GEISLINGER SAE-COUPLING

The technology behind the Geislinger steel spring coupling with its extraordinary reliability has been proven for more than 50 years. This successful design has now been further developed and optimized, resulting in the SAE-Coupling. In circumstances where reliability and cost of ownership are decisive factors, the Geislinger SAE-Coupling is the first choice for a wide variety of applications.

**DESCRIPTION**

The Geislinger SAE-Coupling with its modular concept, enlarged oil volume and the renowned fatigue resistant steel springs permits a short lead time and attractive pricing. The SAE-Coupling is available in four different stiffness levels, and adapts perfectly to the stiffness and torque required by specific applications.

To meet all installation situations, customized adapters with splined interfaces are available to connect to the coupling inner part and allow for axial movement. The composite membrane enables thermal expansion of the oil and allows for a rapid oil exchange by flushing.

Resistant to heat and oil, the Geislinger SAE-Coupling is the perfect solution for installation in harsh environments, such as bell or bearing carrier housings with low air ventilation.

**ADVANTAGES**

- Minimal weight and slim, low profile design
- Compact, high power density
- Reduction of lead time
- Superior reliability is achieved using original Geislinger-made steel springs
- Rapid oil exchange via VSTI-plugs
- Simple calculation using linear and constant parameters
- Longevity of coupling is unaffected by harsh environmental stresses
- Low life-cycle cost
- Geislinger Worldwide After Sales Service

**APPLICATIONS**

- Marine
- Power generation
- Rail
- Mining
- Oil and gas

**TECHNICAL DATA**

- Torque range: 2.4 - 20 kNm
- Twist at nominal torque: 30, 60, 90 and 120 mrad
- Dimensionless damping factor: 0.07 – 0.154
- Ambient temperature: -10°C to 120°C
- SAE-Standard J620 outer connections: 14, 18, 21 and 24
- Inner connection: Spline, blind-assembly
- Multiple adapter options: flange, keyway or conical taper

Standardized interfaces for SAE-Standard J620 (outside) spline connections (inside) and VSTI-plugs for quick oil exchange.

New integrated skeleton for more compactness and less weight (patented).
Preamble

This catalog replaces all old catalog versions.

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Description

**Application**

Geislinger SAE-Couplings are torsional elastic steel spring couplings with the following advantages:

- Modular concept for SAE-flywheel sizes
- High torsional elasticity
- Torsional damping
- Longest life time
- Low weight, small size
- No aging, easy to service
- Low wear and maintenance
- Indifferent to high temperatures, dirt and oil
- Constant stiffness and damping over coupling life
- Suitable for high rotational speeds

Due to the increased power density of today’s diesel and gas engines, more attention must be paid to torsional vibration issues. In many cases it is necessary to dampen torsional vibrations and to move damaging natural frequencies out of the operating speed range of the driven system. The Geislinger SAE-Coupling is capable of solving both of these tasks. The stiffness of the coupling leaf springs can be precisely tuned to isolate or move harmful natural frequencies. In addition the Geislinger SAE-Coupling provides a certain damping which damps torsional vibrations. Without a SAE-Coupling these torsional vibrations create stresses in the driven system, dramatically shortening component life and reliability. The Geislinger SAE-Coupling allows for continuous operation within the operating speed range of the driven system, obtaining lower stresses in shafts and gears.

Geislinger SAE-Couplings do not only meet the demands of any type and size of internal combustion engine, but also the demands of all sorts of other machinery. Applications such as marine and pumps are typical examples. Data collection from many research tests have enabled precise torsional damping and torsional spring stiffness data to be established. This guarantees correct calculation of critical speeds, amplitudes and loads in all parts of the system. Torsional stiffness is available in narrow steps within a wide range to meet the needs of any installation.

Due to the fact that the Geislinger SE-Coupling has no axial stiffness it can easily absorb thermal expansion of the driving and driven system parts. The SE-Coupling also permits radial and angular misalignments in a small range.

