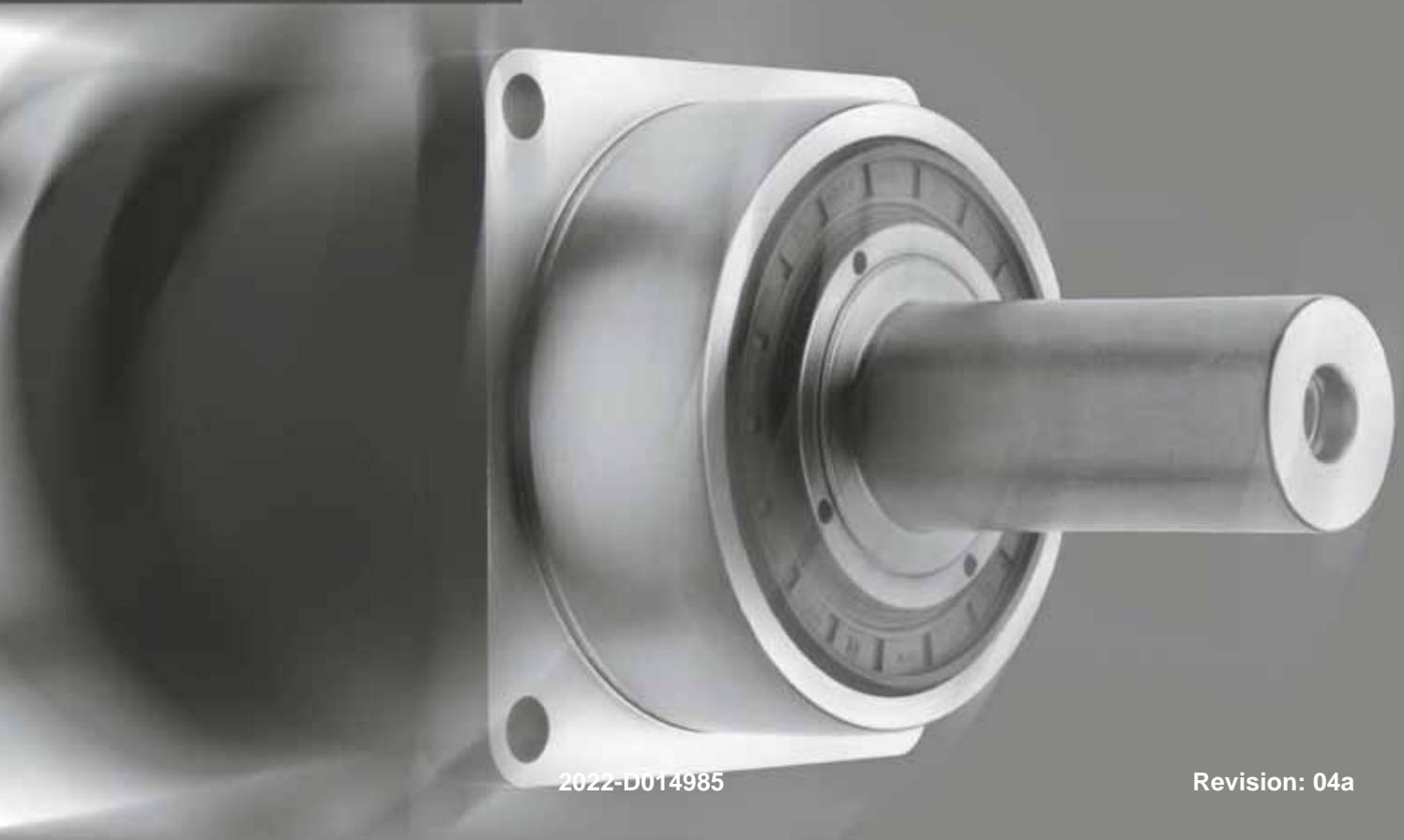


# SP<sup>+</sup> ATEX MC-Version

Operating Manual



## Revision history

Revision	Date	Comment	Chapter
01	14.12.04	New version	All
02	04.11.08	Type plate WITTENSTEIN alpha	All
03	10.11.08	Type plate WITTENSTEIN alpha	All
04	18.10.10	Technical Data, Layout WITTENSTEIN	All
04a	03.12.12	Translation corrections	2.4

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# 1 Regarding this manual

These instructions contain necessary information for safe operation of the planetary gearhead SP+ in areas with explosion hazards, referred to as gearhead in the following.

The operator must ensure that this operating manual is read through by all persons assigned to install, operate, or maintain the gearhead, and that they fully comprehend them.

Store these instructions within reach of the gearhead.

These **safety instructions** should be shared with colleagues working in the vicinity of the device to ensure individual safety.

The original instructions were prepared in German; all other language versions are translations of these instructions.

## 1.1 Signal words

The following signal words are used to indicate possible hazards, prohibitions, and important information:

	<b>⚠ DANGER</b>
	This signal word points out to an imminent danger that can cause serious injuries and even death.
	<b>⚠ WARNING</b>
	This signal word points out to a possible danger that can cause serious injuries and even death.
	<b>⚠ CAUTION</b>
	This signal word points out to a possible danger that can cause slight to serious injuries.
	<b>NOTICE</b>
	This signal word points out to a possible danger that can cause material damage.
	A note without a signal word indicates application tips or especially important information for handling the gearhead.

## 1.2 Safety symbols

The following safety symbols are used to indicate possible hazards, prohibitions, and important information:



General danger



Hot surface



Suspended loads



Danger of being pulled in



Environment protection



Information



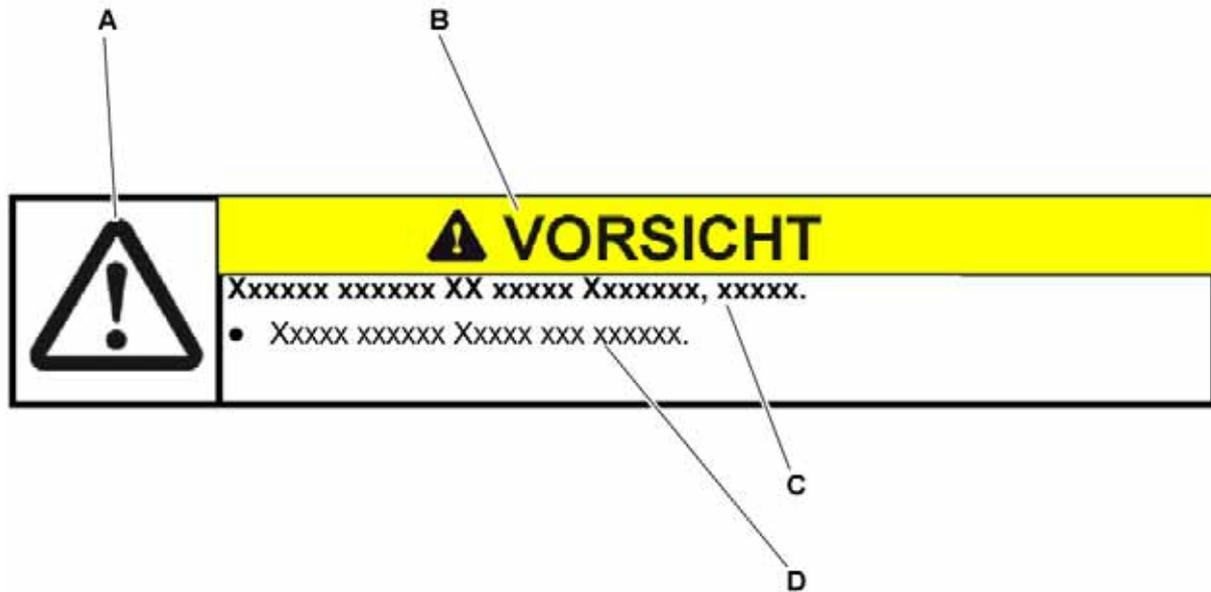
Explosion



Electric voltage

### 1.3 Design of the safety instructions

The safety instructions of this operating manual are designed according to the following pattern:



A = Safety symbol (see Chapter 1.2 "Safety symbols")

B = Signal word (see Chapter 1.1 "Signal words")

C = Type and consequence of the danger

D = Prevention of the danger

### 1.4 Information symbols

The following information symbols are used:

- Indicates an action to be performed
- ➡ Indicates the results of an action
- ⓘ Provides additional information on handling

 An "explosion protection symbol" indicates information on handling in areas with explosion hazards.

## 2 Safety

These instructions, especially the safety instructions and the rules and regulations valid for the operating site, must be observed by all persons working with the gearhead.

In addition to the safety specifications mentioned in this operating manual, the general and also the local regulations on the prevention of accidents and on environmental protection should be observed.

### 2.1 EC directive for devices and protective systems in areas with explosion hazards



Within terms of the EC machinery directive 94/9 EC, the gearhead is considered a device that is mounted together with other devices in a machine. A declaration of conformity for this gearhead can be found in the appendix (see Chapter 9.5 "Declaration of Conformity").

Operation is prohibited within the area of validity of the EC directive until it has been determined that the machine in which this product is installed corresponds to the regulations within this directive.

### 2.2 Dangers

The gearhead has been constructed according to current technological standards and accepted safety regulations.

To avoid danger to the operator or damage to the machine, the gearhead may be put to use only for its intended usage (see chapter 2.4 "Intended use") and in a technically flawless and safe state.

- Be informed of the general safety instructions before beginning work. (see Chapter 2.7 "General safety instructions").

### 2.3 Personnel

Only persons who have read and understood these instructions may carry out work on the gearhead.

### 2.4 Intended use

The gearhead serves to convert torques and speeds. It is designed for industrial applications.



The gearhead can be used in areas with explosion hazard group II, zones 1 and 2, and zones 22 and 21, thus in the device categories 2 and 3. The gearhead can be operated in a gas atmosphere in temperature class T3. In dust atmosphere, a maximum surface temperature of 150 °C is possible.

- Observe the instructions on the type plate and the appendix on the written certificate of conformity.

The gearhead is manufactured and declared applying EN 13463 standards and the 94/9/EC directive for use in areas with explosion hazards.

- Strictly observe the restrictions of speeds and torques (see Chapter 9.4 "Technical specifications").
- Our Customer Service department is available to answer any questions.



The gearhead is specified for installment on motors that:

- Correspond to the design B5 (for any divergences, consult our Customer Service department [technical customer service])
  - Show a radial and axial runout tolerance of at least “N” according to DIN 42955
  - Have a smooth shaft
  - Feature at least the same temperature class as the gearhead
- ⓘ We recommend temperature class T3 and higher, because the gearhead may not be permitted to heat up to more than 90 °C in normal conditions. The gearhead can be heated additionally through heat connection to the motor, and thus reach a higher housing temperature than 90 °C. The performance of our gearhead in explosion-risk areas would therefore no longer be guaranteed.

