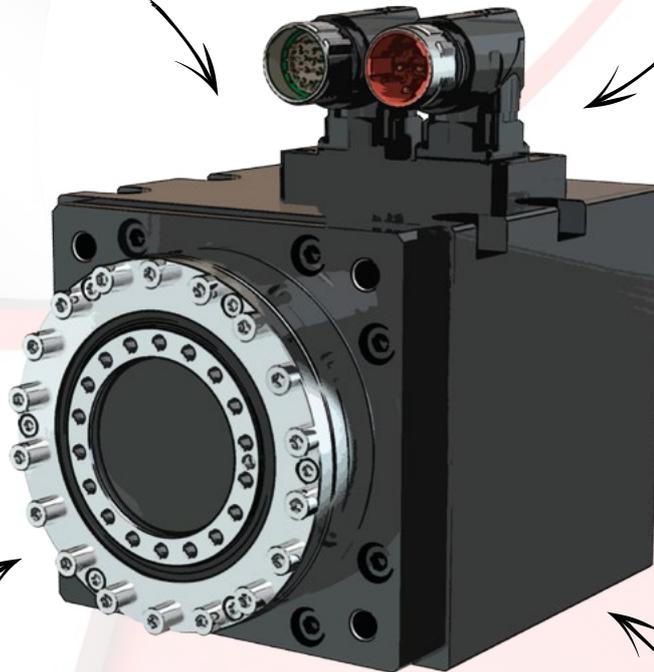






Making x axis solution

Multi point connection



Robust and overload design

Any design of the body



DSM series

MOUNT IT YOUR WAY

DSM

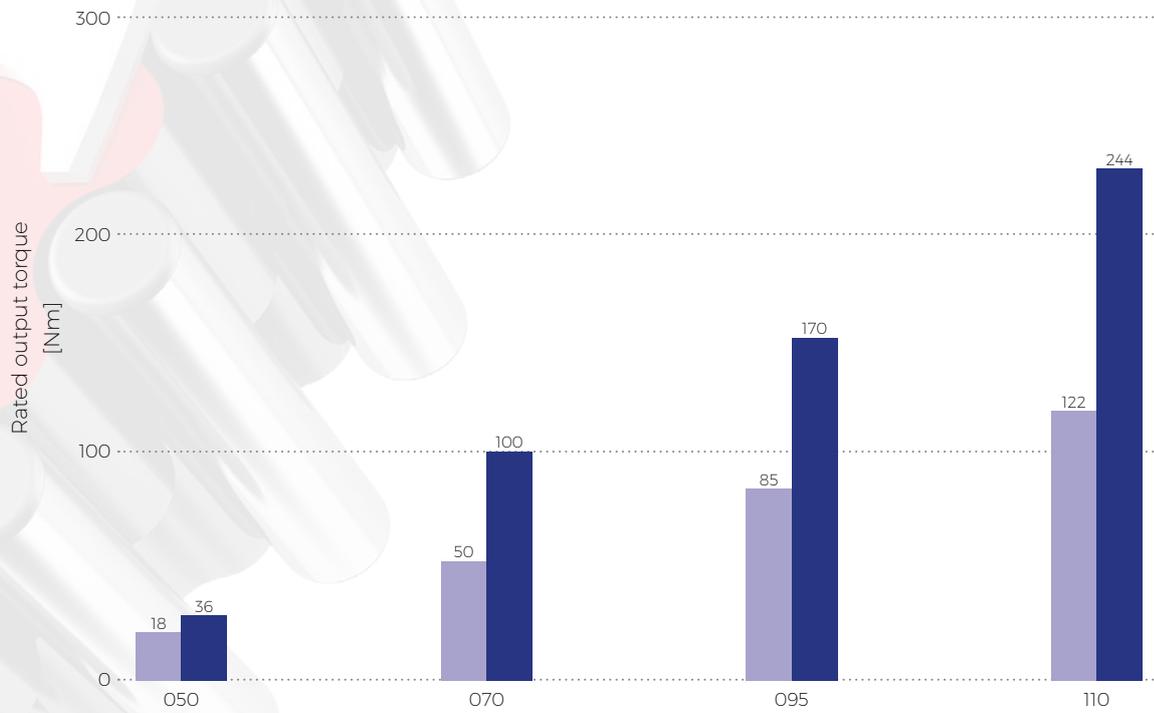
8.4 DSM series



Advantages

- low lost motion
- low moment of inertia
- high reduction ratio
- high kinematic accuracy
- high moment overload capacity
- high capacity of the integrated radial-axial output bearings
- high dynamic performance

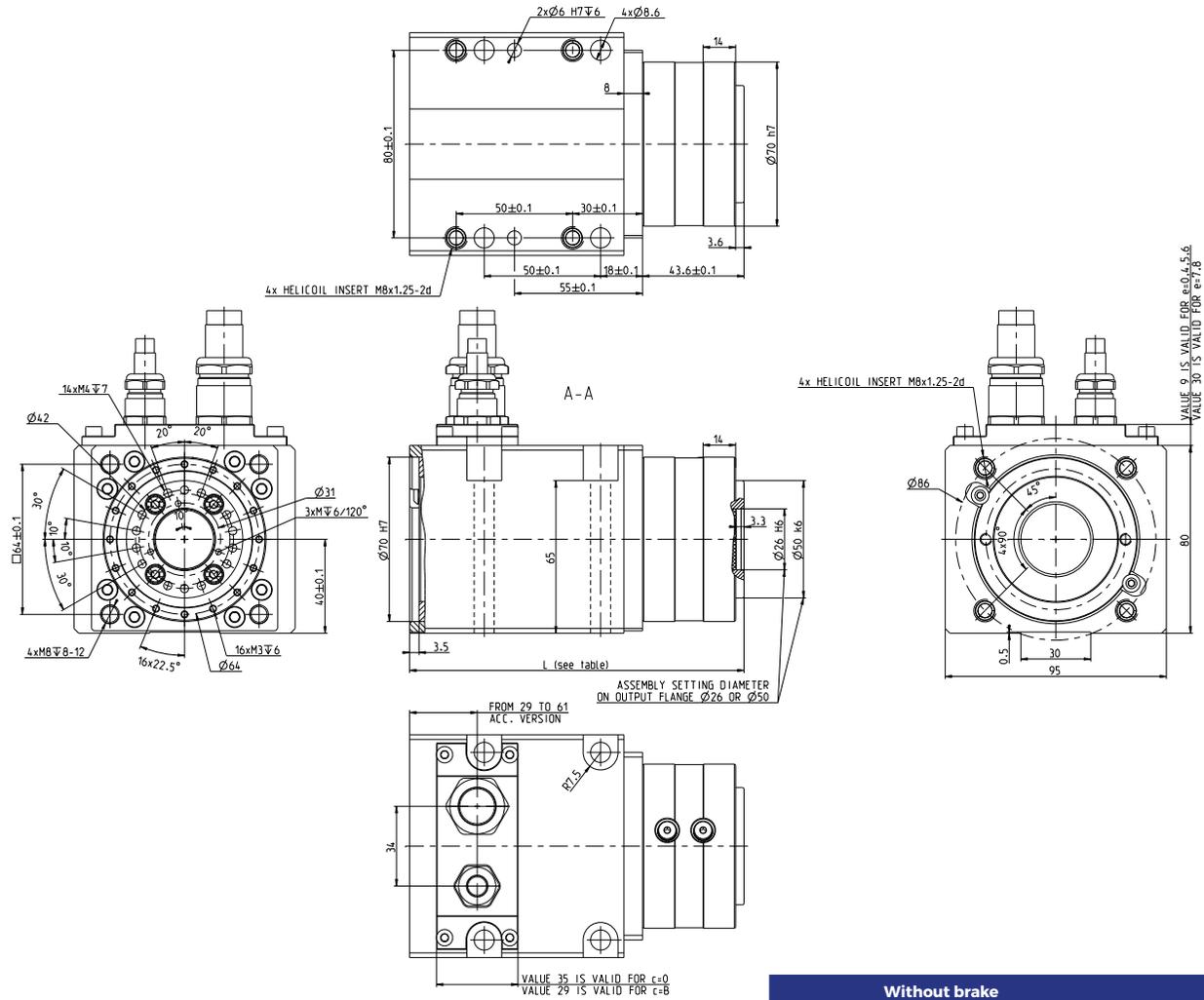
The **DriveSpin® DSM** modular rotary positioning modules provide controlled rotary motion and transfer of torque with a high positioning accuracy and precision. The output flange of the module allows capturing both radial and axial forces. The modules feature a special design, which allows versatile connections, also without additional devices. Actuators can be combined in many ways using the modular system. The simple design integration ability and small dimensions allow creating kinematic assemblies from DSM modules for end effectors, but also for additional devices and positioners. The selection of a module size depends on the required load-carrying capacity and the number of degrees of freedom of the motion axis. The DSM Series is characterized by simple and quick assembly and reduces overall cost. Compact design ensures optimum mounting options and application possibilities, even in confined installation spaces. These actuators are used in applications with request of high torque density, precision and dynamics. Rated output torque is from 18 Nm to 122 Nm.



Tab. 8.4a: Rated output torque

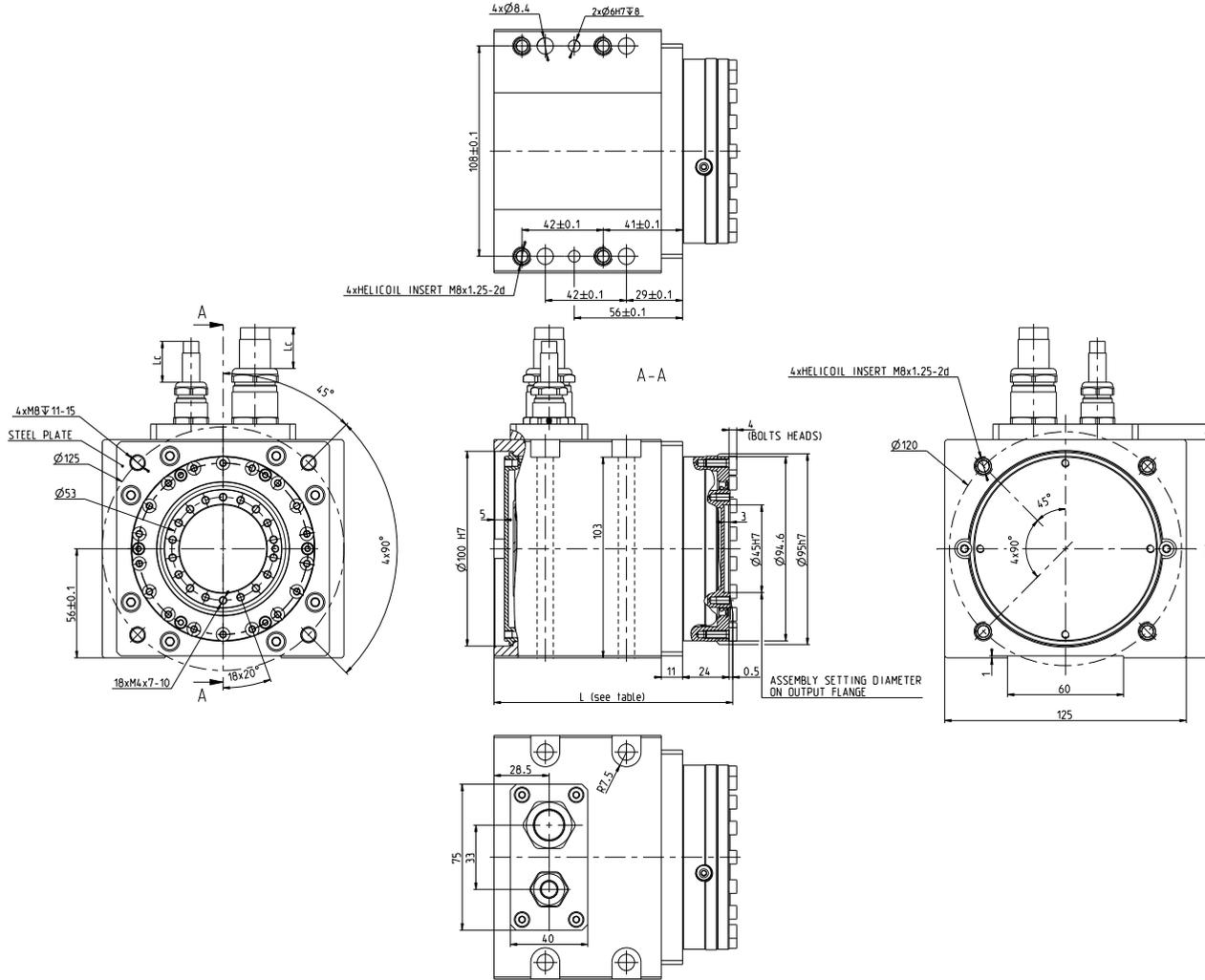
Size		050	070	095	110
Rated output torque	T_r [Nm]	18	50	85	122
Acceleration/ braking output torque	T_{max} [Nm]	36	100	170	244

DSM 070 - i - abcde-fg-xy



Size	Feedback type (d)	Without brake		With brake	
		Dimension L $\pm 0,5$ [mm]	Weight m [kg] *	Dimension L $\pm 0,5$ [mm]	Weight m [kg] *
DSM 070	OA	144	3.2	177	4.2
	OB,OC	144	3.2	177	4.8
	OD,OE	144	3.1	177	4.1
	OH	154	3.4	199	4.6