For high misalignment needs in radial and axial direction the Geislinger SB-Coupling with internal axial/radial fixation of the driven flange is combined with a Gesilco® BF-Coupling. This coupling combination allows for very low reaction forces and homo-kinetic torque transmission. Adapters are tailor-made.
**Design SE-Coupling**

The Geislinger SE-Coupling design is a further development of the Geislinger torsional elastic coupling GED using radially arranged steel springs. The unique skeleton forms the backbone of the coupling, accommodating the coupling springs. Spring fixing is done by using a conical clamping ring which forces sets of three V-shaped springs radially into V-shaped clamping positions of the skeleton (international patents). All major coupling components are essentially made of the same materials as those used for diesel engines and the associated driven components. The backpack is a FE-optimized glass fibre reinforced plastic membrane, compensating thermal expansion of the coupling oil. All major components are shown in Fig. 1.
Design SB+BF Coupling-Combination

The Geislinger SB-Coupling design is a further development of the Geislinger SE-Coupling using radially arranged steel springs. The unique skeleton forms the backbone of the coupling with its flange part taking over the function of the clamping ring. Spring fixation is done by forcing sets of three V-shaped springs radially into V-shaped clamping positions of the skeleton (international patents). All major coupling components are essentially made of the same materials as those used for diesel engines and the associated driven components. The backpack is a FE-optimized glass fibre reinforced plastic membrane, compensating thermal expansion of the coupling oil.

The SB-Coupling is combined with the Gesilco® BF-Coupling as a standard. The patented Gesilco® BF-Coupling consists of two membranes, an intermediate shaft with openings for assembly of fitted steel inserts and pre-stressed screws and two flanges. Membranes, intermediate shafts and flanges are manufactured as a single piece advanced composite structure.

The halves of the coupling are bolted together at the outer flanges with fitted bolts. By use of variable thickness spacers, installation tolerances and centering recesses can be compensated. At the inner flanges fitted steel inserts combined with pre-stressed screws are used to connect the BF-Coupling to the driving and driven components. All major components are shown in Fig. 2.
It is possible to adjust the Gesilco® BF-Coupling installation length (i.e. 3 washer thicknesses can be installed in 3 different combinations to change the overall length of the BF-Coupling. See Fig. 3):

Fig. 3

The BF-Coupling inner flange bolts are mounted through the openings with a torque spanner. See fig.4. Afterwards the coupling halves are turned into the operating position and bolted together. See fig. 5.

Fig. 4  Fig. 5

Openings for mounting of inner flange bolts

**Torsional Stiffness**

The steel springs represent the core components of a Geislinger SAE-Coupling. Three V-shaped springs distanced by shims create a spring pack. They are produced in four basic stiffness series and develop by using several numbers of spring packs (6, 8, 10, 12, 14, 15, 16, 18, 20) a fine graded stiffness range. The stiffness series, listed in this catalogue, form standard determinations based on the requirements of most applications.

The Gesilco® BF-Coupling can be considered as more or less torsional stiff.
**Torsional Damping**

The torsional damping of the oil filled Geislinger SAE-Coupling is mainly influenced by damping due to friction between the springs and between springs and inner star grooves, as the effect of hydrodynamic damping is set very low.

**Misalignment**

**Axial Misalignment**

The Geislinger SE-Coupling provides axial displacement capacity due to a splined connection between innerstar and the driven part. It enables absorption of axial thermal expansion of drive shaft components. In addition, the coupling’s axial displacement capacity allows blind assembly and removal of any driven arrangement without disassembly of surrounding components.

The Geislinger SB+BF-Coupling-Combination provides axial displacement capacity due to the properties of the Gesilco® BF-Coupling. Each Gesilco® membrane is able to compensate for axial misalignments. Reaction forces caused by axial deflections are nearly linear within a wide range.

The values for axial displacement are mentioned in the Technical Data tables.

**Radial and Angular Misalignment**

For the Geislinger SE-Coupling radial and angular misalignment capacity of the coupling is determined by the size of gap $\Delta K_r$. Resulting reaction forces are determined by the stiffness of the coupling springs and are relatively small. Most importantly, no permanent deformation is occurring during misalignment compensation. This is due to the fact that loads are absorbed elastically by the spring packs.