**2.5 Reasonably predictable misuse**



Any use transgressing the maximum permitted speeds, torques and temperature (especially ignoring the regulations on explosion protection) is not compliant with the regulations, and thus prohibited.

**2.6 Guarantee and liability**

Guarantee and liability claims are excluded for personal injury and material damage in case of

- Ignoring the information on transport and storage
- Improper use (misuse)
- Improper or neglected maintenance and repair
- Improper assembly / disassembly or improper operation
- Operation of the gearhead when safety devices and equipment are defective
- Operation of the gearhead without lubricant
- Operation of a heavily soiled gearhead
- Operating the gearhead despite leakage or unusual running noises



- Operating the gearhead in an atmosphere whose ignition temperature lies under the temperature class specified on the type plate.
- Modifications or reconstructions that have been executed without written approval of **WITTENSTEIN alpha GmbH**

**2.7 General safety instructions**

	<p style="text-align: center;"><b>⚠ DANGER</b></p> <p><b>Operating the gearhead in areas for which it is not approved can lead to explosions that can cause serious injuries and even death.</b></p> <ul style="list-style-type: none"> <li>• Make sure that the gearhead is only used in those areas for which it is permitted according to the identification plate (see Chapter 3.1 "Type plate").</li> </ul>
	<p style="text-align: center;"><b>⚠ DANGER</b></p> <p><b>Assembly and maintenance in areas with explosion hazards can lead to explosions that can cause serious injuries and even death.</b></p> <ul style="list-style-type: none"> <li>• Be certain that there is no explosive atmosphere during assembly and maintenance.</li> </ul>

	Table "Tbl-1" lists a summary of the possible hazards, their causes and protective measures for areas with explosion hazards.		
	Dangers	Possible causes	Protective measures
	Hot surfaces	Increased friction and dissipated power because of wear, improper assembly, overload, or leaks.	Reduction of the torques and speeds in comparison to standard gears
			Limiting the motor current and maximum speed of the motor
			Maintenance intervals for wear parts and lubrication according to maintenance schedule
			Inspection of the temperature behavior and the running-in behavior before startup
			Regular visual and acoustic inspections
	Prohibition of certain mounting positions and conditions		
		Increased surface temperature because of dust deposits.	Cleaning regulations according to maintenance plan
Mechanically caused sparks	Overload on shafts, moving parts and connection elements.	Reduction of the torques and external loads in comparison to standard gears	
		Limiting the motor current of the motor	
		Maximum load test before startup	
Electrostatic loading	Potential differences between components, cleaning processes, insulating layers	Grounding the gearhead and the motor	

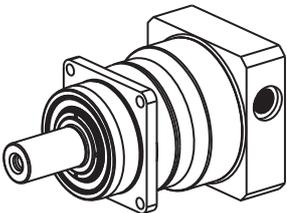
Tbl-1: Summary of the hazards and protective measures for areas with explosion hazards

	<b>⚠ WARNING</b>
	<p><b>Objects flung out by rotating components can cause serious injuries.</b></p> <ul style="list-style-type: none"> <li>Remove objects and tools from the gearhead before putting it into operation.</li> </ul>
	<b>⚠ WARNING</b>
	<p><b>Rotating components on the gearhead can pull in parts of the body and cause serious injuries and even death.</b></p> <ul style="list-style-type: none"> <li>Keep a sufficient distance to rotating machinery while the gearhead is running.</li> <li>Secure the machine against restarting and unintentional movements during assembly and maintenance work.</li> </ul>

	<p style="text-align: center;"><b>⚠ CAUTION</b></p> <p><b>Hot gearhead housing can cause serious burns.</b></p> <ul style="list-style-type: none"><li>• Touch the gearhead housing only when wearing protective gloves or after the gearhead has been at standstill for some time.</li></ul>
	<p style="text-align: center;"><b>NOTICE</b></p> <p><b>Loose or overloaded screw connections can damage the gearhead.</b></p> <ul style="list-style-type: none"><li>• Use a calibrated torque wrench to tighten and check all screw connections for which tightening torques have been specified.</li></ul>
	<p><b>Solvents and lubricants can pollute soil and water.</b></p> <ul style="list-style-type: none"><li>• Use and dispose of cleaning solvents as well as lubricants appropriately.</li></ul>

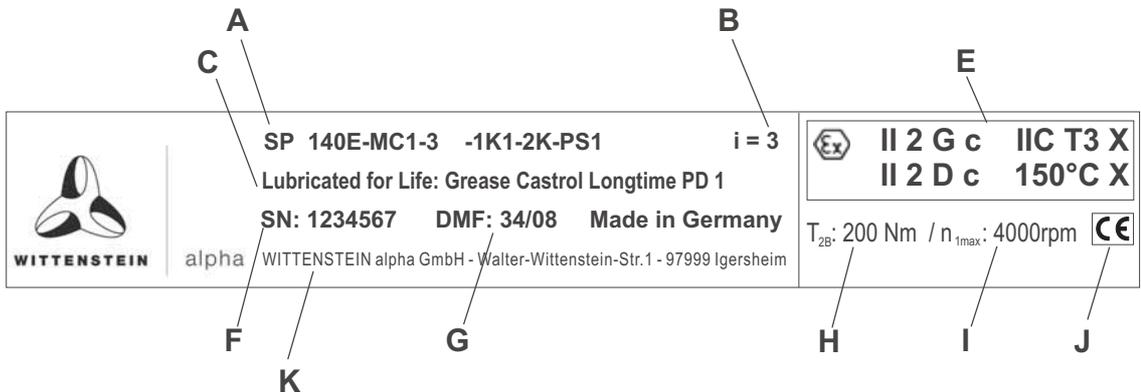
### 3 Description of the gearhead

The gearhead is a single- or multi-stage, low-backlash planetary gearhead, which is manufactured as standard in the following versions:

	<p><b>"M" (motor-mounted gearhead)</b></p> <p>Motor centering of the motor-mounted gearhead is performed:</p> <ul style="list-style-type: none"> <li>- Up to gearhead size SP+ 100 and a motor shaft diameter of 28 mm by the clamping hub (plug receptacle or coupling)</li> <li>- From gearhead size SP+ 140 and a motor shaft diameter of &gt;28 mm by the centering collar of the motor</li> </ul> <p>A radial distortion of the motor is avoided.</p> <p>Adaptation to various motors is done by an adapter plate and, in some cases, a bushing.</p> <p>The output shaft bearing is designed to withstand high tilting moments and axial forces.</p> <p>The <b>gearhead sizes SP+ 075 to 180</b> are equipped with an integrated linear length compensation to compensate for linear expansion of the motor shaft when heated up.</p> <p>Only motors with a drive side fixed bearing are approved for use with <b>gearhead size SP+ 210</b>.</p>
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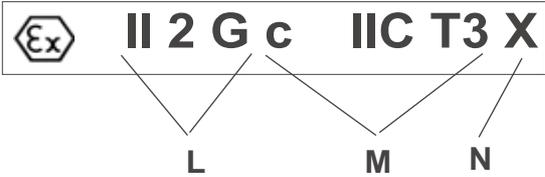
#### 3.1 Type plate

The type plate is attached to the gearhead housing.

		<p><b>E</b></p> <p>II 2 G c IIC T3 X II 2 D c 150°C X</p> <p><b>J</b></p> <p>CE</p>	
<p><b>A</b></p> <p>Ordering code (see Chapter 3.2 "Ordering code")</p>	<p><b>G</b></p> <p>Production date</p>	<p><b>H</b></p> <p>Maximum permitted gear output torque <math>T_{2B}</math></p>	<p><b>I</b></p> <p>Maximum permitted drive speed <math>n_{1Max}</math></p>
<p><b>B</b></p> <p>Ratio</p>	<p><b>K</b></p> <p>Name and address of manufacturer</p>	<p><b>F</b></p> <p>Serial number</p>	
<p><b>C</b></p> <p>Lubricant</p>	<p><b>F</b></p> <p>Serial number</p>		
<p><b>E</b></p> <p>Atex identification</p>	<p><b>J</b></p> <p>CE identification</p>		
<p><b>F</b></p> <p>Serial number</p>	<p><b>K</b></p> <p>Name and address of manufacturer</p>		

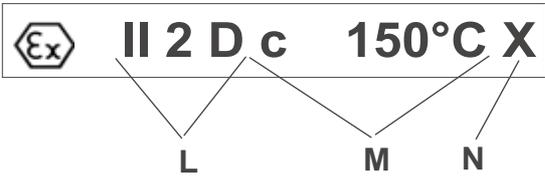
Tbl-2: Type plate (sample values)

3.1.1 ATEX identification in gas atmospheres with explosion hazard

		Designation
	L	Group, category
	M	Type of ignition protection, explosion group, temperature class
	N	Ambient temperature (See chapter 6.1 "Note during startup")

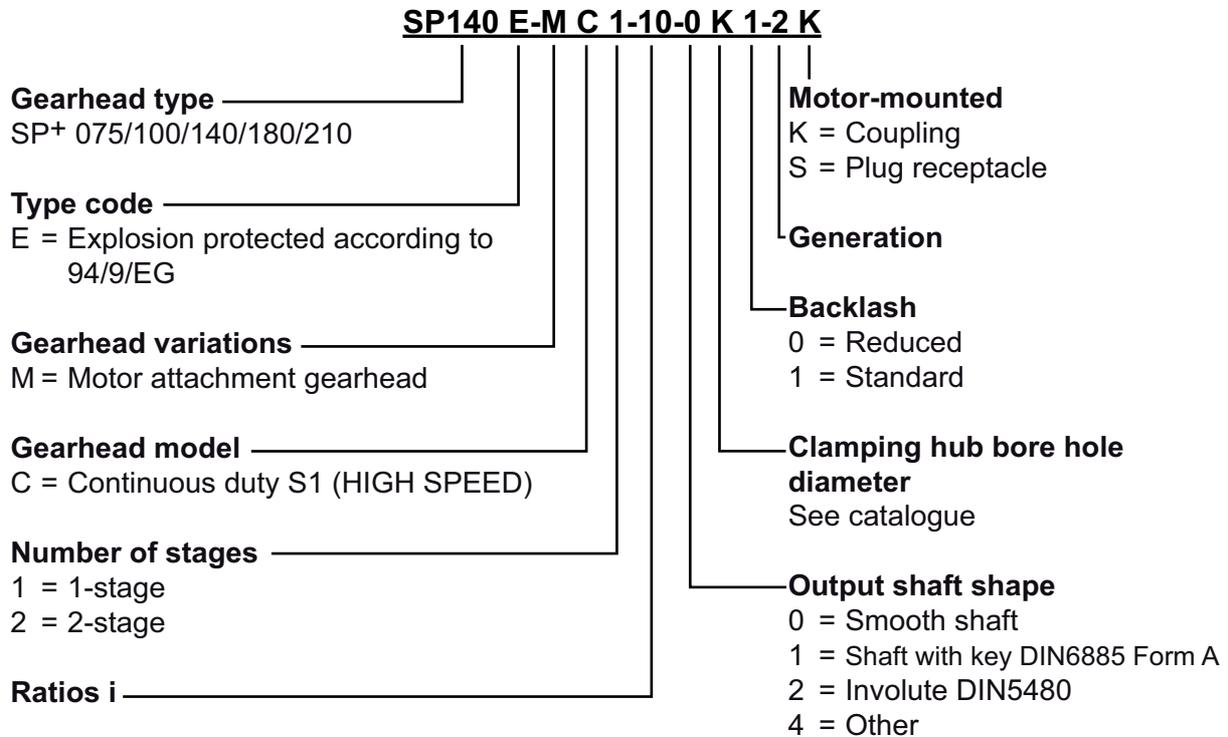
Tbl-3: Type plate (sample values)