DSM 095 - i - abcde-fg-xy



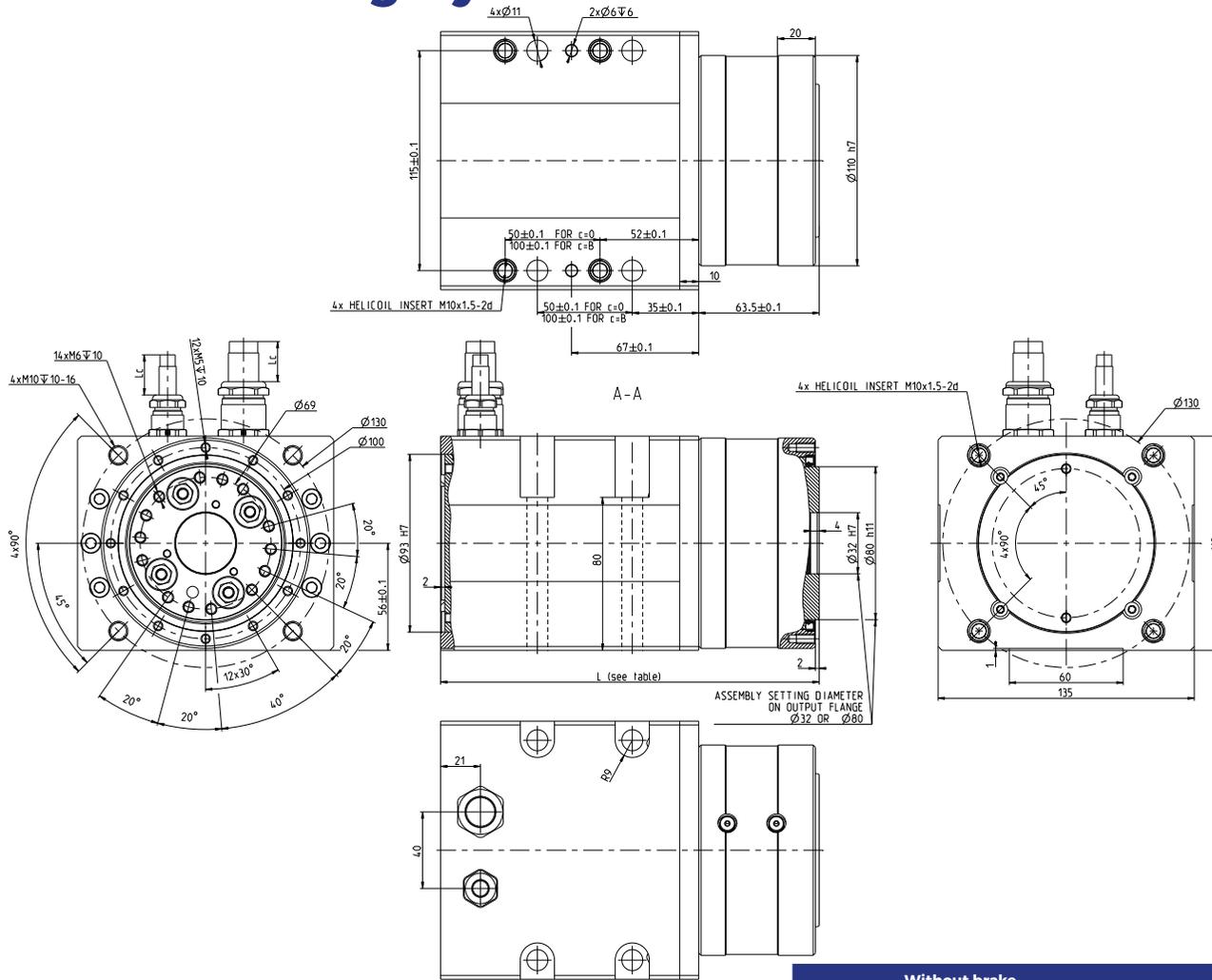
DSM 095 - i - abcde-fg-xy

Drawings



Size	Feedback type (d)	Without brake		With brake	
		Dimension L $\pm 0,5$ [mm]	Weight m [kg] *	Dimension L $\pm 0,5$ [mm]	Weight m [kg] *
DSM 095	OA	122	5.9	145	6.5
	OB,OC	122	6.1	145	6.6
	OD,OE	122	6.0	145	6.7
	OG,OH,OF	142	6.6	165	7.3

DSM 110 - i - abcde-fg-xy



Size	Feedback type (d)	Without brake		With brake	
		Dimension L $\pm 0,5$ [mm]	Weight m [kg] *	Dimension L $\pm 0,5$ [mm]	Weight m [kg] *
DSM 110	0A	200	10.5	252	12.4
	0B,0C	200	10.5	252	12.4
	0D,0E	200	10.6	252	12.5
	0H	200	10.6	252	12.5

Tab. 8.4b: DSM series technical data table

Reduction Gear parameters	Tolerance			DSM 050		
Reduction ratio	i			63		
Rated output torque	T_r [Nm]			18		
Acceleration/braking output torque	T_{max} [Nm]			36		
Rated input speed	n_r [rpm]			2 000		
Maximum allowable input speed ⁹⁾	n_{max} [rpm]			5 000		
Allowable moment ²⁾³⁾	M_{cmax} [Nm]			44		
Tilting stiffness ¹⁾⁶⁾	M_t [Nm/arcmin]			4		
Torsional stiffness ¹⁾⁷⁾	k_t [Nm/arcmin]			2.5		
Lost motion	LM [arcmin]			< 1.5		
Hysteresis	H [arcmin]			< 1.5		
Rated radial force ²⁾	F_{rR} [kN]			1.44 ⁸⁾		
Maximum axial force ²⁾⁴⁾	F_{amax} [kN]			1.9		
Gear lubrication				Grease Castrol TRIBOL GR TT 1 PD		
Reduction gear limit temperature	[°C]			65 °C		
Standard ambient temperature range	[°C]			-10 °C to +40 °C		
Motor parameters						
DC BUS voltage	U_{dc} [V _{dc}]	+/- 10%	24	320	560	
Motor rated speed	n_n [rpm]		3 500	3 500	3 500	
Motor rated torque	M_n [Nm]	+/- 10%	0.23	0.23	0.23	
Motor rated current	I_n [A _{rms}]		7.1	0.58	0.3	
Motor stall torque	M_o [Nm]	+/- 10%	0.24	0.24	0.24	
Motor stall current	I_o [A _{rms}]		7.4	0.6	0.3	
Motor peak torque	M_{max} [Nm]	+/- 10%	1	1	1	
Motor peak current	I_{max} [A]		30.8	2.5	1.25	
Motor back-EMF constant	K_E [V _{peak} /krpm]	+/- 10%	2.7	36	67	
Motor torque constant	K_T [Nm/A _{rms}]	+/- 10%	0.032	0.4	0.8	
Terminal resistance (L-L)	R_{2ph} [Ω]	+/- 10%	0.2	36	122	
Terminal inductance (L-L)	L_{2ph} [mH]	+/- 20%	0.2	36	130	
Number of poles	2p		6	6	6	
Electromagnetic brake DC supply	[V _{dc}]			24. Special		
Electromagnetic brake torque at input	[Nm]			0.4		
Protection class				IP 64		
Motor Insulation class				F		
Paint				RAL 9005		
Motor number of phases				3		
Motor type of connection				Y(star-configuration)		

1) Mean statistical value

2) Load at output speed 32 rpm for size 050, other sizes at 15 rpm

 3) Moment M_c max at $F_a=0$. If $F_a \neq 0$ see Glossary

 4) Axial force F_a max for $M_c=0$ (In case of size 050 also $F_r=0$ condition has to be fulfilled). If $M_c \neq 0$ see Glossary

5) 3 900 rpm for ratio 67 : 4 500 rpm for ratios 89, 119

6) The parameter depends on the version of high precision reduction gear.

7) The parameter depends on the version, ratio and lost motion of the high precision reduction gear.

 8) For size 050 this is value of MAXIMUM RADIAL FORCE F_{rmax} for $a_2=0$; $F_a=0$ and at 32 rpm output speed. For $a_2>0$; $F_a=0$ at 32 rpm output speed $F_{rmax} = 44/(a_2+0.0305)$. a_2 represents the distance of the radial force centre from the front of the output flange in meters see Glossary

9) Instantaneous speed peak that may occur within the working cycle. Note please the temperature on the gear case that should not exceed significantly 60°C

10) 4 500 rpm for ratio 73 : 4 800 rpm for ratio 95

Tab. 8.4b: DSM series technical data table - continued

DSM 070			DSM 095			DSM 110		
57.75			73.95			67.89.119		
50			85			122		
100			170			244		
2 000			2 000			2 000		
5 000			4 500 / 4 800 ¹⁰⁾			3 900 / 4 500 ⁵⁾		
142			410			740		
35			120			150		
7			15			22		
< 1.5			< 1			< 1		
< 1.5			< 1			< 1		
2.8			3.5			9.3		
4.1			11.1			13.1		
Grease Castrol TRIBOL GR TT 1 PD			Grease Castrol TRIBOL GR TT 1 PD			Grease Castrol TRIBOL GR TT 1 PD		
65 °C			60 °C			65 °C		
-10 °C to +40 °C			-10 °C to +40 °C			-10 °C to +40 °C		
24	320	560	24	320	560	24	320	560
2 500	4 500	4 500	4 000	4 000	4 000	2 500	3 000	3 000
0.88	0.76	0.76	1.4	1.4	1.4	3.4	3.2	3.2
13	1.2	0.7	27	5.6	3.1	37	4.9	2.8
0.9	0.9	0.9	1.6	1.6	1.6	3.8	3.8	3.8
13.3	1.42	0.83	31	6.4	3.5	41	6	3
3	3	3	5.5	5.5	5.5	11	11	11
44.3	4.7	2.8	106.1	22	12.1	120	17	10
5.7	68.3	105.6	4.4	25	47	8	57	103
0.0677	0.63	1.09	0.052	0.25	0.46	0.09	0.65	1.14
0.13	17	40.5	0.052	1.2	4.36	0.027	1.4	4.5
0.25	34.4	87	0.11	2.84	8.71	0.15	7.4	24
10	10	10	10	10	10	10	10	10
24. Special			24. Special			24. Special		
4.5			2			4.5		
IP 64			IP 64			IP 64		
F			F			F		
RAL 9005			RAL 9005			RAL 9005		
3			3			3		
Y(star-configuration)			Y(star-configuration)			Y(star-configuration)		

IMPORTANT NOTES:

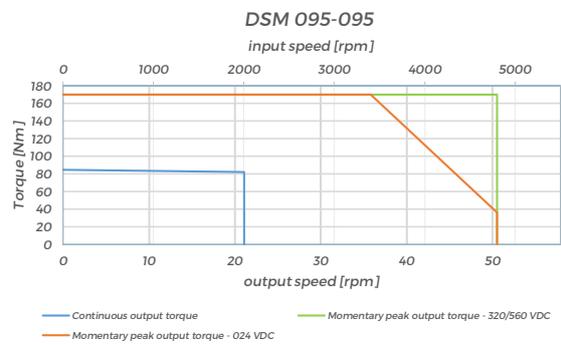
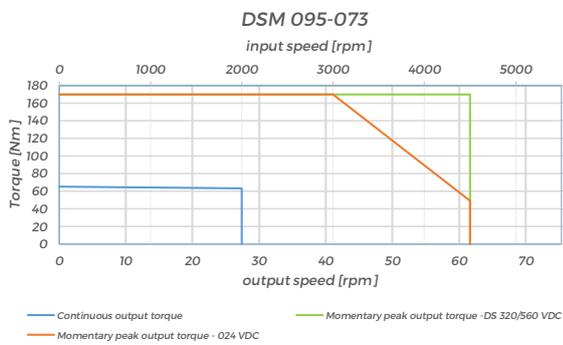
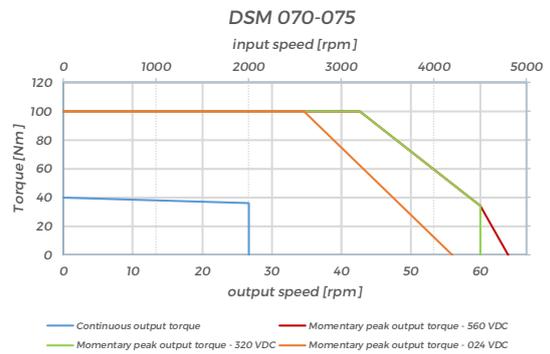
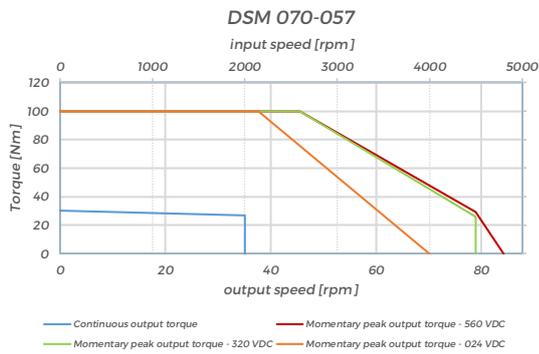
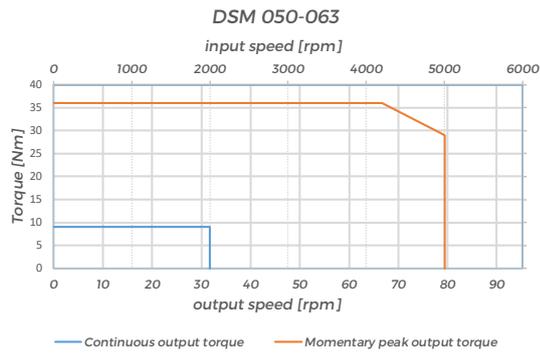
- Load values in the table are valid for the nominal lifetime $L_{10} = 6\,000$ hours excluding DSM 095 where values are valid for $L_{10} = 12\,000$ hours. Service life for average torque T_a and average speed n_a other than rated n_r , T_r can be recalculated. Please contact manufacturer with estimated duty cycle.
- High precision reduction gears are preferred for intermittent duty cycles (S3-S8): the output speed in applications is inverted-variable. The S1 continuous duty cycle needs to be consulted with manufacturer
- Please consult the maximum speed in duty cycle with the manufacturer
- The values in the table refer to the ambient temperature of 20 °C to 25 °C
- For ambient temperatures lower than -10 °C pre-heating might be considered please consult manufacturer

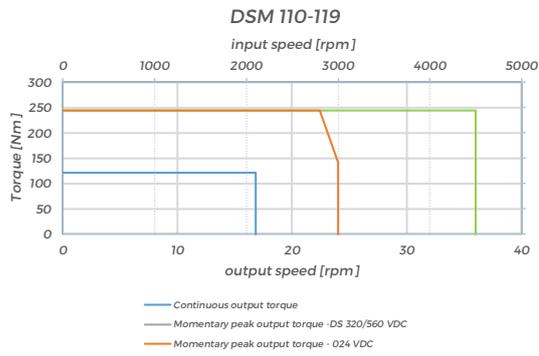
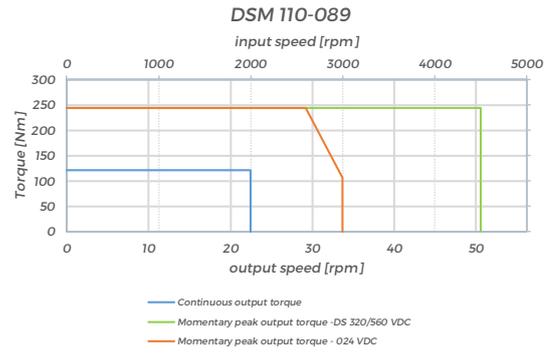
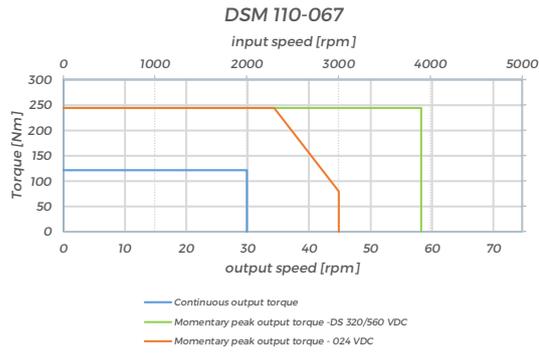
Tab. 8.4c: Inertia at input (DSM actuator without brake)

Feedback type (d)	$J_{w/o\ brake}$	DSM 050	DSM 070	DSM 095	DSM 110
OA	10^{-4} kgm^2	0.062	0.420	1.657	1.825
OB	10^{-4} kgm^2	0.061	0.487	1.646	1.814
OC	10^{-4} kgm^2	0.061	0.487	1.646	1.814
OD	10^{-4} kgm^2	0.037	0.416	1.640	1.830
OE	10^{-4} kgm^2	0.037	0.416	1.640	1.830
OF	10^{-4} kgm^2	-	-	1.661	-
OG	10^{-4} kgm^2	-	-	1.661	-
OH	10^{-4} kgm^2	-	0.416	1.661	1.830
OK	10^{-4} kgm^2	0.060	-	-	-
OL	10^{-4} kgm^2	0.060	-	-	-