For the Geislinger SB+BF-Coupling-Combination radial and angular misalignment capacity are determined by the properties of the Gesilco® BF-Coupling. In radial direction, a single Gesilco® membrane is relatively stiff.

The combination of two membranes, coupled by a given length, allows for compensation of radial, angular and axial misalignments. Reaction forces caused by axial and angular deflections are nearly linear within a wide range.

Misalignment values can be seen in the Technical Data tables.

**Assembly**

The SAE-Coupling is designed for standard connection of SAE-flywheel size 14, size 18, size 21 and size 24. In the same configuration there are also connection solutions available for nonstandard metric connecting bolts and/or for a different number of connecting bolts.
The driven part of the SE-Coupling can connect directly to the coupling’s inner spline or an adapter can be used for connecting a tapered shaft, a keyway shaft or a flange shaft. Even in the most difficult situations, assembly is possible through design optimization of an adapter.

The driven part of the SB+BF-Coupling -Combination can connect directly to the BF-flange or a tapered hub, a keyway hub or a flange hub can be provided with customized dimensions.

- **Overload Capability**
  Due to the SAE-Coupling’s design, half or all of the spring packs come in contact with the spring bending limitation at 1.4 times of the nominal torque. This is referred to as torque on buffer. The coupling’s standard design enables it to transmit transient shock torques up to 3.25 times of the nominal torque. With respect to marine applications, the spring bending limitations can help the coupling to act as a rigid coupling or as “homecoming device” if some spring packs are damaged.

- **Oil Supply**
  The Geislinger SAE-Coupling is oil filled directly after the assembly process. There are 2 connections for a quick oil change available on the sideplate or the skeleton of the coupling. Oil change is done by flushing a certain oil volume through the coupling. Oil change intervals and a detailed description of the oil change process are mentioned in the coupling’s manual.

- **Approval**
  All couplings are produced and certified in accordance with quality assurance requirements of DIN/ISO 9001 and DIN/ISO 14001. Geislinger’s Quality Assurance System has been certified by all major classification societies.

  All couplings can be supplied with approvals of major classification societies. Those classification society approvals do not require design alterations or compulsory spare parts.

  For survey by a classification society, the following information is requested:
  - Name of Classification Society
  - Shipyard
  - Hull number
Designation

- **Designation Code**
  In order to produce the Geislinger SAE-couplings as small and cost effective as possible, very soft couplings are designed as non-reversible couplings.

**Non-Reversible Type NC3**
This design is used with non-reversible engines. It has asymmetric bending capacity in forward and reverse direction.

**Reversible Type UC3**
This design has a symmetric spring bending capacity in the forward and reverse direction. It can be used for reversible engines. In reverse direction, this coupling can transmit the same torque as in forward direction ($1.0 \cdot T_{KN}$).

The SE-Coupling designation has the following meaning:

**SE 41/2.2/120NC3/1/L/20/S14**

- **SE**: SAE-type of engine flywheel. Inner connection of the SE-Coupling is a standardized spline connection. Different adaptors fitting to the spline connection are available on request.
- **41**: Outer diameter of centre part in cm
- **2.2**: Spring pack width in cm
- **120**: Stiffness series and the approximate twist in mrad at nominal torque. Standard series are 30, 60, 90 and 120. Torsional stiffness and nominal torque can be varied by different number of spring packs.
- **NC3, UC3**: Directionality code for coupling type with 3-spring design
  - **NC3**: non-reversible
  - **UC3**: reversible
- **L**: Left hand coupling rotation when looking to the side plate, if torque input from coupling outer part.
- **R**: Right hand coupling rotation when looking to the side plate, if torque input from inner star.
- **1/L**: Left hand coupling rotation when looking to the side plate, if torque input from inner star.
- **1/R**: Right hand coupling rotation when looking to the side plate, if torque input from coupling outer part.
- **20**: Number of spring packs per coupling (8, 10, 12, 14, 15, 16, 18 or 20)
- **S14**: Connection fitting for SAE-flywheel
  - **S14**: fitting for SAE-flywheel size 14 (flange drillings for SAE-inch bolts)
  - **M14/..**: fitting for SAE-flywheel size 14 (with customized drillings)
The SB+BF-Coupling-Combination designation has the following meaning:

**SB 50/2.2/120NC3/1/L/20/S14 + BF 50/50/2USO**

**SB:** SAE-type of engine flywheel. The SB-Coupling with its innerstar fixation is always combined with the Gesilco® BF-Coupling connecting to a customized flange hub.