3.1.2 ATEX identification in dust-air atmosphere with explosion hazard

		Designation
	L	Group, category
	M	Type of ignition protection, maximum surface temperature
	N	Ambient temperature (See chapter 6.1 "Note during startup")

Tbl-4: Type plate (sample values)

3.2 Ordering code



### 3.3 Performance statistics

Based on test results, torques and speeds are reduced in relation to the standard gearhead. The shaft loads are also reduced in relation to the standard gear. Refer to Chapter 9.4 "Technical specifications".

	<span style="font-size: 1.2em;">⚠</span> DANGER
	<p><b>Deviant values can cause the loss of explosion protection.</b></p> <ul style="list-style-type: none"> <li>• If values are divergent, consult our Customer Service department.</li> </ul>

### 3.4 Dimensioning

	<span style="font-size: 1.2em;">⚠</span> DANGER
	<p><b>Erroneous dimensioning and inspection may lead to loss of explosion protection.</b></p> <ul style="list-style-type: none"> <li>• Observe all instructions in this chapter.</li> </ul>



- Adopt the construction according to specifications in the total catalogue, Chapter "Information" or "Detailed construction", or contact **WITTENSTEIN alpha GmbH**.
- Note the reduced output specifications in construction according to Chapter 9.4 "Technical specifications".
- If you have any questions, contact our Customer Service department.
- Note the instructions in Chapter 7.1.5 "Replacing the gearhead", if the calculated **bearing life is less than 30,000 h**.
- Prevent gearhead overloading by the motor by limiting motor current and motor speed.
- Clarify the chemical stability of the gearhead for every individual case so as to avoid a premature failure of a shaft seal or corrosion on the gearhead. This also includes water and steam, which can cause corrosion. Contact **WITTENSTEIN alpha GmbH** about this.

#### 3.4.1 Inspection



- Make sure that the connection of the motor to the gearhead corresponds to the required protection types (according to DIN 40050) :
  - in dust atmosphere IP6x,
  - in gas atmosphere IP54.

- ① The required protection types can be achieved for example by the following measures:
- Use surface-bonding agent between motor flange and adapter plate.
  - Use sealing plates between motor flange and adapter plate to seal the through-holes of the adapter plate.

Sealing plates are available upon request from **WITTENSTEIN alpha GmbH**.

### 3.5 Weight

The table "Tbl-5" specifies the gearhead dimensions with medium-sized adapter plate. If another adapter plate is mounted, the actual dimensions can deviate by up to 10%.

Gearhead size SP <sup>+</sup>		075	100	140	180	210
Design	Stages					
M	1	3.9	7.7	17.2	34.0	56.0
	2	3.6	7.9	17.0	36.4	–

Tbl-5: Weight [kg]

### 3.6 Noise emission

Depending on the gearhead type and product size, the continuous sound pressure level is up to 66 dB(A).

	<p>Contact our Customer Service department if further information is needed regarding a particular product.</p>
---	---

## 4 Transport and storage

### 4.1 Scope of delivery

- Check the completeness of the delivery against the delivery note.
  - ① Missing parts or damage must be notified immediately in writing to the carrier, the insurance, or **WITTENSTEIN alpha GmbH**.

### 4.2 Packaging

The gearhead is delivered packed in foil and cardboard boxes.

- Dispose of the packaging materials at recycling sites intended for that. Observe the locally valid regulations for disposals.

### 4.3 Transport

	NOTICE
	<p><b>Hard knocks because of falling or hard dropping, can damage the gearhead.</b></p> <ul style="list-style-type: none"> <li>• Only use hoisting equipment and transports with sufficient capacity.</li> <li>• The maximum permitted lift capacity of a hoist may not be exceeded.</li> <li>• Lower the gearhead slowly.</li> </ul>
	⚠ WARNING
	<p><b>Suspended loads can fall and can cause serious injuries and even death.</b></p> <ul style="list-style-type: none"> <li>• Do not stand under suspended loads.</li> </ul>

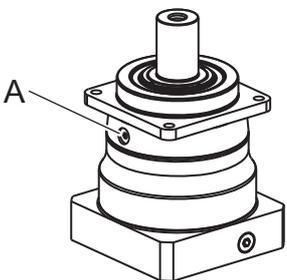
Specifications on the weights, refer to Chapter 3.5 "Weight".

#### 4.3.1 Transport of gearheads up to and including size SP+ 140

No special transport mode is prescribed for transporting the gearhead.

#### 4.3.2 Transport of gearheads as of size SP+ 180

For gearheads as of size SP+ 180, a support bore (A) is provided for a ring screw (e.g. acc. to DIN 580). The ring screw is used for attaching the gearhead securely to the hoisting equipment.

	Gearhead size SP+	Support bore (A) [Ø]
	180	M8
	210	M10

Tbl-6: Support bore on the gearhead

### 4.4 Storage

Store the gearhead in horizontal position and dry surroundings at a temperature of 0 °C to +40 °C in the original packaging. Store the gearhead for a maximum of 2 years.

For storage logistics, we recommend the "first in – first out" method.

## 5 Assembly

- Be informed of the general safety instructions before beginning work. (see Chapter 2.7 "General safety instructions").

### 5.1 Preparations

	NOTICE
	<p><b>Pressurized air can damage the gearhead seals.</b></p> <ul style="list-style-type: none"> <li>• Do not use pressurized air to clean the gearhead.</li> </ul>

	NOTICE
	<p><b>Directly sprayed cleaning agents can alter the frictional values of the clamping hub.</b></p> <ul style="list-style-type: none"> <li>• Only spray cleaning agents onto a cloth for wiping off the clamping hub.</li> </ul>

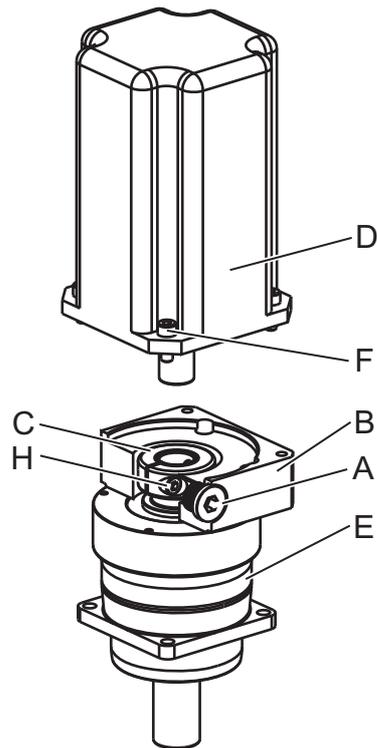
- Clean / de-grease the following components with a clean and lint-free cloth and grease-dissolving, non-aggressive detergent:
  - All fitting surfaces to neighboring components
  - Centering
  - The motor shaft
  - The inside diameter of the clamping hub
  - The bushing inside and out
- Dry all fitting surfaces to neighboring components in order to achieve the proper friction values of the screw connections.
- Check the fitting surfaces additionally for damage and impurities.

### 5.2 Installation conditions

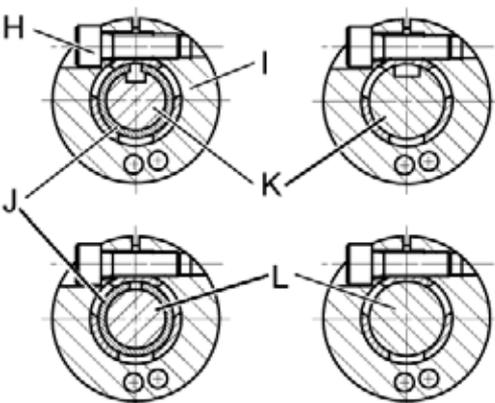
- |   |  |
|---|--|
|  | <ul style="list-style-type: none"> <li>• Provide a metallic frame for connection of the gearhead.</li> <li>• Provide a ground in the areas of the motor gear and gear-gear connection, so as to prevent any electrostatic charge that may arise.</li> <li>• With <b>gearhead size SP+ 210</b>, only use motors with a drive side fixed bearing.</li> </ul> |
|---|--|

### 5.3 Installing the motor onto the gearhead

	<ul style="list-style-type: none"> <li>• Observe the general information and safety instructions of the motor manufacturer.</li> <li>• Observe the safety and processing instructions of the screw-bonding agents to be used.</li> </ul>
--	--



- Ensure that the motor is mounted if possible in a vertical direction.
- If the motor shaft has a shaft key, remove the shaft key.
  - ① If recommended by the motor manufacturer, insert a half wedge.
- Remove the plug (A) from the mounting bore in the adapter plate (B).
- Turn the clamping hub (C) until the clamping bolt (H) can be reached by the mounting bore.
- Loosen the clamping bolt (H) of the clamping hub (C) by one revolution.
- Push the motor shaft into the clamping hub of the gearhead (E).
  - ① The motor shaft should slip in easily. If this is not the case, the clamping bolt must be loosened more.
  - ① A slotted bushing has to be installed extra for certain motor shaft diameters and applications.
  - ① The slot of the bushing (if provided) and clamping hub have to be flush with the groove (if provided) of the motor shaft, see table "Tbl-7".
  - ① No gap is permitted between motor (D) and the adapter plate (B).