Tab. 8.4d: Inertia at input (DSM actuator with brake)

Feedback type (d)	$J_{w/o\ brake}$	DSM 050	DSM 070	DSM 095	DSM 110
OA	10^{-4} kgm^2	0.121	0.780	1.707	2.193
OB	10^{-4} kgm^2	0.101	0.853	1.695	2.182
OC	10^{-4} kgm^2	0.101	0.853	1.695	2.182
OD	10^{-4} kgm^2	0.101	0.778	1.689	2.196
OE	10^{-4} kgm^2	0.101	0.778	1.689	2.196
OF	10^{-4} kgm^2	-	-	1.711	-
OG	10^{-4} kgm^2	-	-	1.711	-
OH	10^{-4} kgm^2	-	0.778	1.711	2.196
OK	10^{-4} kgm^2	0.100	-	-	-
OL	10^{-4} kgm^2	0.100	-	-	-

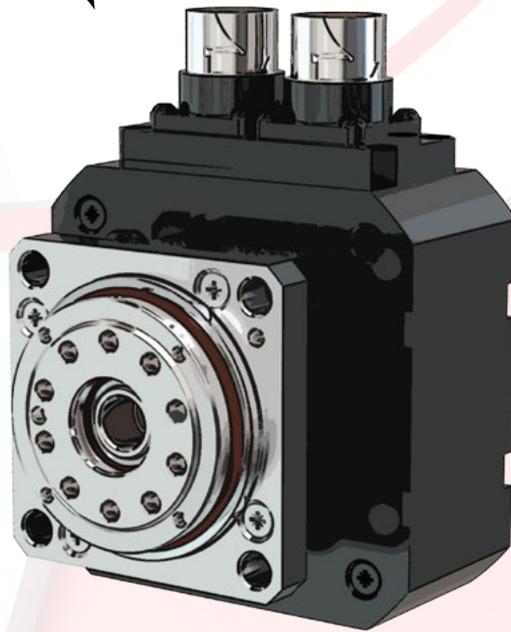






Small dimensions and compact design

Very low mass



Torque density

*Short axial length
pancake design*

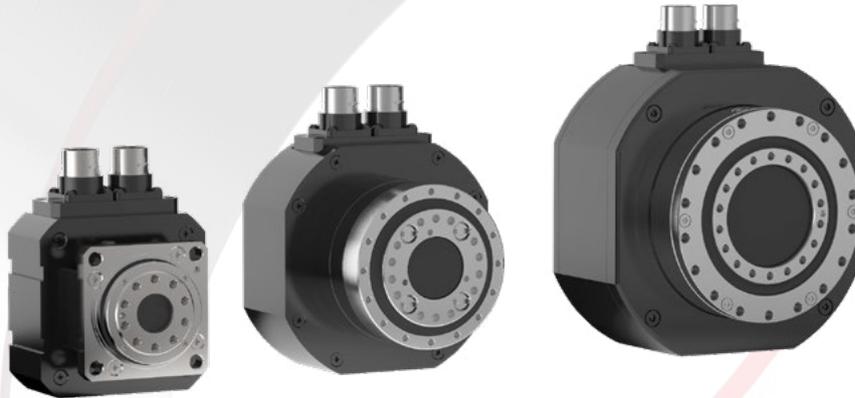


DSF series

AND YET IT IS FLAT

DSF

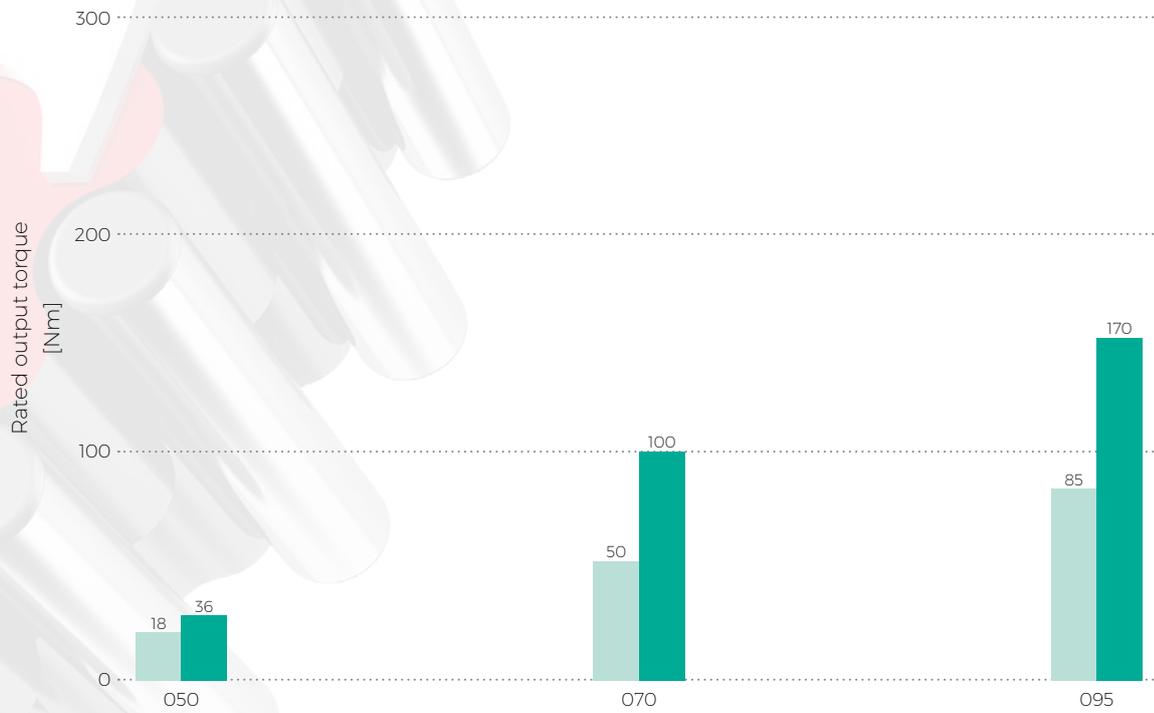
8.5 DSF series



Advantages

- low mass
- compact design
- extremely short axial length
- high torque density
- high dynamic performance
- high moment overload capacity

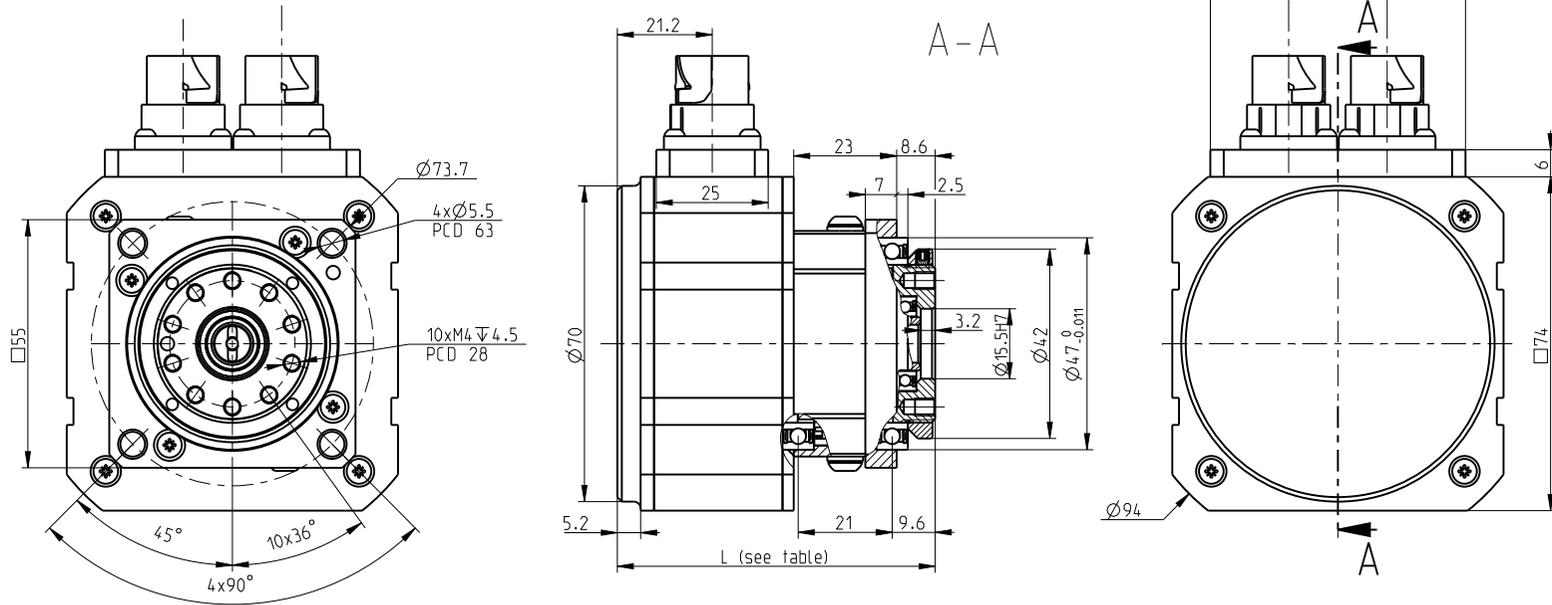
The **DriveSpin® DSF** "flat" series of electric actuators is characterized by the extremely short axial length with focus on maintaining the key features of the DriveSpin®. The DSF series was designed to be the most compact solution with very low mass and small dimensions. The DS "Flat" series consists of TwinSpin® reduction gear, servomotor and various feedback systems to be fully compatible with customer requirements. The TwinSpin® reduction gear used in the DSF actuators secures high accuracy, positioning repeatability, torsional stiffness as well as high carrying load due to the implemented bearing systems. Rated torque range of the DSF series is from 12Nm to the 85 Nm.



Tab. 8.5a: Rated output torque

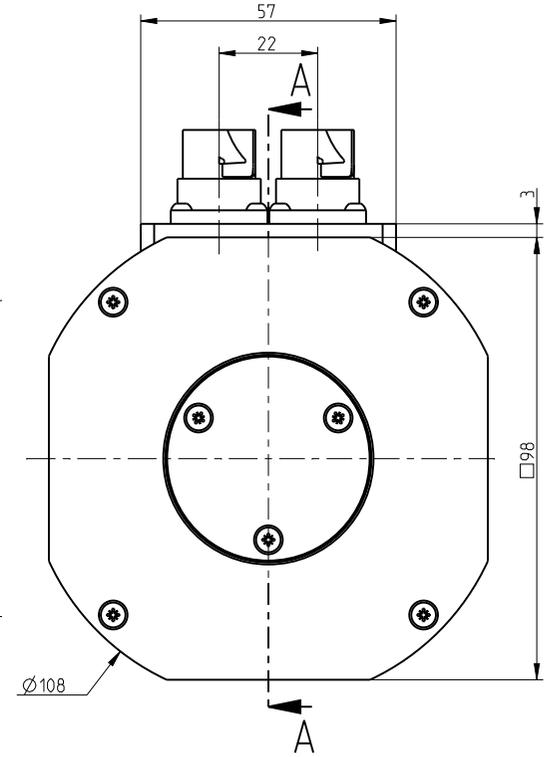
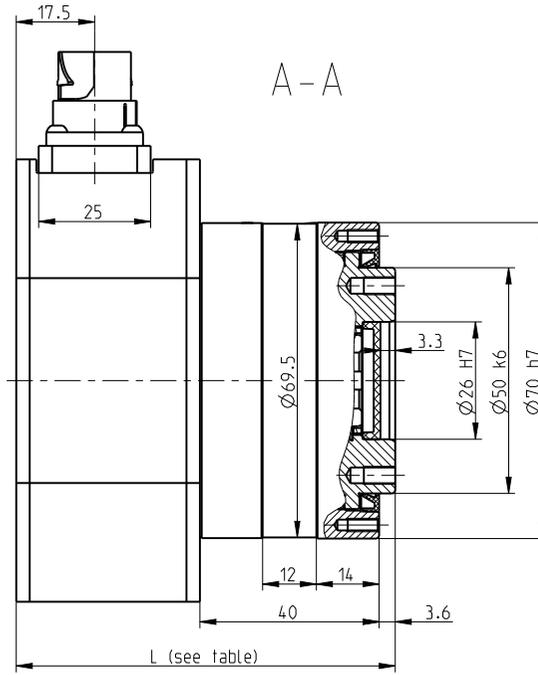
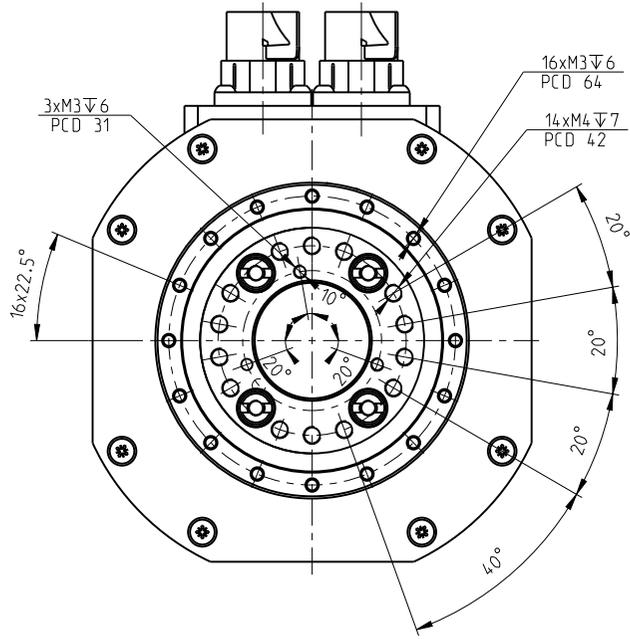
Size		050	070	095
Rated output torque	T_r [Nm]	18	50	85
Acceleration/ braking output torque	T_{max} [Nm]	36	100	170

DSF 050 - i - abcde-fg-xy



Size	Feedback type (d)	Without brake		With brake	
		Dimension L ± 0.5 [mm]	Weight m [kg] *	Dimension L ± 0.5 [mm]	Weight m [kg] *
DSF 050	OD,OE	71	1.2	94	1.4
	OJ	71	1.2	94	1.4
	ON	71	1.2	94	1.4