**50:** Outer diameter of centre part in cm

**2.2:** Spring pack width in cm

**120:** Stiffness series and the approximate twist in mrad at nominal torque. Standard series are 60, 90 and 120. Torsional stiffness and nominal torque can be varied by different number of spring packs.

**NC3, UC3:** Directionality code for coupling type with 3-spring design
- **NC3** non-reversible
- **UC3** reversible

**L:** Left hand coupling rotation when looking to the side plate if torque input from coupling outer part.

**R:** Right hand coupling rotation when looking to the side plate if torque input from inner star.

**1/L:** Left hand coupling rotation when looking to the side plate if torque input from inner star.

**1/R:** Right hand coupling rotation when looking to the side plate if torque input from coupling outer part.

**20:** Number of spring packs per coupling (8, 10, 12, 14, 15, 16, 18 or 20)

**S14:** Connection fitting for SAE-flywheel
- **S14:** fitting for SAE-flywheel size 14 (flange drillings for SAE-inch bolts)
- **M14/...:** fitting for SAE-flywheel size 14 (with customized drillings)

**BF 50/50/2USO**

**BF** Gesilco® BF-Coupling consisting of 2 symmetrical coupling halves

**50** nominal outside diameter of the coupling in cm

**50** stiffness series

**2** number of membranes

**U** reversible

**S** manufacturing technique

**O** 3 openings between the 2 coupling halves for assembly of inner flange bolts
Selection

Technical data for each SAE-Coupling, depending on the outer diameter of the centre part, width of the spring packs, stiffness of the spring packs and directionality code for the coupling type, can be selected from the technical data sheets.

- **Type NC3, UC3**
  Based on the application, it is necessary to determine whether a reversible or non-reversible coupling is required.

  Torsional stiffer reversible coupling series (series 30UC3, series 60UC3) are selected as a first approach for generating sets, pump drives or other industrial applications, whereas torsional softer non reversible coupling series (series 90NC3, series 120NC3) are mainly considered for marine applications.

- **Nominal Torque** \( T_{KN} \)
  The mean torque \( T \) is calculated from the engine power \( P \) and rotational speed \( n \)

  \[
  T = 9.55 \cdot \frac{P}{n}
  \]

  \( T \) mean torque kNm
  \( P \) engine power kW
  \( n \) rotational speed min\(^{-1}\)

  The coupling size should be selected in order that the coupling’s nominal torque \( T_{KN} \) is greater or equal to the maximum mean torque \( T \) in the engine operating speed range specified by the prime mover or application.

  \( T_{KN} > T \)

- **Stiffness Series**
  Four different basic torsional stiffness series are listed in this catalog (series 30, 60, 90 and 120). In order to transmit the same nominal torque \( T_{KN} \) a wider coupling is required for a torsional softer coupling (series 120) than for a stiffer coupling (series 90).

  In addition the number of spring packs (6, 8, 10, 12, 14, 15, 16, 18 and 20) can be varied in narrow steps for each stiffness series. By that a fine graded stiffness range is achieved.
The following comparison illustrates the dependence of the coupling width on choice of stiffness for the same nominal torque $T_{KN}$:

SE 41/1.4/90NC3/20/.. $T_{KN} = 6 \text{ kNm}$

SE 41/2.2/120NC3/20/.. $T_{KN} = 6 \text{ kNm}$

For an initial calculation it is recommended that a torsional stiffer coupling is selected. The torsional stiffer reversible coupling series 30UC3 or 60UC3 are selected as a first approach for generating sets, pump drives or other industrial applications, whereas the torsional softer non reversible coupling series 90NC3 or 120NC3 are mainly used for marine applications.