		Designation
		H
		I
		J
		K
		L

Tbl-7: Arrangement of motor shaft, clamping hub, and bushing

- Smear screw-bonding agent (for example Loctite 243) onto the four bolts (F).
- Fasten the motor (A) onto the adapter plate (B) with the four screws (F).
- With **gearhead sizes SP+ 075 to 180**, smear screw-bonding agent (for example Loctite 243) onto the fastening bolt (H).
- Tighten the clamping bolt (H) of the clamping hub (I).
  - ① For bolt sizes and specified torques refer to chapter 9.1 "Specifications on mounting onto a motor", tables "Tbl-12".

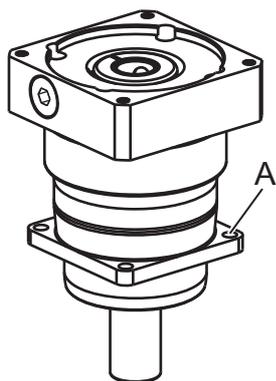
- Screw in plug (A) of the adapter plate (B).
- ① For screw sizes and specified torques refer to table "Tbl-8".

Width across flats [mm]	5	8	10
Tightening torque [Nm]	10	35	50

Tbl-8: Torques for the plugs

#### 5.4 Mounting the gearhead to a machine

- Observe the safety and processing instructions of the screw-bonding agents to be used.



- Center the gearhead in the machine bed.
- Smear a screw-bonding agent (for example Loctite 243) onto the fastening screws.
- Fasten the gearhead on the machine with the fastening screws through the through-holes (A).
  - ① Mount the gearhead in such a way that the type plate remains legible.
  - ① Do not use washers (e.g. plain washers, tooth lock washers).
  - ① For prescribed screw sizes and torques refer to Chapter 9.2 "Specifications on mounting onto a machine", table "Tbl-13".

#### 5.5 Mounted components on the gear output side



NOTICE

**Distortions during mounting operations can damage the gearhead.**

- Mount gearwheels and toothed belt pulleys onto the output shaft without forcing.
- Do not on any account attempt an assembly by force or hammering!
- Only use suitable tools and equipment for assembly.
- Make sure not to exceed the maximum static axial forces on the output bearing ( $F_{2A\text{Max}}$  see Chapter 9.4 "Technical specifications") when pulling or shrink-fitting a gear on the output shaft.

## 6 Startup and operation

- Be informed of the general safety instructions before beginning work. (see Chapter 2.7 "General safety instructions").

	<span style="font-size: 1.5em;">⚠</span> DANGER
	<p><b>Operating the gearhead in areas for which it is not approved can lead to explosions that can cause serious injuries and even death.</b></p> <ul style="list-style-type: none"> <li>• Make sure that the gearhead is only used in those areas for which it is permitted according to the identification plate (see Chapter 3.1 "Type plate").</li> </ul>

- Check the gearhead before startup for possible damage, especially the radial shaft seal on the gear output.

	<span style="font-size: 1.5em;">⚠</span> DANGER
	<p><b>A damaged gearhead can lead to explosions that can cause serious injuries and even death.</b></p> <ul style="list-style-type: none"> <li>• <b>Never</b> operate damaged or abnormally running or sounding gearheads in an area of explosion hazard.</li> </ul>

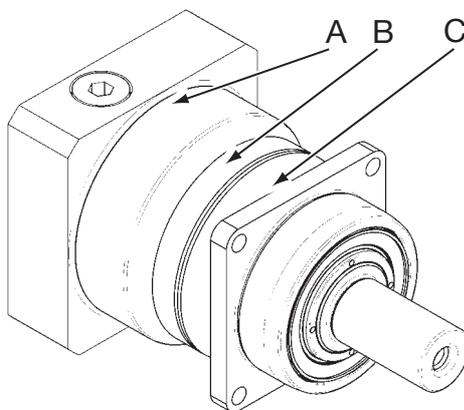
### 6.1 Note during startup



**Improper use can cause damage to the gearhead and cause ignition dangers.**

- Make sure that
  - the **ambient temperature** does not drop below 0 °C or exceed +40 °C and
  - the **operating temperature** does not exceed +90 °C.
- Prevent gearhead from overloading by limiting the motor current and the maximum motor speed. Otherwise, the drive output should be switched off in case the motor temperature rises 10 °C above the usual operational temperature.
- Use the gearhead only in a clean and dry environment. Contact our Customer Service department if the gearhead is exposed to dust or fluids of any type when in operation.

### 6.2 Check running-in behavior



- After 4 running hours in maximum operating conditions, check the gearhead for leakage between gear and gearhead and on the output shaft seal.
- Measure the surface temperature on the input flange (A) and on the housing (B) and bearing flange (C). Consult our Customer Service department if the surface temperature exceeds +90 °C.
- Check the proper assembly of the clamping hub before startup by a maximum load test.

Increased running noises may be caused by faulty motor mounting.

- If so, mount onto motor again according to the operating manual, or consult our Customer Service department.

## 7 Maintenance and disposal

- Be informed of the general safety instructions before beginning work. (see Chapter 2.7 "General safety instructions").

### 7.1 Maintenance work



**The following maintenance work is crucial for the explosion protection.**

- Perform these tasks thoroughly and diligently.

#### 7.1.1 Visual/Noise inspection

- Dust off the housing. Make sure that the deposit of dust layers on the housing never exceeds a layer thickness of 5 mm.
- Check the entire gearhead for exterior damage and corrosion.
- Check the clamping hub for external damage when inspecting the tightening torques of the clamping bolt.
- Check the gearhead for unusual running noises and vibrations during operation.
- ① For special information on maintenance-related issues, contact our Customer Service department.

#### 7.1.2 Checking the tightening torques

- Check the tightening torque of the fastening bolts on the gearhead housing.
  - ① The prescribed tightening torques can be found in Chapter 9.2 "Specifications on mounting onto a machine", table "Tbl-13".
- Check the tightening torque of the clamping bolt on the motor mounting.
  - ① The prescribed tightening torques can be found in Chapter 9.1 "Specifications on mounting onto a motor", table "Tbl-12".

#### 7.1.3 Check for leakage

- Check the gear output radial shaft seal for leakage.
- Look for external emission of lubricant from the drive.

	<b>⚠ DANGER</b>
	<p><b>When opening up the Ermeto screw connection, dust could collect on the adapter plate and catch fire during later operation.</b></p> <ul style="list-style-type: none"> <li>• Make sure that <b>no</b> explosive dust-air mixture is present and <b>no</b> dust can get into adapter plate before opening the Ermeto screw connection or dismantling the motor.</li> </ul>

- Open up the Ermeto screw connection in the adapter plate and check for any lubricant emission inside the adapter plate.
- If a leak is detected, remove the lubricant and re-check the inside of the adapter plate after brief operation.
- In case lubricant still is emitted, shut down the gearhead and consult our Customer Service department.

### 7.1.4 Exchanging the radial shaft seal on gear output

- Observe the safety and processing instructions of the screw-bonding agents to be used.

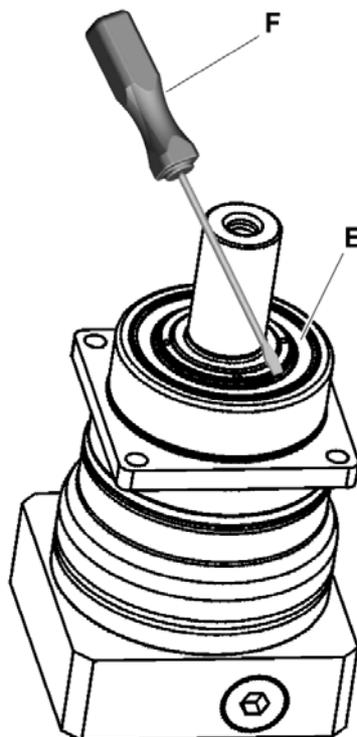
#### Removing the radial shaft seal



### NOTICE

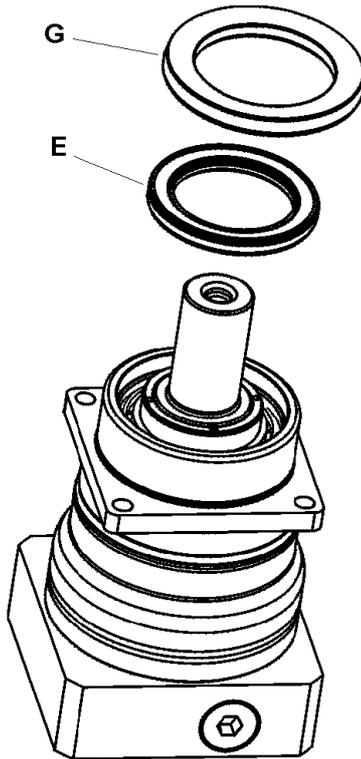
**Damaged seal surfaces can increase the wear at the radial shaft seal.**

- Take care not to scratch the running surface.



- Clamp the gearhead vertically (with the radial shaft seal to the top).
- Push a screwdriver (F) from outside between shaft nut and sealing lip of the radial shaft seal ring (E).
- Actuate a tilting moment in the direction of the shaft nut and lever the radial shaft seal out of the housing.

### Installing the radial shaft seal



- Prior to installation, check the seal surfaces for damage.
  - If any damage is discovered, contact our Customer Service department.
  - De-grease the seal surfaces.
  - Make an assembly device (G) that corresponds to the drawing.
    - $D_{\text{outside}} = \text{RWDR}_{\text{outside}} \varnothing + 5 \text{ mm}$
    - $D_{\text{inside}} = \text{RWDR}_{\text{inside}} \varnothing + 2 \text{ mm}$
  - Additionally, a sleeve of sufficient height is required.
  - Grease the space between dust guard and sealing lip of the radial shaft seal (E) to 30% (Optimol compound CTS X).
  - Smear the outer diameter of the radial shaft seal with a surface-bonding agent (for example Loctite 573 or 574).
  - Wet the sealing lip of the radial shaft seal and the running surface thinly with oil (e.g. Tribol 800/220).
  - Place the radial shaft seal into the housing parallel by hand.
  - Place the assembly device onto the radial shaft seal.
- 
- Press in the radial shaft seal with the aforementioned sleeve under a toggle press or column drill until this fits level in the housing.
  - Press the sealing lip briefly to the side with a blunt tool (a paper clip will do) to vent the gearhead.

#### 7.1.5 Replacing the gearhead

- Replace the gearhead:
  - When 90 % of the calculated life of the gear output bearing has been reached (see „Cymex®“ design or total catalogue: Chapter "Information" or "Detailed construction").
  - At the latest after a total of 30,000 operating hours.
- ① Alternatively, the gearhead can be checked by **WITTENSTEIN alpha GmbH** and if necessary, released for further operation.