DSF 070 - i - abcde-fg-xy

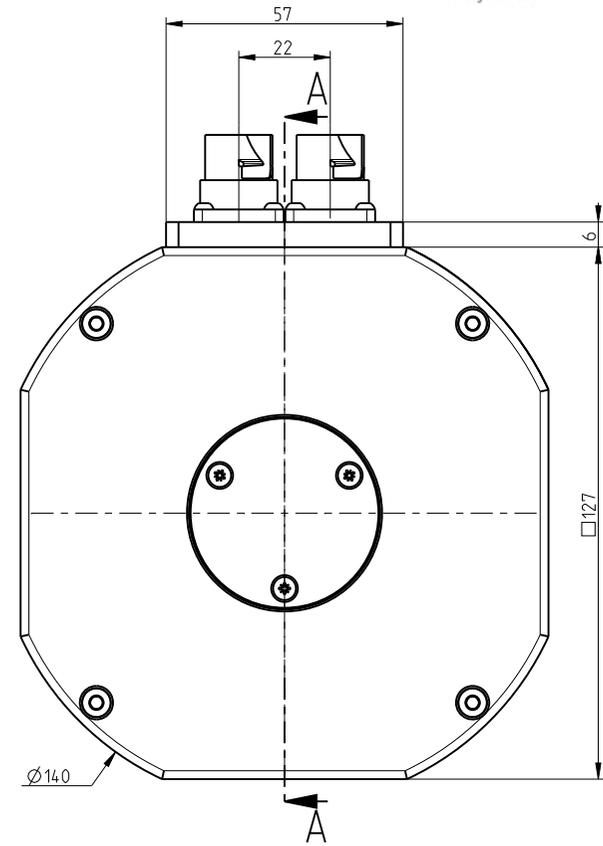
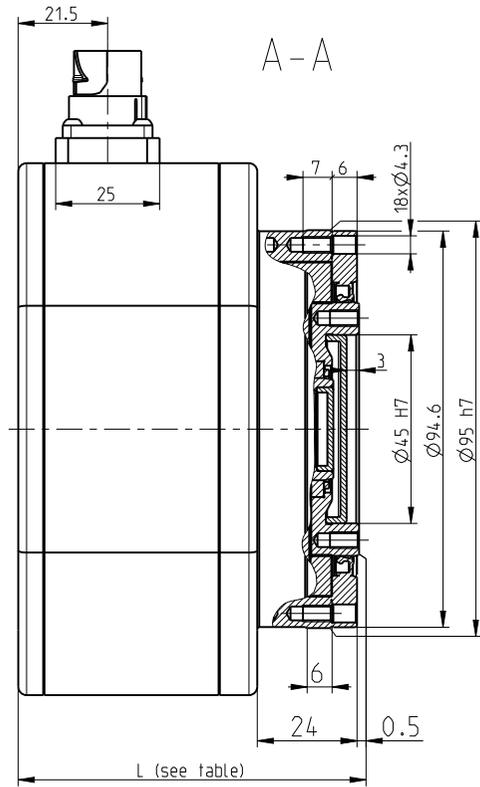
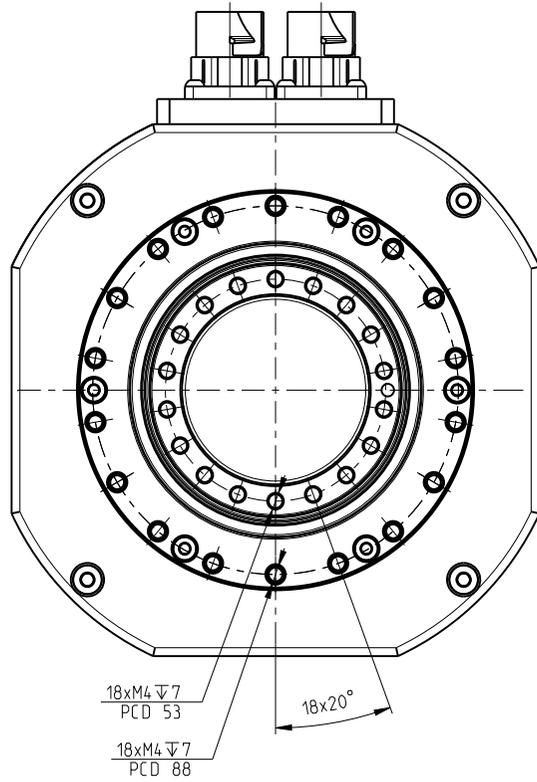


Drawings



Size	Feedback type (d)	Without brake		With brake	
		Dimension L ± 0.5 [mm]	Weight m [kg] *	Dimension L ± 0.5 [mm]	Weight m [kg] *
DSF 070	OA	92	3.5	-	-
	OB,OC	97	3.5	-	-
	OD,OE	92	3.5	-	-
	OM,ON	85	3.5	-	-

DSF 095 - i - abcde-fg-xy



Size	Feedback type (d)	Without brake		With brake	
		Dimension L \pm 0.5 [mm]	Weight m [kg] *	Dimension L \pm 0.5 [mm]	Weight m [kg] *
DSF 095	OA	93	4.5	-	-
	OB,OC	93	4.5	-	-
	OD,OE	93	4.5	-	-
	OJ	93	4.5	-	-
	OM,ON	82	4.5	-	-

Tab. 8.5b: DSF series technical data table

Reduction Gear parameters		Tolerance		DSF 050	
Reduction ratio	i			63	
Rated output torque	T_r [Nm]			18	
Acceleration/braking output torque	T_{max} [Nm]			36	
Rated input speed	n_r [rpm]			2 000	
Maximum allowable input speed ⁹⁾	n_{max} [rpm]			5 000	
Allowable moment ²⁾³⁾	M_{cmax} [Nm]			44	
Tilting stiffness ¹⁾⁶⁾	M_t [Nm/arcmin]			4	
Torsional stiffness ¹⁾⁷⁾	k_t [Nm/arcmin]			2.5	
Lost motion	LM [arcmin]			< 1.5	
Hysteresis	H [arcmin]			< 1.5	
Rated radial force ²⁾	F_{rR} [kN]			1.44 ⁸⁾	
Maximum axial force ²⁾⁴⁾	$F_{a max}$ [kN]			1.9	
Gear lubrication				Grease Castrol TRIBOL GR TT 1 PD	
Reduction gear limit temperature	[°C]			65 °C	
Standard ambient temperature range	[°C]			-10 °C to +40 °C	
Motor parameters					
DC BUS voltage	U_{dc} [V _{dc}]	+/- 10%	24	320	560
Motor rated speed	n_n [rpm]		On request	3 500	3 500
Motor rated torque	M_n [Nm]	+/- 10%		0.3	0.3
Motor rated current	I_n [A _{rms}]			2	2
Motor stall torque	M_o [Nm]	+/- 10%		0.3	0.3
Motor stall current	I_o [A _{rms}]			2	2
Motor peak torque	M_{max} [Nm]	+/- 10%		1.2	1.2
Motor peak current	I_{max} [A]			8	8
Motor back-EMF constant	K_E [V _{peak} /krpm]	+/- 10%		12	12
Motor torque constant	K_T [Nm/A _{rms}]	+/- 10%		0.15	0.15
Terminal resistance (L-L)	R_{2ph} [Ω]	+/- 10%		4.4	4
Terminal inductance (L-L)	L_{2ph} [mH]	+/- 20%		6	6
Number of poles	2p			10	10
Electromagnetic brake DC supply	[V _{dc}]			24. Special	
Electromagnetic brake torque at input	[Nm]			0.4	
Protection class			IP 64		
Motor Insulation class			F		
Paint			RAL 9005		
Motor number of phases			3		
Motor type of connection			Y(star-configuration)		

1) Mean statistical value

2) Load at output speed 32 rpm for size 050, other sizes at 15 rpm

 3) Moment M_c max at $F_a=0$. If $F_a \neq 0$ see Glossary

 4) Axial force F_a max for $M_c=0$ (In case of size 050 also $F_r=0$ condition has to be fulfilled). If $M_c \neq 0$ see Glossary

5) 3 900 rpm for ratio 67 : 4 500 rpm for ratios 89, 119

6) The parameter depends on the version of high precision reduction gear.

7) The parameter depends on the version, ratio and lost motion of the high precision reduction gear.

 8) For size 050 this is value of MAXIMUM RADIAL FORCE $F_{r max}$ for $a_2=0$; $F_a=0$ and at 32 rpm output speed. For $a_2>0$; $F_a=0$ at 32 rpm output speed $F_{r max} = 44/(a_2+0.0305)$. a_2 represents the distance of the radial force centre from the front of the output flange in meters see Glossary

9) Instantaneous speed peak that may occur within the working cycle. Note please the temperature on the gear case that should not exceed significantly 60°C

10) 4 500 rpm for ratio 73 : 4 800 rpm for ratio 95

Tab. 8.5b: DSF series technical data table - continued

DSF 070			DSF 095		
	57.75			73.95	
	50			85	
	100			170	
	2 000			2 000	
	5 000			4 500 / 4 800 ¹⁰⁾	
	142			410	
	35			120	
	7			15	
	< 1.5			< 1	
	< 1.5			< 1	
	2.8			3.5	
	4.1			11.1	
	Grease Castrol TRIBOL GR TT 1 PD			Grease Castrol TRIBOL GR TT 1 PD	
	65 °C			60 °C	
	-10 °C to +40 °C			-10 °C to +40 °C	
24	320	560	24	320	560
On request	3 000	3 000	On request	2 500	2 500
	1	1		1.8	1.8
	2	1.12		2.6	1.5
	1.08	1.08		1.8	1.8
	2.2	1.2		2.6	1.5
	3	3		4.3	4.3
	6	3.4		6.2	3.6
	44.37	84		61.2	111
	0.5	0.89		0.692	1.2
	5.2	14.5		3.9	14
	9.8	30		7.8	26
16	16	20	20		
24. Special			24. Special		
4.5			4.5		
IP 64			IP 64		
F			F		
RAL 9005			RAL 9005		
3			3		
Y(star-configuration)			Y(star-configuration)		

IMPORTANT NOTES:

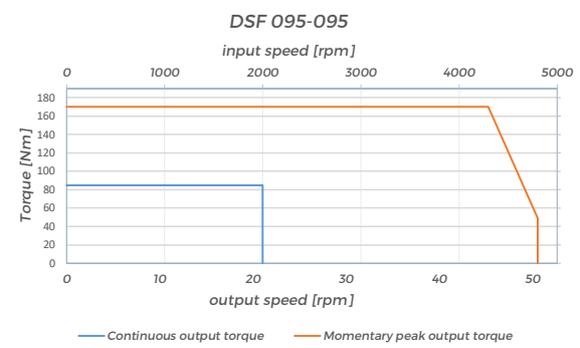
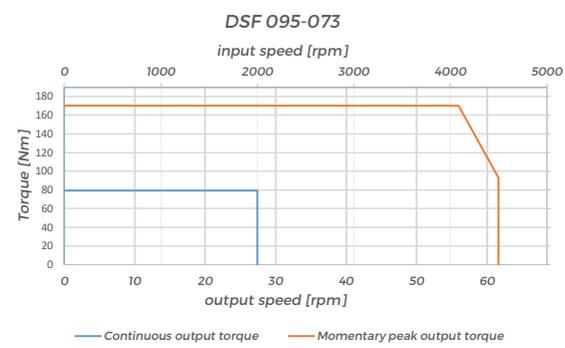
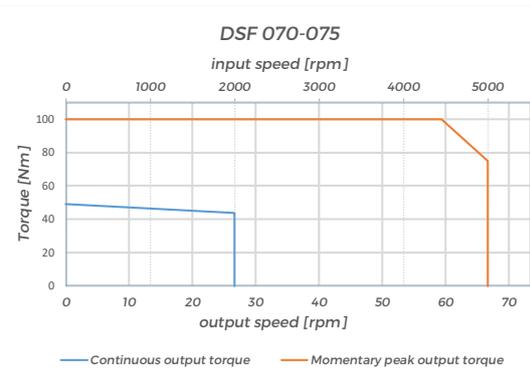
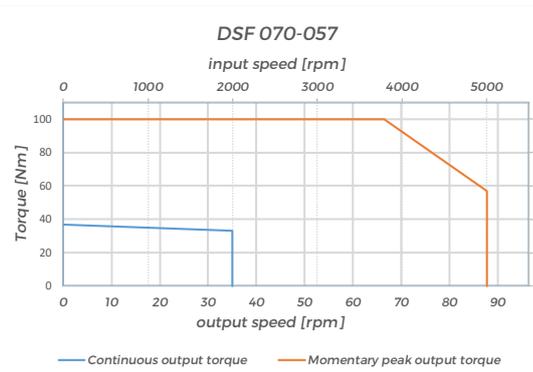
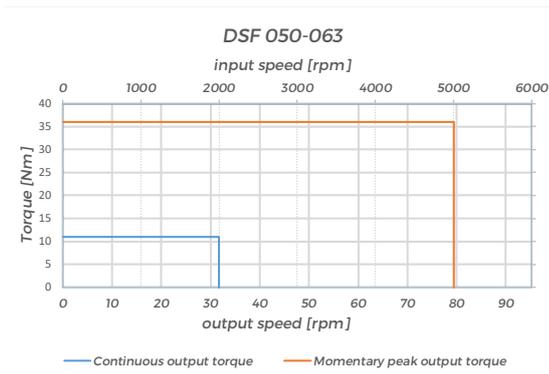
- Load values in the table are valid for the nominal lifetime $L_{10} = 6\,000$ hours excluding DSF 095 where values are valid for $L_{10} = 12\,000$ hours. Service life for average torque T_a and average speed n_a other than rated n_r , T_r can be recalculated. Please contact manufacturer with estimated duty cycle.
- High precision reduction gears are preferred for intermittent duty cycles (S3-S8): the output speed in applications is inverted-variable. The S1 continuous duty cycle needs to be consulted with manufacturer
- Please consult the maximum speed in duty cycle with the manufacturer
- The values in the table refer to the ambient temperature of 20°C to 25°C
- For ambient temperatures lower than -10°C pre-heating might be considered please consult manufacturer

Tab. 8.5c: Inertia at input (DSF actuator without brake)

Feedback type (d)	$J_{w/o\ brake}$	DSF 050	DSF 070	DSF 095
OA	10^{-4} kgm^2	–	0.637	3.349
OB	10^{-4} kgm^2	–	0.615	3.330
OC	10^{-4} kgm^2	–	0.615	3.330
OD	10^{-4} kgm^2	0.094	0.617	3.332
OE	10^{-4} kgm^2	0.094	0.617	3.332
OJ	10^{-4} kgm^2	0.091	–	3.330
OM	10^{-4} kgm^2	–	0.630	3.346
ON	10^{-4} kgm^2	0.105	0.630	3.346

Tab. 8.5d: Inertia at input (DSF actuator with brake)

Feedback type (d)	$J_{w/o\ brake}$	DSF 050	DSF 070	DSF 095
OA	10^{-4} kgm^2	–	–	–
OB	10^{-4} kgm^2	–	–	–
OC	10^{-4} kgm^2	–	–	–
OD	10^{-4} kgm^2	0.104	–	–
OE	10^{-4} kgm^2	0.104	–	–
OJ	10^{-4} kgm^2	0.102	–	–
OM	10^{-4} kgm^2	–	–	–
ON	10^{-4} kgm^2	0.118	–	–



9. Configuration matrix

Tab. 9.a: Feedback availability matrix

(d) Feedback type	DS 050	DS 060	DS 070	DS 095	DS 110	DS 115	DS 140	DS 155
OA Resolver	✓	✓	✓	✓	✓	✓	✓	✓
OB Absolute Singleturn Encoder Hiperface	✓	✓	✓	✓	✓	✓	✓	✓
OC Absolute Multiturn Encoder Hiperface	✓	✓	✓	✓	✓	✓	✓	✓
OD Absolute Singleturn Encoder EnDat	✓	✓	✓	✓	✓	✓	✓	✓
OE Absolute Multiturn Encoder EnDat	✓	✓	✓	✓	✓	✓	✓	✓
OF Absolute Singleturn Encoder EnDat + sin/cos	○	○	✓	○	○	○	✓	○
OG Absolute Multiturn Encoder EnDat + sin/cos	○	○	✓	○	○	○	✓	○
OH Incremental sin/cos Encoder + sin/cos Commutation	✗	✓	✓	✓	✓	✓	✓	✓
OJ Incremental A/B/I Encoder + Block Commutation	✓	✓	✓	○	○	✓	○	○
OK Absolute Singleturn Encoder Hiperface DSL	✓	✗	✓	✓	✓	✓	○	✓
OL Absolute Multiturn Encoder Hiperface DSL	✓	✗	✓	✓	✓	✓	○	✓
OM Absolute Singleturn Encoder BiSS	○	✗	○	○	○	✓	○	✓
ON Absolute Multiturn Encoder BiSS	○	✗	○	○	○	✓	○	✓
OP Absolute Singleturn Encoder DRIVE-CLiQ	○	✗	✓	✓	✓	○	○	○
OQ Absolute Multiturn Encoder DRIVE-CLiQ	○	✗	✓	✓	✓	○	○	○
OR Absolute Multiturn Fanuc	✗	✗	✓	✓	✓	○	○	○
OS Absolute Singleturn Fanuc	✗	✗	✓	✓	✓	○	○	○