A torsional vibration calculation must be performed to confirm that a selected stiffness is suitable for a given application. The calculation must use the excitations of the total system and must be performed for all possible operating conditions (normal operation, misfiring of one cylinder, etc.) and speeds.

For these calculations, it is necessary to use the damping factor $\kappa$.

From the analyses results, for instance the vibratory torques can be determined. These consist of damping and elastic components and must be checked against the permitted values as described in the following chapters.

**Stiffness:**

This is the torsional stiffness value at a static nominal torque. It is shown in the Technical Data sheets as $C$. For a Geislinger SAE-Coupling the static stiffness is practically constant.
### Damping

Conversion table for different damping values

<table>
<thead>
<tr>
<th></th>
<th>$k$</th>
<th>$\kappa$</th>
<th>$\psi$</th>
<th>$M$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$k =$</td>
<td>__</td>
<td>$\frac{\kappa \cdot C}{\omega}$</td>
<td>$\frac{\psi \cdot C}{2 \cdot \pi \cdot \omega}$</td>
<td>$\frac{C \cdot \sqrt{1}}{\omega \cdot \sqrt{M^2 - 1}}$</td>
</tr>
<tr>
<td>$\kappa =$</td>
<td>$\frac{k \cdot \omega}{C}$</td>
<td>__</td>
<td>$\frac{\psi}{2 \cdot \pi}$</td>
<td>$\frac{1}{\sqrt{M^2 - 1}}$</td>
</tr>
<tr>
<td>$\psi =$</td>
<td>$\frac{2 \cdot \pi \cdot \omega \cdot k}{C}$</td>
<td>$2 \cdot \pi \cdot \kappa$</td>
<td>__</td>
<td>$\frac{2 \cdot \pi}{\sqrt{M^2 - 1}}$</td>
</tr>
<tr>
<td>$M =$</td>
<td>$\frac{\sqrt{C^2 + k^2 \cdot \omega^2}}{k \cdot \omega}$</td>
<td>$\frac{\sqrt{1 + \kappa^2}}{\kappa}$</td>
<td>$\frac{\sqrt{4 \cdot \pi^2 + \psi^2}}{\psi}$</td>
<td>__</td>
</tr>
</tbody>
</table>

$k$  linear viscous damping Nms/rad  
$\kappa$  undimensioned damping factor  
$\psi$  ratio of damping energy  
$M$  magnifier

Geislinger uses the undimensioned damping factor $\kappa$.

The damping of the oil filled Geislinger SAE-Coupling is mainly influenced by damping due to friction, as the effect of hydrodynamic damping is very small. In general the damping at $T_v / T_{KN} = 0.3$ can be calculated by the following formula:

$$\kappa = 0.035 + 0.08 \cdot \frac{T_{stat}}{T_{KN}}$$

$\kappa$  undimensioned damping factor  
$T_{stat}$  static torque  kNm  
$T_v$  vibratory torque  kNm  
$T_{KN}$  nominal torque  kNm
**Permissible Elastic Vibratory Torque** $T_{el}$

From a total vibratory torque $T_v$, which is transmitted by the coupling only the elastic component $T_{el}$ is important to be considered.

$$T_{el} = T_v \cdot \frac{1}{\sqrt{1 + \kappa^2}}$$

- $T_{el}$: elastic vibratory torque kNm
- $T_v$: vibratory torque kNm
- $\kappa$: undimensioned damping factor

This calculation has to be made for each harmonic order and the synthesis value has to be derived.