#### 7.2 Startup after maintenance work

- Clean the outside of the gearhead.
- Attach all safety devices.
- Do a trial run before releasing the gearhead again for operation.

**7.3 Maintenance schedule**

Maintenance work	At initial startup	After running-in (4 hours)	After every 500 operating hours or 3 months	Every 10,000 operating hours
Visual/Noise inspection	X	X	X	-
Checking the tightening torques	X	X	X	-
Check running-in behavior (see Chapter 6.2 "Check running-in behavior")	-	X	-	-
Check for leakage	X	X	X	-
Exchange the radial shaft seal on gear output <sup>1)</sup>	-	-	-	X
<b>Replace gearhead</b> after reaching 90% of the calculated nominal bearing life, but at the <b>latest</b> after 30,000 operating hours.				
<sup>1)</sup> Contact our Customer Service department for this service. The necessary documents, spare parts, information and any training needed, will be provided..				

Tbl-9: Maintenance schedule

**7.4 Notes on the lubricant used**

	<p>All gearheads have been lubricated in the factory with high-performance grease for their entire working life. All bearings are permanently lubricated by the company.</p> <p>For information on the type of lubricant, see the type plate or contact our Customer Service department.</p>
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The manufacturer listed below will provide any further information on the lubricants:

Castrol Industrie GmbH, Mönchengladbach

Tel.: + 49 (0) 21 61 / 9 09 - 30

[www.castrol.com](http://www.castrol.com)

**7.5 Disposal**

Consult our Customer Service department for supplementary information on exchanging the adapter plate, on disassembly, and on disposal of the gearhead.

- Dispose of the gearhead at the recycling sites intended for this purpose.
  - ① Observe the locally valid regulations for disposals.

## 8 Malfunctions

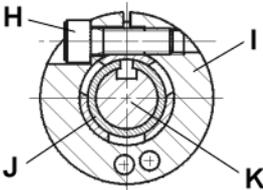
	NOTICE
<p><b>Changed operational behavior can be an indication of existing damage to the gearhead or cause damage to the gearhead.</b></p> <ul style="list-style-type: none"> <li>Do not put the gearhead back into operation until the cause of the malfunction has been rectified.</li> </ul>	
	<p>Rectifying of malfunctions may only be done by specially trained technicians.</p>

Fault	Possible cause	Solution
Increased operating temperature	The gearhead is not suited for the task.	Check the technical specifications.
	Motor is heating the gearhead.	Check the wiring of the motor.
		Ensure adequate cooling.
	Change the motor.	
Ambient temperature too high.	Ensure adequate cooling.	
Increased noises during operation	Distortion in motor mounting	Consult our Customer Service department.
	Damaged bearings	
	Damaged gear teeth	
Loss of lubricant	Lubricant quantity too high	Wipe off discharged lubricant and continue to watch the gearhead. Lubricant discharge must stop after a short time.
	Seals not tight	Consult our Customer Service department.
Clamp connection is slipping	Clamping bolt not tightened properly	Check the shaft seat and hub bore for damages. Replace damaged parts. Check the screw for proper tightening torque and secure it against loosening by itself. Check the operating parameters.
	Operating parameters not maintained	
Metal bellows of the coupling broken	Operating parameters do not meet the requirements	Consult our Customer Service department.
	Operating errors of the plant unit	

TbI-10: Malfunctions

## 9 Appendix

### 9.1 Specifications on mounting onto a motor

		Designation
	H	Clamping bolt
	I	Clamping ring (part of the clamping hub)
	J	Bushing
	K	Motorshaft

Tbl-11: Arrangement of motor shaft, clamping hub, and bushing

Gearhead size SP+		Clamping hub interior Ø "x" [mm]	Clamping screw (H) / DIN ISO 4762	Width across flats [mm]	Tightening torque [Nm] property class 12.9 (8.8)	max. axial force clamping hub [N]	
						Plug receptacle	Coupling
075	1-stage	x ≤ 14	M5	4	9.5 (5.6)	-	20
		14 < x ≤ 19	M6	5	14 (9.5)		
		19 < x ≤ 24	M8	6	35 (23)		
	2-stage	x ≤ 11	M4	3	4.1 (2.8)	-	10
		11 < x ≤ 14	M5	4	9.5 (5.6)		
		14 < x ≤ 19	M6	5	14 (9.5)		
100	1-stage	x ≤ 19	M6	5	14 (9.5)	-	30
		19 < x ≤ 24	M8	6	35 (23)		
		24 < x ≤ 28	M6	5	14 (9.5)		
		28 < x ≤ 38	M10	8	79 (45)		
	2-stage	x ≤ 14	M5	4	9.5 (5.6)	-	20
		14 < x ≤ 19	M6	5	14 (9.5)		
		19 < x ≤ 24	M8	6	35 (23)		
140	1-stage	x ≤ 24	M8	6	35 (23)	-	50
		24 < x ≤ 38	M10	8	79 (45)		
		38 < x ≤ 48	M12	10	135 (78)		
	2-stage	x ≤ 19	M6	5	14 (9.5)	-	30
		19 < x ≤ 24	M8	6	35 (23)		
		24 < x ≤ 38	M10	8	79 (45)		
180	1-stage	x ≤ 38	M10	8	79 (45)	-	200
		38 < x ≤ 48	M12	10	135 (78)		
	2-stage	x ≤ 24	M8	6	35 (23)	-	50
		24 < x ≤ 38	M10	8	79 (45)		
210	1-stage	48 < x ≤ 55	M12	10	135 (78)	300	—

Tbl-12: Specifications on mounting onto a motor

## 9.2 Specifications on mounting onto a machine

Gearhead size SP <sup>+</sup>	Hole circle Ø [mm]	Bore Ø [mm]	Screw size / property class	Tightening torque [Nm]
<b>075</b>	85	6.6	M6 / 12.9	15.4
<b>100</b>	120	9.0	M8 / 12.9	37.3
<b>140</b>	165	11.0	M10 / 12.9	73.4
<b>180</b>	215	13.0	M12 / 12.9	126
<b>210</b>	250	17.0	M16 / 12.9	310

Tbl-13: Specifications on mounting onto a machine

## 9.3 Tightening torques for common thread sizes in general mechanics

The specified tightening torques for headless screws and nuts are calculated values and are based on the following conditions:

- Calculation acc. VDI 2230 (Issue February 2003)
- Friction value for thread and contact surfaces  $\mu=0.10$
- Exploitation of the yield stress 90 %

Property class Bolt / nut	Tightening torque [Nm] for threads												
	M3	M4	M5	M6	M8	M10	M12	M14	M16	M18	M20	M22	M24
<b>8.8 / 8</b>	1.15	2.64	5.24	8.99	21.7	42.7	73.5	118	180	258	363	493	625
<b>10.9 / 10</b>	1.68	3.88	7.69	13.2	31.9	62.7	108	173	265	368	516	702	890
<b>12.9 / 12</b>	1.97	4.55	9.00	15.4	37.3	73.4	126	203	310	431	604	821	1042

Tbl-14: Tightening torques for headless screws and nuts

## 9.4 Technical specifications

### 9.4.1 Technical specifications for SP<sup>+</sup> 075 for use in areas with explosion hazards

Technical specifications for SP <sup>+</sup> 075, 1-stage						
Ratio		3	4	5	7	10
<b>Max. Acceleration torque T<sub>2B</sub></b> (max. 1000 cycles per hour)	<b>Nm</b>	45	60	60	60	46
	<b>in.lb</b>	398	531	531	531	407
<b>Nominal torque at gear output T<sub>2N</sub></b> (At n <sub>1N</sub> )	<b>Nm</b>	28	48	48	48	30
	<b>in.lb</b>	248	425	425	425	266
<b>EMERGENCY-STOP torque T<sub>2Not</sub></b> (1000 times possible during the lifespan of the gearhead)	<b>Nm</b>	186	200	200	200	170
	<b>in.lb</b>	1646	1770	1770	1770	1505
<b>Permissible medium drive speed in n<sub>1N</sub></b> (At T <sub>2N</sub> and 20 °C ambient temperature)	<b>min<sup>-1</sup></b>	3200	3200	3200	3600	3600
<b>Max. drive speed in n<sub>1Max</sub></b>	<b>min<sup>-1</sup></b>	4000	4000	4000	4500	4500
<b>Average no-load running torque T<sub>012</sub></b> (At n <sub>1</sub> =3000 rpm and 20 °C gearhead temperature)	<b>Nm</b>	1.4	1.1	0.9	0.6	0.5
	<b>in.lb/arcmin</b>	12.4	9.7	8	5.3	4.4
<b>Max. torsional backlash j<sub>t</sub></b>	<b>arcmin</b>	Standard ≤ 6 / Reduced ≤ 4				
<b>Torsional rigidity C<sub>t12</sub></b>	<b>Nm/arcmin</b>	10				
	<b>in.lb/arcmin</b>	89				
<b>Max. axial force F<sub>2AMax</sub><sup>a</sup></b>	<b>N</b>	2350				
	<b>lb<sub>f</sub></b>	529				
<b>Max. radial force F<sub>2RMax</sub><sup>a</sup></b>	<b>N</b>	2800				
	<b>lb<sub>f</sub></b>	630				
<b>Max. tilting moment M<sub>2KMax</sub></b>	<b>Nm</b>	165				
	<b>in.lb</b>	1460				
<b>Life L<sub>h</sub></b> Calculation see "Technical Basics"	<b>h</b>	> 30000				
<b>Weight incl. standard adapter plate m</b>	<b>kg</b>	3.9				
	<b>lb<sub>m</sub></b>	8.6				
<b>Noise level L<sub>PA</sub></b> (At i=10 and n <sub>1</sub> =3000 min <sup>-1</sup> w/o load)	<b>dB(A)</b>	≤ 59				
<b>Max. permissible housing temperature</b>	<b>°C</b>	+90				
	<b>F</b>	194				
<b>Ambient temperature</b>	<b>°C</b>	See chapter 6.1 "Note during startup"				
	<b>F</b>					
<b>Paint</b>		Blue RAL 5002				
<b>Direction of rotation</b>		Drive and gear output equidirectional				
<b>Protection class</b>		IP 65				

Technical specifications for SP <sup>+</sup> 075, 1-stage						
Ratio		3	4	5	7	10
Mass moment of inertia $J_1$ referring to the drive; Bore diameters of the clamping hub: 19 mm	$\text{kgcm}^2$	1.03	0.78	0.68	0.59	0.54
	$10^{-3} \text{ in.lb.s}^2$	0.91	0.69	0.6	0.52	0.48
Mass moment of inertia $J_1$ referring to the drive; Bore diameters of the clamping hub: 24 mm	$\text{kgcm}^2$	2.4	2.15	2.05	1.96	1.91
	$10^{-3} \text{ in.lb.s}^2$	2.12	1.9	1.81	1.73	1.69
<sup>a</sup> Based on the shaft or flange center at the gear output						