✓ Available ✗ Not available ○ On request

Tab. 9.b: Feedback types and signal wiring diagrams matrix

(d) Feedback type	(g) Signal wiring diagram	Position Feedback
OA Resolver	I for Terminal cable	Analogue sin/cos tracks
	J for Connectors	
OB Absolute Singleturn Encoder Hiperface	G for Terminal cable	via Hiperface protocol
	H for Connectors	
OC Absolute Multiturn Encoder Hiperface	G for Terminal cable	via Hiperface protocol
	H for Connectors	
OD Absolute Singleturn Encoder EnDat	A for Terminal cable	via Endat protocol
	B for Connectors	
OE Absolute Multiturn Encoder EnDat	A for Terminal cable	via Endat protocol
	B for Connectors	
OF Absolute Singleturn Encoder EnDat + sin/cos	C for Terminal cable	via Endat protocol
	D for Connectors	
OG Absolute Multiturn Encoder EnDat + sin/cos	C for Terminal cable	via Endat protocol
	D for Connectors	
OH Incremental sin/cos Encoder + sin/cos Commutation	E for Terminal cable	TVpp sin/cos tracks
	F for Connectors	
OJ Incremental A/B/I Encoder + Block Commutation	N for Terminal cable	Rectangular A/B tracks and Index mark once per revolution
	O for Connectors	
OK Absolute Singleturn Encoder Hiperface DSL	J1 for Terminal cable	via Hiperface DSL protocol
	H1 for Connectors	
OL Absolute Multiturn Encoder Hiperface DSL	J1 for Terminal cable	via Hiperface DSL protocol
	H1 for Connectors	
OM Absolute Singleturn Encoder BiSS	R for Terminal cable	via BiSS protocol
	S for Connectors	
ON Absolute Multiturn Encoder BiSS	R for Terminal cable	via BiSS protocol
	S for Connectors	
OP Absolute Singleturn Encoder DRIVE-CLiQ	T for Terminal cable	via Drive-CLiQ protocol
	U for Connectors	
OQ Absolute Multiturn Encoder DRIVE-CLiQ	T for Terminal cable	via Drive-CLiQ protocol
	U for Connectors	
OR Absolute Multiturn Fanuc	A for Terminal cable	via Fanuc serial αi protocol
	B for Connectors	
OS Absolute Singleturn Fanuc	A for Terminal cable	via Fanuc serial αi protocol
	B for Connectors	

Tab. 9.a: Feedback availability matrix - continued

DSM 050	DSM 070	DSM 095	DSM 110	DSH 050	DSH 070	DSH 085	DSH 110	DSH 115	DSH 125	DSH 155	DSH 170	DSF 050	DSF 070	DSF 095
✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	○	✓	✓
✓	✓	✓	✓	○	✗	✓	○	✓	✓	✓	✓	○	✓	✓
✓	✓	✓	✓	○	✗	✓	○	✓	✓	✓	✓	○	✓	✓
✓	✓	✓	✓	✗	○	✓	○	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✗	○	✓	○	✓	✓	✓	✓	✓	✓	✓
○	○	○	○	✗	○	○	○	○	○	○	○	○	○	○
○	○	○	○	✗	✗	○	✗	✗	✗	✗	○	○	○	○
✗	✓	✓	✓	✗	✗	○	✗	✗	✗	✗	○	✗	○	○
○	○	○	○	✓	✓	○	○	○	○	○	○	✓	○	○
✓	○	○	○	✗	✗	✗	✗	✗	✗	✗	✗	○	○	○
✓	○	○	○	✗	✗	✗	✗	✗	✗	✗	✗	○	○	○
○	✓	○	○	✓	○	✓	○	○	✓	○	○	✓	✓	✓
○	✓	○	○	✓	✓	✓	○	○	✓	○	✓	✓	✓	✓
○	✗	○	○	✗	○	✗	○	✗	✗	✗	○	○	○	○
○	✗	○	○	✗	○	✗	○	✗	✗	✗	○	○	○	○
✗	○	○	○	✗	○	✗	○	✗	✗	✗	○	✗	○	○
✗	○	○	○	✗	○	✗	○	✗	✗	✗	○	✗	○	○

✓ Available ✗ Not available ○ On request

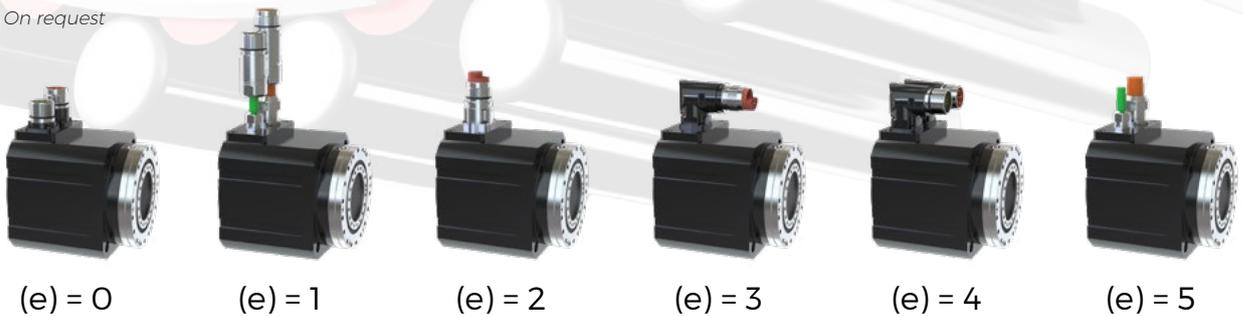
Tab. 9.b: Feedback types and signal wiring diagrams matrix - continued

Position resolution	Commutation type	Additional Incremental signals	Additional signals Resolution
1 line per revolution	via Position Feedback Absolute Position	-	-
Number of bits per revolution	via Position Feedback Absolute Position	1Vpp sin/cos 1)	Number of lines per revolution
Number of bits per revolution + Number of revolutions	via Position Feedback Absolute Position	1Vpp sin/cos 1)	Number of lines per revolution
Number of bits per revolution	via Position Feedback Absolute Position	-	-
Number of bits per revolution + Number of revolutions	via Position Feedback Absolute Position	-	-
Number of bits per revolution	via Position Feedback Absolute Position	1Vpp sin/cos	Number of lines per revolution
Number of bits per revolution + Number of revolutions	via Position Feedback Absolute Position	1Vpp sin/cos	Number of lines per revolution
Number of lines per revolution	1 sin/cos track over one revolution for coarse absolute position of commutation angle		1 line per revolution
Number of counts per revolution	U/V/W states (Halls states) for block commutation		Motor poles dependant
Number of bits per revolution	via Position Feedback Absolute Position	-	-
Number of bits per revolution + Number of revolutions	via Position Feedback Absolute Position	-	-
Number of bits per revolution	via Position Feedback Absolute Position	-	-
Number of bits per revolution + Number of revolutions	via Position Feedback Absolute Position	-	-
Number of bits per revolution	via Position Feedback Absolute Position	-	-
Number of bits per revolution + Number of revolutions	via Position Feedback Absolute Position	-	-
Number of bits per revolution + Number of revolutions	via Position Feedback Absolute Position	-	-
Number of bits per revolution	via Position Feedback Absolute Position	-	-

Tab. 9.c: Type of electrical connection (e) and power wiring diagrams (f)

Type and size	DC Bus Voltage	(e) = 0		(e) = 1		(e) = 2			(e) = 3		
		Straight connectors 923/623	Straight connectors 915/615	Connector on cable directed upward 923/623	Connector on cable directed upward 915/615	Hybrid Straight connectors 723 (Hiperface DSL only)	Hybrid Straight connectors 923 (Hiperface DSL only)	Hybrid Straight connectors 915 (Hiperface DSL only)	Hybrid Angled rotatable connectors 723 (Hiperface DSL only)	Hybrid Angled rotatable connectors 923 (Hiperface DSL only)	Hybrid Angled rotatable connectors 915 (Hiperface DSL only)
DSx xxx	(a)	✓/○/✗	✓/○/✗	✓/○/✗	✓/○/✗	✓/○/✗	✓/○/✗	✓/○/✗	✓/○/✗	✓/○/✗	✓/○/✗
DSx 050	24VDC										
	320VDC	✗	✓	✓	○	○	○	○	○	○	○
	560VDC										
DS 060	24VDC										
	320VDC	✗	✓	✓	○	○	○	○	○	○	○
	560VDC										
DSx 070	24VDC										
	320VDC	✓	○	✓	○	○	○	○	○	○	○
	560VDC										
DS 085	24VDC										
	320VDC	✓	○	✓	○	○	○	○	○	○	○
	560VDC										
DSx 095	24VDC		✗		✗			✗			✗
	320VDC	✓	○	✓	○	○	○	○	○	○	○
	560VDC										
DSx 110	24VDC		✗		✗	✗	✗	✗	✗	✗	✗
	320VDC	✓	○	✓	○	○	○	○	○	○	○
	560VDC										
DSx 115	24VDC	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
	320VDC	✓	○	✓	○	○	○	○	○	○	○
	560VDC										
DSH 125	24VDC	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
	320VDC	✓	○	✓	○	○	○	○	○	○	○
	560VDC										
DS 140	24VDC	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
	320VDC	✓	○	✓	○	○	○	○	○	○	○
	560VDC										
DSx 155	24VDC	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
	320VDC	✓	○	✓	○	○	○	○	○	○	○
	560VDC										
DSH 170	24VDC	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
	320VDC	✓	○	✓	○	○	○	○	○	○	○
	560VDC										

- ✓ Available
- ✗ N/A - Not available
- On request



Tab. 9.c: Type of electrical connection (e) and power wiring diagrams (f) - continued

DC Bus Voltage	(e) = 4		(e) = 5	(e) = 6	(e) = 7	(e) = 8	(e) = B		(e) = C	
	Angled rotatable connectors 923/623	Angled rotatable connectors 915/615	Cable upwards	Y-tec connector 915/615	Cable forwards	Cable backwards	Connector on cable directed forward 923/623	Connector on cable directed forward 915/615	Connector on cable directed backward 923/623	Connector on cable directed backward 915/615
(a)	✓/o/x	✓/o/x	✓/o/x	✓/o/x	✓/o/x	✓/o/x	✓/o/x	✓/o/x	✓/o/x	✓/o/x
24VDC										
320VDC	x	o	✓	✓	✓	✓	✓	o	✓	o
560VDC										
24VDC										
320VDC	x	o	✓	✓	✓	✓	✓	o	✓	o
560VDC										
24VDC										
320VDC	✓	o	✓	✓	o	o	✓	o	✓	o
560VDC										
24VDC										
320VDC	✓	o	✓	✓	o	o	✓	o	✓	o
560VDC										
24VDC		x		x				x		x
320VDC	✓	o	✓	o	o	o	✓	o	✓	o
560VDC										
24VDC		x		x			o	x	o	x
320VDC	✓	o	✓	o	o	o	✓	o	✓	o
560VDC										
24VDC	x	x		x			x	x	x	x
320VDC	✓	o	✓	o	o	o	✓	o	✓	o
560VDC										
24VDC	x	x	o	x	o	✓	x	x	x	x
320VDC	✓	o	o	o	o	o	✓	o	✓	o
560VDC										
24VDC	x	x		x			x	x	x	x
320VDC	✓	o	✓	o	o	o	✓	o	✓	o
560VDC										
24VDC	x	x		x			x	x	x	x
320VDC	✓	✓	✓	✓	✓	✓	✓	o	✓	o
560VDC										

- ✓ Available
- x N/A - Not available
- o On request



(e) = 6



(e) = 7



(e) = 8



(e) = B



(e) = C

Tab. 9.d: Power connection: Connectors and Terminal cable

Connector type	923 (6 pin, rotation E)		923 (8 pin, rotation E)		923 (8 pin, rotation E)		Terminal cable		
Power wiring diagram (f)	A		B		C		D		
	Pin	Signal	Pin	Signal	Pin	Signal	Colour	Mark	Signal
	1	U	1	U	1	Brake+ ¹⁾	Green/Yellow		PE
	2	V	2	PE	2	Brake- ¹⁾	-	1	U
	3	PE	3	W	3	therm+ ²⁾	-	2	V
	4	Brake+ ¹⁾	4	V	4	therm- ²⁾	-	3	W
	5	Brake- ¹⁾	A	Brake+ ¹⁾	5	N/C	White	or 4	Brake+ ¹⁾
	6	W	B	Brake- ¹⁾	A	U	Brown	or 5	Brake- ¹⁾
	-	-	C	N/C	B	W			
	-	-	D	N/C	C	V			
	-	-	-	-	PE	PE			
Pinout (for actuators with connectors and cables directed upwards / forwards / backwards with connector, e=0, 1, 4, 6, B, C)	Connector type 923 (6 pin, rotation E)	Connector type 923 (8 pin, rotation E)		Connector type 915 (9 pin, rotation E)					
Pinout (for cables between actuator and servo drive, CAB-POW-XXX-XX- XXX-XXX)	Connector type 923 (6 pin, rotation P)	Connector type 923 (8 pin, rotation P)		Connector type 915 (9 pin, rotation P)					

NOTES:

- N/C - Not Connected
- ¹⁾ Only connected in actuators with option Electromagnetic brake
- ²⁾ Only connected in combination with Signal wiring diagram (g)=0

NOTES:

- N/C - Not Connected
- 1) BAT use with EBI 135 and EBI 1135 with multiturn function powered via battery instead of **Sensor** which is internally connected to corresponding supply line, and may be used for remote sense and control of power supply
- 2) Only connected in combination with Signal wiring diagram (g)=0
- 3) C/D signals for sin/cos commutation
- 4) In case of type of electrical connection with connector type 915/615 series thermistor are connected in **POWER** part of wiring diagram
(f) = C to pins **3 = therm+** and **4 = therm-**
- 5) U/V/W signals for block commutation

Tab. 9.e: Signal connection: Connectors

Connector type	623 (12 pin, rotation E) 615 (12 pin, rotation E)					623 (17 pin, rotation E) 615 (15 pin, rotation E)			617 (10 pin, rotation E)	
Signal wiring diagram (g)	B	B	H	J	S	D	F (Only 623 17 pin connector)	O	U	
Feedback type (d)	EnDat	Fanuc ai	Hiperface	Reslover	BiSS-C	EnDat + sin/cos	Incremental sin/cos + sin/cos commutation	Incremental A/B/I + block commutation	Drive-CLiQ	
Pin	Signal									
1	Up (supply)	Up (supply)	Us (supply)	N/C	Us (supply)	B-	A+	A+	TxP	
2	Sensor Up/VBAT ¹⁾	Sensor Up	GND (supply)	therm+	N/C	0 V (supply)	A-	A-	TxN	
3	0 V (supply)	0 V (supply)	+COS	S4	GND (supply)	A-	R+	B+	N/C	
4	Sensor OV/ 0 VBAT ¹⁾	Sensor OV	REFCOS	S3	N/C	Up (supply)	D- ³⁾	B-	N/C	
5	DATA+	DATA+	REFSIN	R2 (supply)	MA+	DATA+	C+ ³⁾	I+	RxP	
6	DATA-	DATA-	+SIN	therm-	MA-	N/C	C- ³⁾	I-	RxN	
7	CLOCK+	Request+	therm+	S2	SLO+	therm+	0 V (supply)	U+ ⁵⁾	N/C	
8	CLOCK-	Request-	therm-	S1	SLO-	CLOCK+	therm+	U- ⁵⁾	N/C	
9	N/C	N/C	DATA+	R1 (supply)	N/C	B+	therm-	V+ ⁵⁾	Up (supply)	
10	N/C	N/C	DATA-	N/C	N/C	Sensor 0 V ²⁾	Up (supply)	V- ⁵⁾	0 V (supply)	
11	therm+	therm+	N/C	N/C	therm+	A+	B+	W+ ⁵⁾		
12	therm-	therm-	N/C	N/C	therm-	Sensor Up ²⁾	B-	W- ⁵⁾		
13	N/C	N/C	N/C	N/C	N/C	DATA-	R-	Us (supply)		
14	N/C	N/C	N/C	N/C	N/C	therm-	D+ ³⁾	GND (supply)		
15	N/C	N/C	N/C	N/C	N/C	CLOCK-	Sensor 0 V ²⁾	therm+ ⁴⁾		
16	N/C	N/C	N/C	N/C	N/C	N/C	Sensor Up ²⁾	therm- ⁴⁾		
17	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C		
Pinout (for actuators with connectors and cables directed upwards / forwards / backwards with connector, e=0, 1, 4, 6, B, C)	Connector type 623 (12 pin, rotation E)		Connector type 615 (12 pin, rotation E)			Connector type 623 (17 pin, rotation E)		Connector type 615 (15 pin, rotation E)		Connector type 617 (10 pin, rotation E)
Pinout (for cables between actuator and servo drive, CAB-POW-XXX-XX-XXX-XXX)	Connector type 623 (12 pin, rotation P)		Connector type 615 (12 pin, rotation P)			Connector type 623 (17 pin, rotation P)		Connector type 615 (15 pin, rotation P)		

Tab. 9.f. Signal connection: Terminal cable

Signal wiring diagram (g)		A	A	C	E	G	I	N	R	T
Feedback type (d)		EnDat	Fanuc α i	EnDat + sin/cos	Incremental sin/cos + sin/cos commutation	Hiperface	Resolver	Incremental A/B/I + block commutation	BiSS-C	Drive-CLiQ
Cable DIN 47100		Signal								
Core	Colour									
1	White	therm+	therm+	therm+	therm+	therm+	therm+	therm+	therm+	N/C
2	Brown	therm-	therm-	therm-	therm-	therm-	therm-	therm-	therm-	N/C
3	Green	Up (supply)	Up (supply)	Up (supply)	Up (supply)	Us (supply)	R1 (supply)	Us (supply)	Us (supply)	Up (supply)
4	Yellow	0 V (supply)	0 V (supply)	0 V (supply)	0 V (supply)	GND (supply)	R2 (supply)	GND (supply)	GND (supply)	0 V (supply)
5	Grey	DATA+	DATA+	DATA+	D+ ³⁾	DATA+	S1	A+	SLO+	RXP
6	Pink	DATA-	DATA-	DATA-	D- ³⁾	DATA-	S2	A-	SLO-	RXN
7	Blue	CLOCK+	Request+	CLOCK+	C+ ³⁾	+SIN	S3	B+	MA+	TXP
8	Red	CLOCK-	Request-	CLOCK-	C- ³⁾	+COS	S4	B-	MA-	TXN
9	Black	Sensor Up/UBAT ¹⁾	Sensor Up	Sensor Up ²⁾	Sensor Up ²⁾	REFSIN	N/C	I+	N/C	N/C
10	Violet	Sensor OV/0 VBAT ¹⁾	Sensor OV	Sensor OV ²⁾	Sensor OV ²⁾	REFCOS	N/C	I-	N/C	N/C
11	Grey/Pink	N/C	N/C	A+	A+	N/C	N/C	U+ ⁵⁾	N/C	N/C
12	Red/Blue	N/C	N/C	A-	A-	N/C	N/C	U- ⁵⁾	N/C	N/C
13	White/Green	N/C	N/C	B+	B+	N/C	N/C	V+ ⁵⁾	N/C	N/C
14	Brown/Green	N/C	N/C	B-	B-	N/C	N/C	V- ⁵⁾	N/C	N/C
15	White/Yellow	N/C	N/C	N/C	R+	N/C	N/C	W+ ⁵⁾	N/C	N/C
16	Yellow/Brown	N/C	N/C	N/C	R-	N/C	N/C	W- ⁵⁾	N/aC	N/C
17	White/Grey	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C

NOTES:

- N/C - Not Connected
- ¹⁾ BAT use with EBI 135 and EBI 1135 with multiturn function powered via battery instead of **Sensor** which is internally connected to corresponding supply line, and may be used for remote sense and control of power supply
- ²⁾ Only connected in combination with Signal wiring diagram (g)=0
- ³⁾ C/D signals for sin/cos commutation
- ⁴⁾ In case of type of electrical connection with connector type 915/615 series thermistor are connected in **POWER** part of wiring diagram (f) = C to pins **3 = therm+** and **4 = therm-**
- ⁵⁾ U/V/W signals for block commutation

Tab. 9.g: Hybrid connection: Connectors and Terminal cable

Connector type	723 (7+2 pin, rotation E)		923 (8 pin, rotation E)		923 (8 pin, rotation E)		Terminal cable		
Hybrid wiring diagram (f) - Power + Hiperface DSL	H0		H1		H2		J1		
	Pin	Signal	Pin	Signal	Pin	Signal	Colour	Mark	Signal
	A	U	1	Brake+ ¹⁾	1	U	Green/Yellow	-	PE
	B	V	2	Brake- ¹⁾	2	PE	-	1	U
	C	W	3	DSL+	3	W	-	2	V
	D	N/C	4	DSL-	4	V	-	3	W
	PE	PE	5	N/C	A	Brake+ ¹⁾	White	or 4	Brake+ ¹⁾
	H	DSL+	A	U	B	Brake- ¹⁾	Black	or 5	Brake- ¹⁾
	L	DSL-	B	W	C	DSL+	White		DSL+
	7	Brake+ ¹⁾	C	V	D	DSL-	Blue		DSL-
8	Brake- ¹⁾	PE	PE						
Pinout (for actuators with hybrid connectors, e=2,3)	Connector type 723 (7+2 pin, rotation E)		Connector type 915 (9 pin, rotation E)		Connector type 923 (8 pin, rotation E)				

NOTES:

- N/C - Not Connected
- ¹⁾ Only connected in actuators with option Electromagnetic brake

Technical specifications of thermistors

Tab. 9.h: PTC 111-K13

$T_{NAT} = 140^{\circ}C$	
Resistance values according to DIN 44081 and DIN 44082	
Temperature range T [°C]	Resistance R [Ω]
-20 to 120	$R \leq 250$
120 to 135	$R \leq 550$
135 to 145	$R \leq 1330$
> 155	$R \leq 4000$

Tab. 9.i: PT1000

Temperature range T [°C]	Resistance R [Ω]
-40	843
-30	882
-20	922
-10	961
0	1000
10	1039
20	1078
30	1117
40	1155
50	1194
60	1232
70	1271
80	1309
90	1347
100	1385
110	1423
120	1461
130	1498
140	1536
150	1573
160	1611
170	1648
180	1685
190	1722
200	1759
210	1795
220	1832
230	1868
240	1905
250	1941

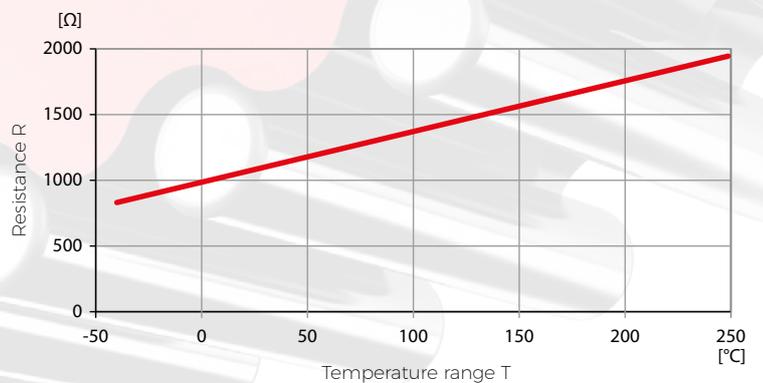


Fig. 9.10: Resistance / Temperature PT 1000

DS·DSH·DSM·DSF 050, 060 Identification Labels

	SPINEA		CE	
Ordering code	DS 050-i-abcde-fg-xy			
Serial number	000000	XXXXXX-XXXX	IP 64	Protection class
Motor stall torque	0.26 Nm	560 V	7 A	Motor rated current
Motor nominal speed	3500 rpm	<small>Made in EU</small>		
				Article number
				DC bus voltage

DS·DSH·DSM·DSF 070, 085, 095, 110, 115, 125, 140, 155, 170 Identification Labels

	SPINEA				CE	
Ordering code	Typ	ACTUATOR DSH 155-i-abcde-fg-xy		11/17		Week/Year
Serial number	SN	000000	M_o	5 Nm	IP 64	Protection class
Article number	Art.No	XXXXXX-XXXX	n_n	4000 rpm	Iso. Kl. F	Insulation class
Customer number	C.No	XXXXXX	U_{dc}	560 V	I_n	Motor rated current
						Motor stall torque
						Motor nominal speed
						DC bus voltage
	<small>Made in EU</small>					



Tab. 10.a: Ordering code for Cable

Description	Length	Connection type on actuator side	Wiring diagram on actuator side	Connection on servo drive side	Wiring diagram on servo drive side	Ordering code
Power cable, PUR 7x0.5 mm ² , shielded, 6 pin female Intercontec connector	On XXX position, defined as XXX meters (for example code 305 represent 30.5 meters)	923 (6 pin), rotation P	A	Without connector - free end	D	CAB-POW-XXX-00-01A-00D
Power cable, PUR 7x0.5 mm ² , shielded, 8 pin female Intercontec connector		923 (8 pin), rotation P	B		D	CAB-POW-XXX-00-02B-00D
Power cable, PUR 7x0.5 mm ² , shielded, 9 pin female Intercontec connector		915 (9 pin), rotation P	C		D	CAB-POW-XXX-00-03C-00D
Power cable, PUR 4x1 mm ² + 2x0.5 mm ² , shielded, C-track compatible, 6 pin female Intercontec connector		923 (6 pin), rotation P	A		D	CAB-POW-XXX-10-01A-00D
Power cable, PUR 4x1 mm ² + 2x0.5 mm ² , shielded, C-track compatible, 8 pin female Intercontec connector		923 (8 pin), rotation P	B		D	CAB-POW-XXX-10-02B-00D
Power cable, PUR 4x1 mm ² + 2x0.5 mm ² , shielded, C-track compatible, 9 pin female Intercontec connector		915 (9 pin), rotation P	C		D	CAB-POW-XXX-10-03C-00D
Power cable, PUR 4x1.5 mm ² + 2x0.5 mm ² , shielded, C-track compatible, 6 pin female Intercontec connector		923 (6 pin), rotation P	A		D	CAB-POW-XXX-11-01A-00D
Power cable, PUR 4x1.5 mm ² + 2x0.5 mm ² , shielded, C-track compatible, 8 pin female Intercontec connector		923 (8 pin), rotation P	B		D	CAB-POW-XXX-11-02B-00D
Power cable, PUR 4x1.5 mm ² + 2x0.5 mm ² , shielded, C-track compatible, 9 pin female Intercontec connector		915 (9 pin), rotation P	C		D	CAB-POW-XXX-11-03C-00D
Power cable, PUR 4x2.5 mm ² + 2x0.5 mm ² , shielded, C-track compatible, 6 pin female Intercontec connector		923 (6 pin), rotation P	A		D	CAB-POW-XXX-12-01A-00D
Power cable, PUR 4x2.5 mm ² + 2x0.5 mm ² , shielded, C-track compatible, 8 pin female Intercontec connector		923 (8 pin), rotation P	B		D	CAB-POW-XXX-12-02B-00D
Power cable, PUR 4x2.5 mm ² + 2x0.5 mm ² , shielded, C-track compatible, 9 pin female Intercontec connector		915 (9 pin), rotation P	C		D	CAB-POW-XXX-12-03C-00D
Power cable, PUR 4x4 mm ² + 2x1 mm ² , shielded, C-track compatible, 6 pin female Intercontec connector		923 (6 pin), rotation P	A		D	CAB-POW-XXX-13-01A-00D
Power cable, PUR 4x4 mm ² + 2x1 mm ² , shielded, C-track compatible, 8 pin female Intercontec connector		923 (8 pin), rotation P	B		D	CAB-POW-XXX-13-02B-00D
Power cable, PUR 4x4 mm ² + 2x1 mm ² , shielded, C-track compatible, 9 pin female Intercontec connector		915 (9 pin), rotation P	C		D	CAB-POW-XXX-13-03C-00D
Signal cable, PUR 10x0.14 mm ² , shielded, C-track compatible, 12 pin female Intercontec connector		On XXX position, defined as XXX meters (for example code 305 represent 30.5 meters)	623 (12 pin), rotation P		B/H/J/S	Without connector - free end
Signal cable, PUR 10x0.25 mm ² , shielded, C-track compatible, 12 pin female Intercontec connector	623 (12 pin), rotation P		B/H/J/S	A/G/I/R	CAB-SIG-XXX-01-01B (or H/J/S)-00A(or G/I/R)	
Signal cable, PUR 18x0.14 mm ² , shielded, C-track compatible, 17 pin female Intercontec connector	623 (17 pin), rotation P		D/F/O	C/E/N	CAB-SIG-XXX-02-02D (or F/O)-00C(or E/N)	
Signal cable, PUR 18x0.14 mm ² , shielded, C-track compatible, 15 pin female Intercontec connector	615 (15 pin), rotation P		D/F/O	C/E/N	CAB-SIG-XXX-02-04D (or F/O)-00C(or E/N)	

NOTES:

- Please consider cable length limits for used feedback type and cross sections of power cables