Tbl-15: SP<sup>+</sup> 075, 1-stage: Technical specifications for use in areas with explosion hazards

Technical specifications for SP <sup>+</sup> 075, 2-stage										
Ratio		16	20	25	28	35	40	50	70	100
Max. Acceleration torque $T_{2B}$ (max. 1000 cycles per hour)	Nm	60								46
	in.lb	531								407
Nominal torque at gear output $T_{2N}$ (At $n_{1N}$ )	Nm	50								30
	in.lb	443								266
EMERGENCY-STOP torque $T_{2Not}$ (1000 times possible during the lifespan of the gearhead)	Nm	200								170
	in.lb	1770								1505
Permissible medium drive speed in $n_{1N}$ (At $T_{2N}$ and 20 °C ambient temperature)	min <sup>-1</sup>	3600								
Max. drive speed in $n_{1Max}$	min <sup>-1</sup>	4500								
Average no-load running torque $T_{012}$ (At $n_1=3000$ min-1 and 20 °C gearhead temperature)	Nm	0.5	0.4	0.4	0.3	0.3	0.2	0.2	0.2	0.2
	in.lb/ arcmin	4.4	3.5	3.5	2.7	2.7	1.8	1.8	1.8	1.8
Max. torsional backlash $j_t$	arcmin	Standard $\leq 8$ / Reduced $\leq 6$								
Torsional rigidity $C_{t12}$	Nm/ arcmin	10								
	in.lb/ arcmin	89								
Max. axial force $F_{2AMax}$ <sup>a</sup>	N	2350								
	lb <sub>f</sub>	529								
Max. radial force $F_{2RMax}$ <sup>a</sup>	N	2800								
	lb <sub>f</sub>	630								
Max. tilting moment $M_{2KMax}$	Nm	165								
	in.lb	1460								
Life $L_h$ Calculation see "Technical Basics"	h	> 30000								
Weight incl. standard adapter plate m	kg	3.6								
	lb <sub>m</sub>	8								

Technical specifications for SP+ 075, 2-stage										
Ratio		16	20	25	28	35	40	50	70	100
Noise level $L_{PA}$ (At $i=100$ and $n_1=3000 \text{ min}^{-1}$ w/o load)	dB(A)	≤ 59								
Max. permissible housing temperature	°C	+90								
	F	194								
Ambient temperature	°C	See chapter 6.1 "Note during startup"								
	F									
Paint		Blue RAL 5002								
Direction of rotation		Drive and gear output equidirectional								
Protection class		IP 65								
Mass moment of inertia $J_1$ referring to the drive; Bore diameters of the clamping hub: 14 mm	kgcm <sup>2</sup>	0.23	0.2	0.2	0.18	0.18	0.16	0.16	0.16	0.16
	10 <sup>-3</sup> in.lb.s <sup>2</sup>	0.204	0.179	0.176	0.157	0.156	0.146	0.145	0.144	0.144
Mass moment of inertia $J_1$ referring to the drive; Bore diameters of the clamping hub: 19 mm	kgcm <sup>2</sup>	0.55	0.53	0.52	0.5	0.5	0.49	0.49	0.49	0.49
	10 <sup>-3</sup> in.lb.s <sup>2</sup>	0.490	0.466	0.462	0.445	0.443	0.433	0.432	0.431	0.431
c Based on the shaft or flange center at the gear output										

Tbl-16: SP+ 075, 2-stage: Technical specifications for use in areas with explosion hazards

9.4.2 Technical specifications for SP+ 100 for use in areas with explosion hazards

Technical specifications for SP+ 100, 1-stage						
Ratio		3	4	5	7	10
Max. Acceleration torque $T_{2B}$ (max. 1000 cycles per hour)	Nm	80	120	128	132	84
	in.lb	708	1062	1133	1168	743
Nominal torque at gear output $T_{2N}$ (At $n_{1N}$ )	Nm	64	96	102	105	68
	in.lb	566	850	903	929	602
EMERGENCY-STOP torque $T_{2Not}$ (1000 times possible during the lifespan of the gearhead)	Nm	500	500	500	500	330
	in.lb	4425	4425	4425	4425	2921
Permissible medium drive speed in $n_{1N}$ (At $T_{2N}$ and 20 °C ambient temperature)	min <sup>-1</sup>	2800	3000	3200	3600	3600
Max. drive speed in $n_{1Max}$	min <sup>-1</sup>	3600	3800	4000	4500	4500
Average no-load running torque $T_{012}$ (At $n_1=3000 \text{ rpm}$ and 20 °C gearhead temperature)	Nm	2.4	2.1	1.8	1.1	0.8
	in.lb/arcmin	21.24	18.58 5	15.93	9.735	7.08
Max. torsional backlash $j_t$	arcmin	Standard ≤ 4 / Reduced ≤ 2				
Torsional rigidity $C_{t12}$	Nm/arcmin	31				
	in.lb/arcmin	274				

Technical specifications for SP <sup>+</sup> 100, 1-stage						
Ratio		3	4	5	7	10
Max. axial force $F_{2AMax}^a$	N	3950				
	lb <sub>f</sub>	889				
Max. radial force $F_{2RMax}^a$	N	4400				
	lb <sub>f</sub>	990				
Max. tilting moment $M_{2KMax}$	Nm	340				
	in.lb	3009				
Life $L_h$ Calculation see "Technical Basics"	h	> 30000				
Weight incl. standard adapter plate m	kg	7.7				
	lb <sub>m</sub>	17				
Noise level $L_{PA}$ (At $i=10$ and $n_1=3000 \text{ min}^{-1}$ w/o load)	dB(A)	≤ 64				
Max. permissible housing temperature	°C	+90				
	F	194				
Ambient temperature	°C	See chapter 6.1 "Note during startup"				
	F					
Paint		Blue RAL 5002				
Direction of rotation		Drive and gear output equidirectional				
Protection class		IP 65				
Mass moment of inertia $J_1$ referring to the drive; Bore diameters of the clamping hub: 24 mm	kgcm <sup>2</sup>	3.99	3.04	2.61	2.29	2.07
	10 <sup>-3</sup> in.lb.s <sup>2</sup>	3.53	2.69	2.31	2.03	1.83
Mass moment of inertia $J_1$ referring to the drive; Bore diameters of the clamping hub: 38 mm	kgcm <sup>2</sup>	11.1	10.1	9.68	9.36	9.14
	10 <sup>-3</sup> in.lb.s <sup>2</sup>	9.78	8.95	8.57	8.28	8.09
<sup>a</sup> Based on the shaft or flange center at the gear output						

TbI-17: SP<sup>+</sup> 075, 1-stage: Technical specifications for use in areas with explosion hazards

Technical specifications for SP <sup>+</sup> 100, 2-stage										
Ratio		16	20	25	28	35	40	50	70	100
Max. Acceleration torque $T_{2B}$ (max. 1000 cycles per hour)	Nm	120	128	128	132	128	120	128	132	84
	in.lb	1062	1133	1133	1168	1133	1062	1133	1168	743
Nominal torque at gear output $T_{2N}$ (At $n_{1N}$ )	Nm	96	102	102	106	102	96	102	106	68
	in.lb	850	903	903	938	903	850	903	938	602
EMERGENCY-STOP torque $T_{2Not}$ (1000 times possible during the lifespan of the gearhead)	Nm	500	500	500	500	500	500	500	500	330
	in.lb	4425	4425	4425	4425	4425	4425	4425	4425	2921
Permissible medium drive speed in $n_{1N}$ (At $T_{2N}$ and 20 °C ambient temperature)	min <sup>-1</sup>	3600								

Technical specifications for SP+ 100, 2-stage										
Ratio		16	20	25	28	35	40	50	70	100
Max. drive speed in $n_{1Max}$	min <sup>-1</sup>	4500								
Average no-load running torque $T_{012}$ (At $n_1=3000$ min <sup>-1</sup> and 20 °C gearhead temperature)	Nm	0.8	0.7	0.6	0.5	0.4	0.4	0.3	0.3	0.3
	in.lb/arcmin	7.1	6.2	5.3	4.4	3.5	3.5	2.7	2.7	2.7
Max. torsional backlash $j_t$	arcmin	Standard $\leq 6$ / Reduced $\leq 4$								
Torsional rigidity $C_{t12}$	Nm/arcmin	31								
	in.lb/arcmin	274								
Max. axial force $F_{2AMax}^a$	N	3950								
	lb <sub>f</sub>	889								
Max. radial force $F_{2RMax}^a$	N	4400								
	lb <sub>f</sub>	990								
Max. tilting moment $M_{2KMax}$	Nm	340								
	in.lb	3009								
Life $L_h$ Calculation see "Technical Basics"	h	> 30000								
Weight incl. standard adapter plate $m$	kg	7.9								
	lb <sub>m</sub>	17.5								
Noise level $L_{PA}$ (At $i=100$ and $n_1=3000$ min <sup>-1</sup> w/o load)	dB(A)	$\leq 60$								
Max. permissible housing temperature	°C	+90								
	F	194								
Ambient temperature	°C	See chapter 6.1 "Note during startup"								
	F									
Paint		Blue RAL 5002								
Direction of rotation		Drive and gear output equidirectional								
Protection class		IP 65								
Mass moment of inertia $J_1$ referring to the drive; Bore diameters of the clamping hub: 19 mm	kgcm <sup>2</sup>	0.81	0.7	0.68	0.6	0.59	0.55	0.54	0.54	0.54
	10 <sup>-3</sup> in.lb.s <sup>2</sup>	0.72	0.62	0.61	0.53	0.52	0.48	0.48	0.48	0.48
Mass moment of inertia $J_1$ referring to the drive; Bore diameters of the clamping hub: 24 mm	kgcm <sup>2</sup>	2.18	2.07	2.05	1.97	1.96	1.92	1.91	1.91	1.91
	10 <sup>-3</sup> in.lb.s <sup>2</sup>	1.93	1.83	1.82	1.74	1.74	1.7	1.69	1.69	1.69
<sup>c</sup> Based on the shaft or flange center at the gear output										

Tbl-18: SP+ 100, 2-stage: Technical specifications for use in areas with explosion hazards