Ordering code example

CAB POW-305-00-01A-00D

00-: **Connection type on Servo drive side**

--D: **Wiring diagram on Servo drive side**

01-: **Connection type on Actuator side**

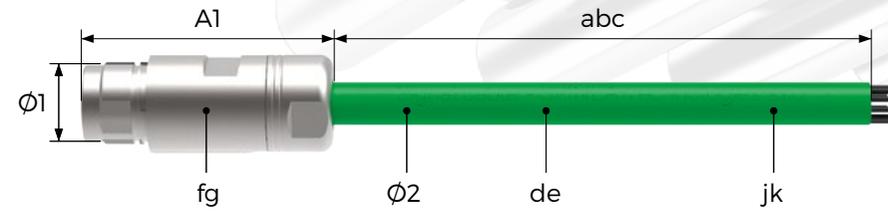
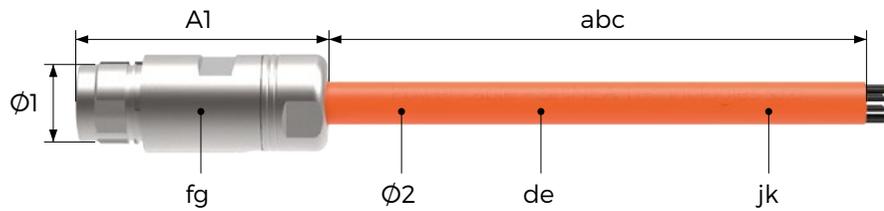
--A: **Wiring diagram on Actuator side**

00: Cable type - **Power cable PUR 7x0.5 mm²**

305: Length of cable - **30.5 meters**

POW: **Power cable**

CAB: **Cable**



Type	abc	Cable length
POW	XXX	Defined as XX.X meters (for example code 305 represent 30.5)
SIG		

Type	de	Cable	φ2 (mm)
POW	00	PUR 7x0.5 mm ²	7.2
	10	PUR 4x1 mm ² + 2x0.5 mm ²	9.6
	11	PUR 4x1.5 mm ² + 2x0.5mm ²	11
	12	PUR 4x2.5 mm ² + 2x0.5mm ²	12.8
	13	PUR 4x4 mm ² + 2x1 mm ²	14.8
SIG	00	PUR 10x0.14 mm ²	6.3
	01	PUR 10x0.25 mm ²	6.9
	02	PUR 18x0.14 mm ²	7.3

Type	jk	Cable length
POW	00	Without connector - free end
SIG	00	Without connector - free end

Type	fg	Connector on actuator side	φ1 (mm)	φA (mm)
POW	01	923 (6 pin), rotation P	28	64
	02	923 (8 pin), rotation P	28	64
	03	915 (9 pin), rotation P	18.7	42
SIG	01	623 (12 pin), rotation P	26	55
	02	623 (17 pin), rotation P	26	55
	04	623 (15 pin), rotation P	18.7	42

11. Performance conditions and technical terminology

TwinSpin®

Trademark of high precision reduction gear.

DriveSpin®

The combination of TwinSpin® high precision reduction gear, permanent magnet synchronous motor (further referred as PMSM, motor or electromotor), thermistor sensor and position feedback sensor. Optionally also power off parking electromagnetic brake can be built-in. Thermistor is inside PMSM windings for overheat protection. PMSM, position feedback sensor and electromagnetic brake are placed on shaft (also referred as input shaft) of TwinSpin®. Loads are usually connected to output flange of TwinSpin® which is also output flange of DriveSpin®.

Input speed

It refers to speed of input shaft of TwinSpin® reduction gear driven by PMSM of DriveSpin®.

Output speed

It refers to the speed of output flange of DriveSpin® to drive connected loads.

Input torque

It refers to torques at input shaft of TwinSpin® reduction gear generated by PMSM. (Note: Electromagnetic brake also generates torque at input but is not included in this term instead defined as braking torque at input).

Output torque

It refers either to limiting torques developed on or by output flange of DriveSpin® or to calculated values of torque generated by PMSM including ratio and losses in gearbox, additional seals or bearings.



Fig. 11.1: Schematic diagram of inputs, outputs and rotation direction

Ratio

Expresses number of motor turns at input shaft needed to make one whole rotation of load at output flange of DriveSpin® actuator. Speed of load at output flange is reversed in contrary to electromotor speed, so for calculation purpose a negative ratio might be considered in control

Hollowshaft diameter

Defines DSH series diameter of hollow through bore. Standard versions of DSH 085, 115, 125, 155, 170 have built-in static tube which prevents from contact with rotating input shaft which rotates at electromotor speed. Hollowshafts are for example used to lead hydraulic, pneumatic or electric media through cables, pipes or by some other means to supply additional components which might reduce space or eventually protects this supplies.

Rated output torque, Rated input speed, Service life

The nominal service life of TwinSpin® reduction gear as a main component of actuator DriveSpin® is determined by service life of the bearings on the input shaft. This nominal service life is limited by the material fatigue of the bearings. It does not take into account other factors that may be a limit to the practical service life, such as insufficient lubrication contamination or overload. The nominal service life is only statistical value. It denotes time in operation under rated conditions during which 10% of a large number of reduction gears get damaged due to material fatigue. For further details or special calculations for your specific application please contact the Sales Department.

Motor rated torque

Nominal value of torque developed by PMSM for continuous operation, when the continuous nominal current is applied to the windings.

Continuous output torque

Actuator calculated output torque from PMSM rated performance including reducer ratio, efficiency and rated output torque of reducer.

Motor rated current

Is the nominal value of the electric RMS current used to obtain the continuous nominal torque from the electromotor.*)

Motor stall torque

Is the value of torque produced at zero speed for continuous functioning *).

Motor stall current

The nominal value of the electric RMS current used to obtain the stall torque from the electromotor.*)

Motor peak torque

The nominal value of torque developed for a limited period of time, when the peak current is applied to the windings.

Momentary peak output torque

Actuator peak output torque for limited period of time during acceleration and deceleration phase of duty cycle for acceleration or deceleration of inertial loads. It is calculated from PMSM peak performance including reducer ratio, efficiency and Acceleration/Braking Torque limits of reducer.

Motor peak current

It is the value of the electric current used to obtain the peak torque from the electromotor.

Motor back-EMF constant

It is the ratio of terminal to terminal peak voltage generated in the windings when motor rotor is mechanically rotated at a speed of 1000 rpm.

Motor torque constant

Is the ratio of the developed torque to the applied RMS current for the electromotor specific winding.*)

Terminal resistance (L-L)

The winding resistance measured between any two leads of the winding in particular configuration at 25 °C. Might differ to catalogue values with dependence to type of connection or cable lengths.

Terminal inductance (L-L)

The winding inductance measured between any two leads of the winding in particular configuration at 25°C at 1 kHz. Permanent magnets of rotor influences measured value of inductance which is varying over each electrical cycle.

Number of poles

Is the number of permanent magnet poles of the rotor (p is the number of pole pairs).

Electromagnetic brake DC supply

For DriveSpin® with option electromagnetic brake ($c \neq 0$ (see ordering code), it is voltage required to release/disengage electromagnetic power off brake. For special modifications please contact our sales department.

Electromagnetic brake torque (at motor)

For DriveSpin® with option electromagnetic brake ($c \neq 0$ (see ordering code), it is value of torque generated by electromagnetic brake at the input shaft of built-in reduction gear mechanism. It is nominal value at standard working conditions stated by manufacturer.

Protection class

The degree of protection according to IS/IEC 60034-5. Assumes DriveSpin® mounted in accordance with assembly instructions and in case of connectors (see type of electrical connection) with counterparts properly connected.

Motor insulation class

Define maximum winding temperature and permissible winding temperature rise in relation to predefined allowed ambient temperature range. (Reduction gear limit temperature must be also taken into consideration). Winding classification F for thermal class 155°C. Each 10°C rise above the rating may reduce the motor lifetime by one half. For example electromotor operating at 180°C have an estimated life of 8500 hours with class F.

Paint

Standardly RAL 9005 black colour. For special painting please contact our sales department.

Motor number of phases, Motor type of connection

Defines electromotor windings arrangement and count.

Inertia at input

Represents calculated value of sum of inertia of all rotating parts at input shaft see Fig. 11.1. For dynamic applications where high accuracy and responsiveness is needed reflected load inertia $J_{L\ in}$ should be less than 5-times of inertia at input $J_{L\ out}$. For calculation of reflected inertia of load to input shaft use following equation:

$$J_{L\ in} = \frac{J_{L\ out}}{i^2}$$

$J_{L\ in}$ - reflected inertia to input shaft
 $J_{L\ out}$ - load inertia
 i - gear ratio

Duty cycle

IEC 60034-1 (the International Electrotechnical Commission) duty cycles designations:

Tab. 11.b: Duty cycles

S1	Continuous duty	The motor works at a constant load for enough time to reach temperature equilibrium.
S2	Short-time duty	The motor works at a constant load, but not long enough to reach temperature equilibrium. The rest periods are long enough for the motor to reach ambient temperature.
S3	Intermittent periodic duty	Sequential, identical run and rest cycles with constant load. Temperature equilibrium is never reached. Starting current has little effect on temperature rise.
S4	Intermittent periodic duty with starting	Sequential, identical start, run and rest cycles with constant load. Temperature equilibrium is not reached, but starting current affects temperature rise.
S5	Intermittent periodic duty with electric braking	Sequential, identical cycles of starting, running at constant load and running with no load. No rest periods.
S6	Continuous operation with intermittent load	Sequential, identical cycles of running with constant load and running with no load. No rest periods.
S7	Continuous operation with electric braking	Sequential identical cycles of starting, running at constant load and electric braking. No rest periods.
S8	Continuous operation with periodic changes in load and speed	Sequential, identical duty cycles run at constant load and given speed, then run at other constant loads and speeds. No rest periods.
S9	Duty with non-periodic load and speed variations	Load and speed vary periodically within the permissible operating range. Frequent overloading may occur.
S10	Duty with discrete constant loads and speeds	Duty with discrete number of load/speed combinations, with these maintained long enough to reach thermal equilibrium.

Thermal Equilibrium is the state reached when the temperature rise of the machine does not vary by more than $2K=2^{\circ}C$ per hour. High precision reduction gears are preferred for intermittent duty cycles (S3-S8). The S1 continuous duty cycles needs to be consulted with manufacturer.

*) The stated values are for frameless electromotor mounted on a standard aluminum heat sink during the process of motor manufacture.

12. Assembly

Values of the axial and radial run-out of the output flange

Tab. 12.a: Values of the axial and radial run-out of the output flange

Type	T [mm]	Z [mm]
050	0.006	0.015
060	0.007	0.020
070	0.007	0.020
095	0.02	0.03
110	0.008	0.025
115	0.03	0.05
140	0.009	0.025
155	0.02	0.04

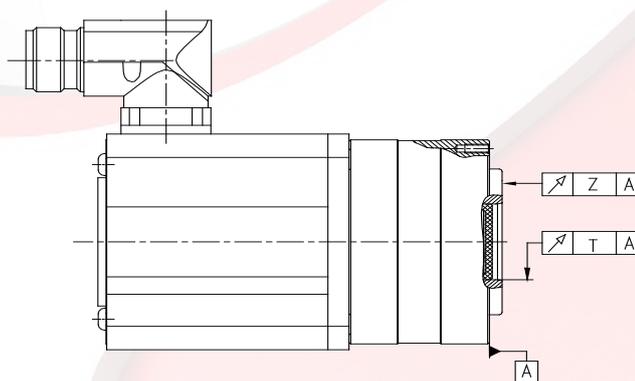


Fig. 12.1: Axial and radial runout to base A

Installation of components on the output flange of the electric actuator

Before the installation, remove the layer of preservation oil from the surface of the reduction gear part of the actuator by means of a clean and dry cloth. Degrease the contact surfaces of the friction connections. During the cleaning, take care the degreasing agent does not get into the reduction gear part of the actuator. The contact surfaces of the reduction gear part of the actuator are not protected against corrosion. If you need more information, please contact the SPINEA Sales Department or our regional representative. During the assembly of screw connections, proceed as follows: Screw a screw into a functional thread until the screw head sits on the part being connected. Screw in all screws in that way and only then tighten them with a wrench. Tighten the screws twice in turns with the required torque. Tighten the screws gradually because otherwise irregular tightening of the connection and thus also deformation of the connection of the parts may occur. Tighten the screws along the perimeter of a circle in a cross-like manner, i.e. as shown in Fig. 12.2. In the case of a connection subjected to shocks and cyclical loads, it is necessary to secure the connection against self-loosening.

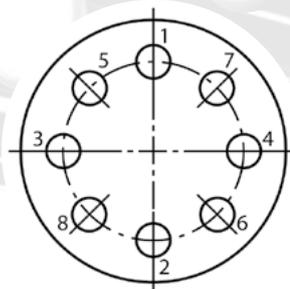


Fig. 12.2: Tighten the screws along the perimeter of a circle in a cross-like manner

For the safe transmission of torque it is always necessary to use the full number of the screws! The tightening torques of the screws are specified in Tab. 12.c.

Tab. 12.c: Tightening torques of screws

Screw	Tightening torque [Nm]	Clamping force [N]	Screw material class and specification
M3	1.6	3 100	ISO 898 T1 10.9 or 12.9
M4	4.3	5 300	
M5	8.4	8 800	
M6	14	12 400	
M8	35	22 750	
M10	70	36 200	

The allowed torques transmitted by the connection screws on the output flange and the casing are contained in Tab. 12.d.

Tab. 12.d: Values of the axial and radial run-out of the output flange

Type	Output flange			Case		
	Number x screw	Pitch diameter [mm]	Transmitted torque [Nm]	Number x screw	Pitch diameter [mm]	Transmitted torque [Nm]
050	10xM4	28	100	4xM5	63	165
060	8xM4	34	108	16xM3	64	238
070	14xM4	42	233	16xM3	64	238
085	12xM5	50	470	18xM3	81	400
095	18xM4	53	85	18xM4	88	85
110	14xM6	69	898	12xM5	100	792
115	18xM5	68	173	18xM4	108	173
125	18xM6	71	1 190	18xM5	116	1 380
140	14xM6	92	1 740	12xM6	127	1 410
	8xM6	74			127	
155	28xM5	146	1 300	18xM6	100	1 480
170	14xM8	110	3 700	12xM8	156	3 200
	8xM8	80			156	

13. FAQ

Feedback encoders:

01. Q: Is it possible implement feedback encoder which is not in standard range or even implement my own feedback encoder??
 A: Yes, we can implement any type of feedback encoder if there is no hardware or mounting limit. In specific cases we can make custom solution for you and implement your feedback encoder.
02. Q: How can i implement safety function with feedback encoders?
 A: We can use single Functional Safety encoder or use 2 independent encoders to provide full safety function for your application.
03. Q: How it's possible make more precise control of drive?
 A: There are 2 ways how to do it. First is use feedback encoder with better resolution and second is use feedback encoder on output flange of reduction gear.

Servomotors:

01. Q: What kind of servomotors are you using?
 A: We are using Permanent Magnet Synchronous Motors (PMSM).
02. Q: Can i choose DC BUS voltage which is not from your standard range?
 A: Our standard DC BUS voltage is 24 V, 320 V and 560 V but we can implement servomotor with your requested DC BUS voltage after check by our engineers.
03. Q: How can i control servomotor without standard feedback encoder?
 A: We can provide you solution with hall sensors inside servomotor for application with low resolution requirements.
04. Q: Is it possible use different torque or speed of used servomotors in standard DriveSpin® series?
 A: If our standard DriveSpin® series doesn't fit your requirements, we can implement different servomotor or design new one based on your requirements.

Ingress Protection (IP):

01. Q: How can i improve protection of standard DriveSpin®?
 A: Ingress Protection of our standard product range is IP 64. If your application requires higher IP, we can design all components of DriveSpin® actuators to reach IP 65, 66 or even 67.