9.4.3 Technical specifications for SP<sup>+</sup> 140 for use in areas with explosion hazards

Technical specifications for SP <sup>+</sup> 140, 1-stage						
Ratio		3	4	5	7	10
<b>Max. Acceleration torque T<sub>2B</sub></b> (max. 1000 cycles per hour)	<b>Nm</b>	170	264	264	264	210
	<b>in.lb</b>	1505	2336	2336	2336	1859
<b>Nominal torque at gear output T<sub>2N</sub></b> (At n <sub>1N</sub> )	<b>Nm</b>	130	195	205	210	160
	<b>in.lb</b>	1151	1726	1814	1859	1416
<b>EMERGENCY-STOP torque T<sub>2Not</sub></b> (1000 times possible during the lifespan of the gearhead)	<b>Nm</b>	1000	1000	1000	730	380
	<b>in.lb</b>	8850	8850	8850	6461	3363
<b>Permissible medium drive speed in n<sub>1N</sub></b> (At T <sub>2N</sub> and 20 °C ambient temperature)	<b>min<sup>-1</sup></b>	2400	2800	3000	3600	3600
<b>Max. drive speed in n<sub>1Max</sub></b>	<b>min<sup>-1</sup></b>	3000	3500	3800	4500	4500
<b>Average no-load running torque T<sub>012</sub></b> (At n <sub>1</sub> =3000 rpm and 20 °C gearhead temperature)	<b>Nm</b>	5.1	3.9	3.1	2.3	1.6
	<b>in.lb/arcmin</b>	45.1	34.5	27.4	20.4	14.2
<b>Max. torsional backlash j<sub>t</sub></b>	<b>arcmin</b>	Standard ≤ 4 / Reduced ≤ 2				
<b>Torsional rigidity C<sub>t12</sub></b>	<b>Nm/arcmin</b>	53				
	<b>in.lb/arcmin</b>	469				
<b>Max. axial force F<sub>2AMax</sub><sup>a</sup></b>	<b>N</b>	6900				
	<b>lb<sub>f</sub></b>	1553				
<b>Max. radial force F<sub>2RMax</sub><sup>a</sup></b>	<b>N</b>	6600				
	<b>lb<sub>f</sub></b>	1485				
<b>Max. tilting moment M<sub>2KMax</sub></b>	<b>Nm</b>	660				
	<b>in.lb</b>	5841				
<b>Life L<sub>h</sub></b> Calculation see "Technical Basics"	<b>h</b>	> 30000				
<b>Weight incl. standard adapter plate m</b>	<b>kg</b>	17.2				
	<b>lb<sub>m</sub></b>	38				
<b>Noise level L<sub>PA</sub></b> (At i=10 and n <sub>1</sub> =3000 min <sup>-1</sup> w/o load)	<b>dB(A)</b>	≤ 65				
<b>Max. permissible housing temperature</b>	<b>°C</b>	+90				
	<b>F</b>	194				
<b>Ambient temperature</b>	<b>°C</b>	See chapter 6.1 "Note during startup"				
	<b>F</b>					
<b>Paint</b>		Blue RAL 5002				
<b>Direction of rotation</b>		Drive and gear output equidirectional				
<b>Protection class</b>		IP 65				
<b>Mass moment of inertia J<sub>1</sub></b> referring to the drive; Bore diameters of the clamping hub: 38 mm	<b>kgcm<sup>2</sup></b>	14.9	12.1	11	10.1	9.5
	<b>10<sup>-3</sup> in.lb.s<sup>2</sup></b>	13.2	10.7	9.8	8.9	8.4

<sup>a</sup> Based on the shaft or flange center at the gear output

TbI-19: SP<sup>+</sup>140, 1–stage: Technical specifications for use in areas with explosion hazards

Technical specifications for SP <sup>+</sup> 140, 2-stage										
Ratio		16	20	25	28	35	40	50	70	100
<b>Max. Acceleration torque</b> $T_{2B}$ (max. 1000 cycles per hour)	<b>Nm</b>	264								210
	<b>in.lb</b>	2336								1859
<b>Nominal torque at gear output</b> $T_{2N}$ (At $n_{1N}$ )	<b>Nm</b>	211								168
	<b>in.lb</b>	1867								1487
<b>EMERGENCY-STOP torque</b> $T_{2Not}$ (1000 times possible during the lifespan of the gearhead)	<b>Nm</b>	1000	1000	1000	1000	1000	1000	1000	730	380
	<b>in.lb</b>	8850	8850	8850	8850	8850	8850	8850	8850	6461
<b>Permissible medium drive speed in</b> $n_{1N}$ (At $T_{2N}$ and 20 °C ambient temperature)	<b>min<sup>-1</sup></b>	3600								
<b>Max. drive speed in</b> $n_{1Max}$	<b>min<sup>-1</sup></b>	4500								
<b>Average no-load running torque</b> $T_{012}$ (At $n_1=3000$ min <sup>-1</sup> and 20 °C gearhead temperature)	<b>Nm</b>	1.6	1.3	1.2	1	0.9	0.7	0.6	0.5	0.5
	<b>in.lb/arcmin</b>	14.2	11.5	10.6	8.9	8	6.2	5.3	4.4	4.4
<b>Max. torsional backlash</b> $j_t$	<b>arcmin</b>	Standard $\leq 6$ / Reduced $\leq 4$								
<b>Torsional rigidity</b> $C_{t12}$	<b>Nm/arcmin</b>	53								
	<b>in.lb/arcmin</b>	469								
<b>Max. axial force</b> $F_{2AMax}^a$	<b>N</b>	6900								
	<b>lb<sub>f</sub></b>	1553								
<b>Max. radial force</b> $F_{2RMax}^a$	<b>N</b>	6600								
	<b>lb<sub>f</sub></b>	1485								
<b>Max. tilting moment</b> $M_{2KMax}$	<b>Nm</b>	660								
	<b>in.lb</b>	5841								
<b>Life</b> $L_h$ Calculation see "Technical Basics"	<b>h</b>	> 30000								
<b>Weight incl. standard adapter plate</b> $m$	<b>kg</b>	17								
	<b>lb<sub>m</sub></b>	38								
<b>Noise level</b> $L_{PA}$ (At $i=100$ and $n_1=3000$ min <sup>-1</sup> w/o load)	<b>dB(A)</b>	$\leq 63$								
<b>Max. permissible housing temperature</b>	<b>°C</b>	+90								
	<b>F</b>	194								
<b>Ambient temperature</b>	<b>°C</b>	See chapter 6.1 "Note during startup"								
	<b>F</b>									
<b>Paint</b>		Blue RAL 5002								
<b>Direction of rotation</b>		Drive and gear output equidirectional								

Technical specifications for SP <sup>+</sup> 140, 2-stage										
Ratio		16	20	25	28	35	40	50	70	100
<b>Protection class</b>		IP 65								
<b>Mass moment of inertia</b> $J_1$ referring to the drive; Bore diameters of the clamping hub: 24 mm	<b>kgcm<sup>2</sup></b>	3.19	2.71	2.67	2.34	2.32	2.1	2.08	2.08	2.07
	<b>10<sup>-3</sup> in.lb.s<sup>2</sup></b>	2.82	2.4	2.36	2.07	2.05	1.85	1.85	1.84	1.83
<b>Mass moment of inertia</b> $J_1$ referring to the drive; Bore diameters of the clamping hub: 38 mm	<b>kgcm<sup>2</sup></b>	10.3	9.77	9.73	9.41	9.39	9.16	9.15	9.14	9.14
	<b>10<sup>-3</sup> in.lb.s<sup>2</sup></b>	9.07	8.65	8.61	8.33	8.31	8.11	8.1	8.09	8.09
° Based on the shaft or flange center at the gear output										

TbI-20: SP<sup>+</sup> 140, 2-stage: Technical specifications for use in areas with explosion hazards

#### 9.4.4 Technical specifications for SP<sup>+</sup> 180 for use in areas with explosion hazards

Technical specifications for SP <sup>+</sup> 180, 1-stage						
Ratio		3	4	5	7	10
<b>Max. Acceleration torque <math>T_{2B}</math></b> (max. 1000 cycles per hour)	<b>Nm</b>	420	528	528	528	420
	<b>in.lb</b>	3717	4673	4673	4673	3717
<b>Nominal torque at gear output <math>T_{2N}</math></b> (At $n_{1N}$ )	<b>Nm</b>	290	422	422	422	336
	<b>in.lb</b>	2567	3735	3735	3735	2974
<b>EMERGENCY-STOP torque <math>T_{2Not}</math></b> (1000 times possible during the lifespan of the gearhead)	<b>Nm</b>	2200	2200	2200	2200	1380
	<b>in.lb</b>	19470	19470	19470	19470	12213
<b>Permissible medium drive speed in <math>n_{1N}</math></b> (At $T_{2N}$ and 20 °C ambient temperature)	<b>min<sup>-1</sup></b>	1850	2400	2800	3200	3200
<b>Max. drive speed in <math>n_{1Max}</math></b>	<b>min<sup>-1</sup></b>	2300	3000	3500	4000	4000
<b>Average no-load running torque <math>T_{012}</math></b> (At $n_1=3000$ rpm and 20 °C gearhead temperature)	<b>Nm</b>	10.2	7.7	6.2	4.5	3.2
	<b>in.lb/arcmin</b>	90.3	68.1	54.9	39.8	28.3
<b>Max. torsional backlash <math>j_t</math></b>	<b>arcmin</b>	Standard $\leq 4$ / Reduced $\leq 2$				
<b>Torsional rigidity <math>C_{t12}</math></b>	<b>Nm/arcmin</b>	175				
	<b>in.lb/arcmin</b>	1549				
<b>Max. axial force <math>F_{2AMax}^a</math></b>	<b>N</b>	9900				
	<b>lb<sub>f</sub></b>	2228				
<b>Max. radial force <math>F_{2RMax}^a</math></b>	<b>N</b>	10290				
	<b>lb<sub>f</sub></b>	2315				
<b>Max. tilting moment <math>M_{2KMax}</math></b>	<b>Nm</b>	1120				
	<b>in.lb</b>	9912				
<b>Life <math>L_h</math> Calculation see "Technical Basics"</b>	<b>h</b>	> 30000				
<b>Weight incl. standard adapter plate <math>m</math></b>	<b>kg</b>	34				
	<b>lb<sub>m</sub></b>	75				

Technical specifications for SP+ 180, 1-stage						
Ratio		3	4	5	7	10
<b>Noise level <math>L_{PA}</math></b> (At $i=10$ and $n_1=3000 \text{ min}^{-1}$ w/o load)	<b>dB(A)</b>	≤ 66				
<b>Max. permissible housing temperature</b>	<b>°C</b>	+90				
	<b>F</b>	194				
<b>Ambient temperature</b>	<b>°C</b>	See chapter 6.1 "Note during startup"				
	<b>F</b>					
<b>Paint</b>		Blue RAL 5002				
<b>Direction of rotation</b>		Drive and gear output equidirectional				
<b>Protection class</b>		IP 65				
<b>Mass moment of inertia <math>J_1</math></b> referring to the drive; Bore diameters of the clamping hub: 48 mm	<b>kgcm<sup>2</sup></b>	58.5	41.6	35.6	30	26.9
	<b>10<sup>-3</sup> in.lb.s<sup>2</sup></b>	51.8	36.8	31.5	26.6	23.8
<sup>a</sup> Based on the shaft or flange center at the gear output						

Tbl-21: SP+ 180, 1-stage: Technical specifications for use in areas with explosion hazards

Technical specifications for SP+ 180, 2-stage										
Ratio		16	20	25	28	35	40	50	70	100
<b>Max. Acceleration torque <math>T_{2B}</math></b> (max. 1000 cycles per hour)	<b>Nm</b>	528								420
	<b>in.lb</b>	4673								3717
<b>Nominal torque at gear output <math>T_{2N}</math></b> (At $n_{1N}$ )	<b>Nm</b>	422								336
	<b>in.lb</b>	3735								2974
<b>EMERGENCY-STOP torque <math>T_{2Not}</math></b> (1000 times possible during the lifespan of the gearhead)	<b>Nm</b>	2200	2200	2200	2200	2200	1520	1900	2200	1380
	<b>in.lb</b>	19470	19470	19470	19470	19470	13452	16815	19470	12213
<b>Permissible medium drive speed in <math>n_{1N}</math></b> (At $T_{2N}$ and 20 °C ambient temperature)	<b>min<sup>-1</sup></b>	3600								
<b>Max. drive speed in <math>n_{1Max}</math></b>	<b>min<sup>-1</sup></b>	4500								
<b>Average no-load running torque <math>T_{012}</math></b> (At $n_1=3000 \text{ min}^{-1}$ and 20 °C gearhead temperature)	<b>Nm</b>	3.2	2.6	2.3	1.9	1.7	1.4	1.2	1	0.9
	<b>in.lb/ arcmin</b>	28.3	23	20.4	16.8	15	12.4	10.6	8.9	8
<b>Max. torsional backlash <math>j_t</math></b>	<b>arcmin</b>	Standard ≤ 6 / Reduced ≤ 4								
<b>Torsional rigidity <math>C_{t12}</math></b>	<b>Nm/ arcmin</b>	175								
	<b>in.lb/ arcmin</b>	149								

Technical specifications for SP <sup>+</sup> 180, 2-stage										
Ratio		16	20	25	28	35	40	50	70	100
<b>Max. axial force</b> $F_{2A\text{Max}}^a$	<b>N</b>	9900								
	<b>lb<sub>f</sub></b>	2228								
<b>Max. radial force</b> $F_{2R\text{Max}}^a$	<b>N</b>	10290								
	<b>lb<sub>f</sub></b>	2315								
<b>Max. tilting moment</b> $M_{2K\text{Max}}$	<b>Nm</b>	1120								
	<b>in.lb</b>	9912								
<b>Life <math>L_h</math></b> Calculation see "Technical Basics"	<b>h</b>	> 30000								
<b>Weight incl. standard adapter plate m</b>	<b>kg</b>	36.4								
	<b>lb<sub>m</sub></b>	80.4								
<b>Noise level <math>L_{PA}</math></b> (At $i=100$ and $n_1=3000$ min <sup>-1</sup> w/o load)	<b>dB(A)</b>	≤ 66								
<b>Max. permissible housing temperature</b>	<b>°C</b>	+90								
	<b>F</b>	194								
<b>Ambient temperature</b>	<b>°C</b>	See chapter 6.1 "Note during startup"								
	<b>F</b>									
<b>Paint</b>		Blue RAL 5002								
<b>Direction of rotation</b>		Drive and gear output equidirectional								
<b>Protection class</b>		IP 65								
<b>Mass moment of inertia</b> $J_1$ referring to the drive; Bore diameters of the clamping hub: 38 mm	<b>kgcm<sup>2</sup></b>	13.5	12	11.7	10.6	10.4	9.74	9.68	9.63	9.6
	<b>10<sup>-3</sup> in.lb.s<sup>2</sup></b>	12	10.6	10.4	9.34	9.23	8.62	8.57	8.52	8.49
° Based on the shaft or flange center at the gear output										

TbI-22: SP<sup>+</sup> 180, 2-stage: Technical specifications for use in areas with explosion hazards

9.4.5 Technical specifications for SP+ 210 for use in areas with explosion hazards

Technical specifications for SP+ 210, 1-stage						
Ratio		3	4	5	7	10
<b>Max. Acceleration torque T<sub>2B</sub></b> (max. 1000 cycles per hour)	<b>Nm</b>	600	1000	1000	850	800
	<b>in.lb</b>	5310	8850	8850	7523	7080
<b>Nominal torque at gear output T<sub>2N</sub></b> (At n <sub>1N</sub> )	<b>Nm</b>	480	800	680	680	640
	<b>in.lb</b>	4248	7080	6018	6018	5664
<b>EMERGENCY-STOP torque T<sub>2Not</sub></b> (1000 times possible during the lifespan of the gearhead)	<b>Nm</b>	4000	400	4000	2950	1500
	<b>in.lb</b>	35400	35400	35400	26108	13275
<b>Permissible medium drive speed in n<sub>1N</sub></b> (At T <sub>2N</sub> and 20 °C ambient temperature)	<b>min<sup>-1</sup></b>	1350	1850	2250	2800	3200
<b>Max. drive speed in n<sub>1Max</sub></b>	<b>min<sup>-1</sup></b>	1700	2300	2800	3500	4000
<b>Average no-load running torque T<sub>012</sub></b> (At n <sub>1</sub> =3000 rpm and 20 °C gearhead temperature)	<b>Nm</b>	13	9	6.5	4	2.5
	<b>in.lb/arcmin</b>	115	80	58	35	22
<b>Max. torsional backlash j<sub>t</sub></b>	<b>arcmin</b>	Standard ≤ 4 / Reduced ≤ 2				
<b>Torsional rigidity C<sub>t12</sub></b>	<b>Nm/arcmin</b>	400				
	<b>in.lb/arcmin</b>	3540				
<b>Max. axial force F<sub>2AMax</sub><sup>a</sup></b>	<b>N</b>	21000				
	<b>lb<sub>f</sub></b>	4725				
<b>Max. radial force F<sub>2RMax</sub><sup>a</sup></b>	<b>N</b>	14700				
	<b>lb<sub>f</sub></b>	3308				
<b>Max. tilting moment M<sub>2KMax</sub></b>	<b>Nm</b>	2170				
	<b>in.lb</b>	19205				
<b>Life L<sub>h</sub></b> Calculation see "Technical Basics"	<b>h</b>	> 30000				
<b>Weight incl. standard adapter plate m</b>	<b>kg</b>	56				
	<b>lb<sub>m</sub></b>	124				
<b>Noise level L<sub>PA</sub></b> (At i=10 and n <sub>1</sub> =3000 min <sup>-1</sup> w/o load)	<b>dB(A)</b>	≤ 64				
<b>Max. permissible housing temperature</b>	<b>°C</b>	+90				
	<b>F</b>	194				
<b>Ambient temperature</b>	<b>°C</b>	See chapter 6.1 "Note during startup"				
	<b>F</b>					
<b>Paint</b>		Blue RAL 5002				
<b>Direction of rotation</b>		Drive and gear output equidirectional				
<b>Protection class</b>		IP 65				
<b>Mass moment of inertia J<sub>1</sub></b> referring to the drive; Bore diameters of the clamping hub: 55 mm	<b>kgcm<sup>2</sup></b>	139	94.3	76.9	61.5	53.1
	<b>10<sup>-3</sup> in.lb.s<sup>2</sup></b>	123	83.5	68.1	54.4	47

<sup>a</sup> Based on the shaft or flange center at the gear output

## 9.5 Declaration of Conformity



## EG-Konformitätserklärung

### EC-Declaration of Conformity

Wir / We, **WITTENSTEIN alpha GmbH**  
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erklären hiermit in alleiniger Verantwortung, daß die Erzeugnisse  
*hereby declare under our sole responsibility, that the products*

Bezeichnung: **SP<sup>+</sup> Spielarme Planetengetriebe mit ein- und zweistufiger Übersetzung**  
 Designation: **SP<sup>+</sup> Low-Backlash Planetary Gear Reducer with one- and two-stage ratio**  
 Baugröße / Size: **SP<sup>+</sup> 075, SP<sup>+</sup> 100, SP<sup>+</sup> 140, SP<sup>+</sup> 180, SP<sup>+</sup> 210**  
 Ausführung: **E-MC-Version (Fettschmierung, für Dauer- und Zyklusbetrieb)**  
 Performance: **E-MC-Version (Grease lubrication, for Continuous- and Cycle Operation)**

mit den wesentlichen Anforderungen der folgenden EN-Normen  
*comply with the principle demands of the following EN standards*

DIN EN 13463-1:2009	Nicht-elektrische Geräte für den Einsatz in explosionsgefährdeten Bereichen - Teil 1: Grundlagen und Anforderungen <i>Non-electrical equipment for potentially explosive atmospheres Part 1: Basic method and requirements</i>
DIN EN 13463-5:2004	Nicht-elektrische Geräte für den Einsatz in explosionsgefährdeten Bereichen - Teil 5: Schutz durch Konstruktive Sicherheit „c“ <i>Non-electrical equipment intended for use in potentially explosive atmospheres Part 5: Protection by constructional safety „c“</i>

und den Prüfdokumenten übereinstimmt. Die Planetengetriebe in der explosionsgeschützten Ausführung sind Geräte im Sinne des Artikels 1 (3) a) der EG-Richtlinie 94/9/EG und erfüllen die grundlegenden Sicherheits- und Gesundheitsanforderungen zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen gemäß Anhang II der RL 94/9/EG.  
*and agree with the test documents. Planetary gear reducers in highly explosive versions are devices in terms of Article 1 (3) a) of the EU directive 94/9/EC and fulfil the basic safety and health requirements for use according to regulations in explosive areas in accordance with supplement II of directive 94/9/EC.*

Kennzeichnung / Marking:  II 2G c IIC T3 X und / and  
 II 2D c 150 °C X

Die explosionsgeschützt ausgeführten Planetengetriebe tragen das CE-Zeichen.  
*The explosion-proof versions of planetary gear reducers carry the CE symbol.*





alpha

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**WITTENSTEIN - being one with the future**

**[www.wittenstein.de](http://www.wittenstein.de)**