DriveSpin® mechanical design:

01. Q: Is it possible prepare special design of actuator housing?
 A: If housing of standard DriveSpin® series is not suitable for you, we can prepare any special design of actuator housing where you can define shape of housing, mounting elements or fixation points which are required for your project.
02. Q: Can i make actuator from any TwinSpin® Reduction gear?
 A: Yes, if you will choose TwinSpin® reduction gear and define other electro-mechanical parameters, we can prepare complete solution for you.
03. Q: Do i need develop completely new product if i have some specific request?
 A: In many cases is not necessary develop completely new product, just change existing mechanical or electrical part of actuator based on your request.

Electrical connection:

01. Q: Is it possible use different connectors for standard DriveSpin® series?
 A: Yes, we can implement your special connector for applications where it is required.
02. Q: Can i use only one connector instead of 2?
 A: For some application it is possible. We have in our product range Hybrid connectors or we can use any other connector which will fit technical requirements, for example maximal current for power pins or available quantity of signal pins for used feedback encoder.

Brakes:

01. Q: Can i use brake in actuator?
 A: Yes, we can implement standard 24 V electromagnetic brake for static applications where brake hold the load in absence of power.
02. Q: It is possible use brake for dynamic applications as well?
 A: Yes it is possible, but in this case calculation of brake parameters is different than in static application brake and need to be consulted with manufacturer.
03. Q: What other modifications are available for brakes?
 A: We can implement brakes with different voltage, hand release and other special modifications.

Accessories:

01. Q: Do you have available any accessories to actuators?
 A: We have available Cables between servo drive and actuator with standard used connectors and length up to 99.9 meters.



14. YourSpin - General information



CUSTOMERS / SPECIAL SOLUTIONS

Customer requirements often call for special solutions. Thanks to many years of experience in technical support and engineering, we realize highly professional solutions according to customer requirements. We design various design modifications of standard products and solutions of higher assembled units TwinSpin® series G, T, E, H and M, DriveSpin® in series DS, DSH, DSM, DSF and RotoSpin modules. Our technical support is based on professional recommendations for various applications of TwinSpin®, DriveSpin® and RotoSpin in industrial segments such as robotics, automation, metalworking, medicine, camera systems, security and others. The advantages of these special solutions are their compact and modular design, easy connection to the supporting structure and technically applied sealing elements

Advantages

- **compact design**
- **modular design**
- **easy connection with the support structure**
- **technically applied sealing elements**

14.1 Customers / Special reduction gears

TwinSpin® reduction gear with right angle gearbox



Advantages

- possibility of a right-angle motor connection
- higher input speeds
- smaller servomotor dimensions
- low lost motion and hysteresis on output
- compact solution

The high precision reduction gear with the possibility of a right-angle motor connection also allows the increase of the total reduction ratio by using an input right-angle reduction gear. This allows to use a servomotor with a lower power and a higher speed, i.e. a smaller motor. This solution is available for the whole line of E series reduction gears.

Note: For more information please contact the SPINEA sales department.

TwinSpin® hollow shaft reduction gear with a pre-stage



Advantages

- high-precision reduction gear
- possibility to have a motor in an offset position
- high reduction ratio in two stages
- coupling and motor flange provide easy motor mounting
- pre-greased and fully sealed solution

A TwinSpin® hollow shaft reduction gear with a pre-stage and offset motor position - a solution for applications that require a completely sealed node with a large through hole for passing cables, tubing or additional shafts.

Note: For more information please contact the SPINEA sales department.

14.2 Customers / Special solutions

RotoSpin - High precision rotory modules

The rotary positioning module, which is offered under the RotoSpin brand, is designed for the building of positioning devices and rotary tables, which are used in automated and robotized workplaces. The RotoSpin module features a high reduction ratio, high kinematic precision, low backlash motion, high torque capacity, low weight, and a compact design.



RotoSpin - Rotory modules - series A



Advantages

- possibility to build into circular holes
- low weigh and small dimensions
- wide area of use
- easy attachment

The RotoSpin A are called flange ones. They feature a flange design, which allows the module's attachment and building into a structure with a circular hole. According to their size, RotoSpins A are manufactured in four size categories with load capacities of 60, 250, 500, and 1000 kg respectively. Due to their small dimensions and low weight, the RS-A modules are used mainly in moving parts of positioning devices. If the RS modules are loaded with a higher than allowed moment or shock load, we use them in combination with a support bearing.

Note: For more information please contact the SPINEA sales department.

RotoSpin - Rotery modules - series B



Advantages

- possibility to attach to flat surfaces
- compact design
- wide area of use
- easy attachment

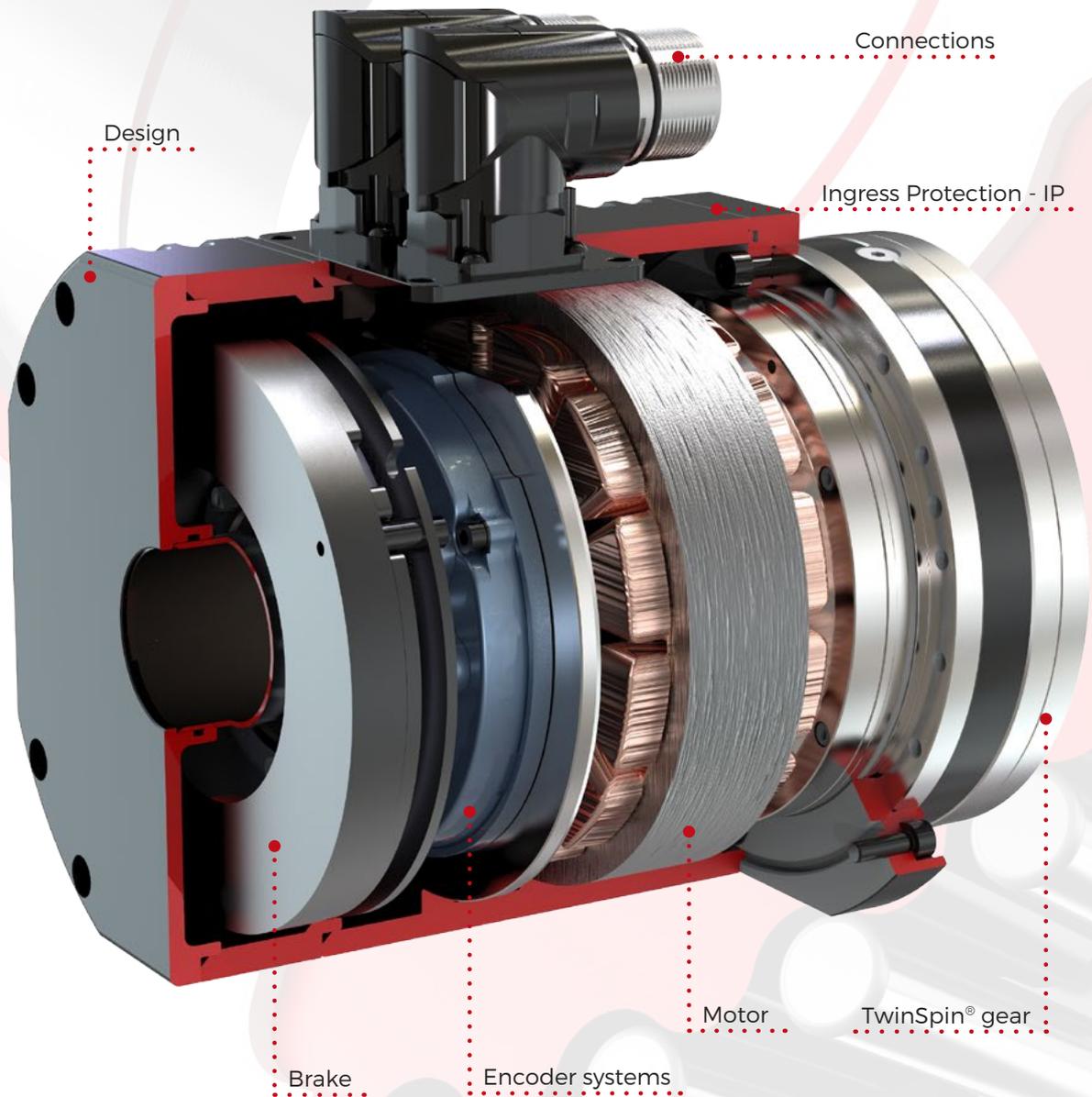
The RotoSpin B are called flange ones. They feature a box design, which allows the module's easy attachment to a flat surface by means of feet. According to their size, RotoSpins B are manufactured in four size categories with load capacities of 60, 250, 500, and 1000 kg respectively. We supply the RS1000 module in two versions according to the foot width. The B version with narrow feet is used where it is necessary to support a long workpiece or welded piece by means of a support module. The module with wide feet is marked as RS 1000-BX and it is used for the clamping of short workpieces without support modules.

Note: For more information please contact the SPINEA sales department.

14.3 Customers / Special actuators

DriveSpin® actuators - design "Your actuators"

The rotary electric actuator can be designed and manufactured according to your specific application requirements. The input and output technical specification can be designed and optimized for you



Advantages

- create your own design
- integrate unique mechatronics components (Servomotor, Encoder)
- make your own color design
- optimize input and output characteristics of the actuator according to your application

Motor

Motors are directly implemented to DriveSpin®, without any need for additional coupling. This helps to reduce weight and dimensions of the whole solution. The main type of motor is a synchronous motor with permanent magnets. Standard versions of motor implemented in DriveSpin® are 24V, 320V and 560V. Low voltage range is possible to modify to 36V, 48V and 60V, high voltage to 680V. These motors are custom solutions and they are modified to suit our customer. If there is a special requirement or our solution is not suitable for you, we can implement any frameless motor and calculate final parameters of DriveSpin®.

Encoder systems

DriveSpin® actuator with cycloidal gearbox excels in terms of precision positioning; however, this would not be possible without the implementation of position feedback sensors. Our primary industries, such as robotics, machine tools, dental machines, and CNCs, require different accuracy standards. Thus, requirements for motion control differ on application. Therefore, our company consults your needs and requirements. Our specialists will analyze your application and find the best solution in terms of accuracy, precision measurement, robustness, as well as compatibility with your control system. Actuator series DS, DSH, DSM, as well as DSF, come with a wide variety of feedback systems. Our portfolio includes sensors from basic feedback systems used in most servo drives, such as incremental encoders, to next-generation protocol encoders such as (EnDat 2.2, Hiperface DSL, BiSS-C). Technical parameters like resolution, sensor protocol, single vs. multiturn are specified in the process of development of the custom product. Supported encoder systems: HIPERFACE®, HIPERFACE® DSL, EnDat 2.2, Resolver, BiSS Interface, DRIVE-CLiQ, FANUC.

Brake

Brakes in our actuators are mostly used in static applications which statically hold the load in the absence of power. Usually, an electromagnetic brake is used, where in a currentless state (without connected DC voltage) the armature becomes engaged with the brake disk, and after applying DC voltage to the brake, the magnetic field is neutralized and the brake is released to free rotation of the actuator. Electromagnetic brakes are also used in dynamic applications where the actuator uses the brake for deceleration or as a safety brake, but these applications require different calculation and implementation to the actuator. Standard in our product range is 24 VDC electromagnetic brake for static applications, but we can implement also 12 VDC electromagnetic brakes, brake with handle release or any other brakes developed for servomotors.

Connections

Electrical as well as mechanical connection used for standard DS, DSH, DSM, and DSF are all available in this catalogue. However, our electrical and mechanical engineering team can adjust most of the connection possibilities according to the requirements of the end customer.

Design

Every piece of DriveSpin® series, either DS, DSM, DSH, or DSF, has its own unique design. If you require a specific design of the housing or mounting flange, or if you need to adjust the design to your own application, our specialists are ready to prepare a solution according to your demands. It is also possible to place a special ID plate (e.g. QR code) to meet your production processes. Of course, the use of your specific colouring is also possible.

Ingress Protection - IP

Ingress Protection of our standard product range is IP 64. If your application requires higher IP, we can design all components of DriveSpin® actuators to reach IP 65, 66, or even 67.

Testing

All our products from the DS, DSH, DSM, and DSF series are subjected for testing and are standardly tested and comply with the European standards, CE. Our company disposes with various test benches, which can be used for simulation of various duty cycles according to the customer specification. We are able to provide for you independent testing of our products according to your requirements and our capabilities.

Note: For more information please contact the SPINEA sales department.



15. General information

15.1 Maintenance

The reduction gear does not require any special maintenance. During its installation please observe the respective dimensional and positional tolerances of the centering diameters (Chapter 5.3). The reduction gear is a high-precision product, therefore it requires careful manipulation, installation, and demounting.

Any tampering with the reduction gear (disassembly, assembly) constitutes immediate loss of warranty. If a reduction gear fails due to a fault in its manufacturing or a material defect, please inform the manufacturer, who will carry out professional repair or replacement.

15.2 Delivery conditions

The reduction gear is delivered completely assembled, without fixing screws, filled with grease, and in a protective package. Not all series are fully sealed as a standard. Each reduction gear is identified with a type label, containing the following data:

- manufacturer
- product type and size
- reduction ratio
- model
- serial number

15.3 Transport and storage

The reduction gears should be transported in closed transport vehicles, in containers secured against movement or overturning. The mode of transport should follow the mutual agreement between the customer and the supplier. In addition, the product must be protected against the elements, aggressive vapours, dust, and mechanical damage. The manufacturer recommends to store TwinSpin® reduction gears in the original transport package.

The standard packaging in the original package ensures corrosion protection for the period of 6 months during storage in closed rooms with the ambient temperature from 5°C to 25°C and the relative humidity up to 60%. After 6 months it is necessary to preserve the reduction gear again.

15.4 Warranty

The warranty is specified in the General Delivery Terms of SPINEA, s.r.o.. For more information visit our website: www.spinea.com

15.5 Final statement

Any design changes, modifications and improvements, aimed at increasing the technological level of the reduction gear, which, however, do not change the main technical parameters, installation and connection dimensions, may be performed by the manufacturer without prior consent from the customer. Any design changes and/or modifications affecting the critical properties and parameters of the reduction gear are subject to an approval procedure.

15.6 Cautions concerning the application of the TwinSpin® high precision reduction gear

If the end user of the product works in the military field or if the product is to be used for the manufacturing of weapons, the product may be subject to trade controls and export regulations. Before the exporting of the product therefore please check the export and trade control terms and conditions and take the required actions.

- If a fault or a malfunction of the product may directly endanger human lives or if the product is used in devices that may damage the human health (nuclear, space, healthcare facilities, various security systems, etc.), regular checks are essential. In such a case please contact our sales agent or our nearest business office.
- Although this product has been manufactured under strict quality control, if it is to be used in machines that, in the event of a malfunction, may seriously endanger human lives or damage equipment, it is essential to adopt appropriate safety measures.
- If this product is to be used in a special environment (clean rooms, food industry, etc.), please contact our sales agent or our nearest business office.

For more information contact our sales department, or visit our website: www.spinea.com



SPINEA, s.r.o.

Okrajová 33
080 05 Prešov
Slovakia, EU

Tel: +421 51 770 01 56

E-mail: info@spinea.com

Web: www.spinea.com