Permissible elastic vibratory torques, for each coupling directionality type can be seen in the following diagrams. The diagrams show:

- the limits for elastic vibratory torques, which momentarily occur (e.g. transient condition),
- the limits for continuous permissible elastic vibratory torques and
- the vibratory torque on buffer (not valid for Gesilco® BF-Coupling).
DIAGRAM SAE-Type-NC3, Non-Reversible

\[ Y = \frac{T_{el}}{T_{KN}} = \frac{\text{perm. elast. vibratory torque}}{\text{nominal torque}} \]

\[ X = \frac{T}{T_{KN}} = \frac{\text{mean torque}}{\text{nominal torque}} \]

\[ 0 \leq X \leq 1 \quad Y = 0.45 - 0.15 \cdot X \]

\[ 1 < X < 1.3 \quad Y = 1.3 - X \]

The vibratory torque on buffer is not applied to the BF-Coupling.
**DIAGRAM SAE-Type-UC3, BF-Type-USO, Reversible**

\[ Y = \frac{T_{el}}{T_{KN}} = \frac{\text{perm. elast. vibratory torque}}{\text{nominal torque}} \]

\[ X = \frac{T}{T_{KN}} = \frac{\text{mean torque}}{\text{nominal torque}} \]

- **Reverse**
  \[ 0 \leq X \leq 1 \quad Y = 0.5 - 0.08354 \cdot X - 0.04432 \cdot X^2 - 0.07209 \cdot X^3 \]
  \[ 1 < X < 1.3 \quad Y = 1.3 - X \]

- **Forward**
  \[ 0 \leq X \leq 1 \quad Y = 0.5 - 0.08354 \cdot X - 0.04432 \cdot X^2 - 0.07209 \cdot X^3 \]
  \[ 1 < X < 1.3 \quad Y = 1.3 - X \]

The vibratory torque on buffer is not applied to the BF-Coupling.
- **Thermal Load** $P_{KW}$

Permissible values for thermal load in the SAE-Coupling also have to be checked. The permissible thermal load, shown in the catalogue section “Technical Data” is valid under the condition of good air circulation.

To obtain the thermal load $P_{KW}$ the following formula applies:

$$P_{KW} = \frac{\pi}{60} \cdot 10^{-3} \cdot \sum \frac{\kappa \cdot T_{v}^{2} \cdot i \cdot n}{(1 + \kappa^{2}) \cdot C}$$

- $P_{KW}$ thermal load, $kW$
- $T_{v}$ total transmitted vibratory torque due to harmonic order $i$, $Nm$
- $i$ harmonic order
- $n$ speed of coupling, $min^{-1}$
- $\kappa$ undimensioned damping factor
- $C$ stiffness, $Nm/rad$

The $\sum$ sign means that the thermal loads of all single orders are to be calculated separately and then to be added up.
Permissible Transient Shock Torques

The coupling can transmit transient shock torques up to the maximum torque. It should be noted that if the nominal torque of the SAE-Coupling is exceeded by more than 1.4 times the coupling is approximately 10 times torsional stiffer. The maximum transient torque for the SAE-Coupling is at least 3.25 times of the nominal torque, and 2.5 times of the nominal torque for the Gesilco® BF-Coupling.

Fig. 6 shows the relationship between SAE-Coupling twist (in mrad) and torque.

Fig. 6
Permissible Misalignment Values of SE-Couplings

It is also necessary to ensure that the permissible radial, axial and angular misalignment capabilities of the coupling are not exceeded during operation.

Axial Misalignment: $\Delta W_a$

An axial misalignment $\Delta W_a$ is the deviation from the theoretical nominal length of the coupling. This deviation in length is caused by axial displacements of the adjoining shafts. Reasons for axial displacements include: errors in assembly distances, shaft movements or thermal expansion.

$\Delta K_a$ is the maximum permissible axial misalignment capacity of the coupling and must not be exceeded during operation. $\Delta K_a$ is determined by the sum of static and dynamic misalignments.

Radial Misalignment: $\Delta W_r$

Radial misalignment $\Delta W_r$ is the misalignment of the driving side to the driven side in a direction perpendicular to the axis of rotation. The reasons for radial misalignment include: errors in assembly alignment, shaft movements or thermal expansion.

$\Delta K_r$ is the maximum permissible radial misalignment capacity of the coupling and must not be exceeded during operation. $\Delta K_r$ is determined by the sum of static and dynamic misalignments.

Radial misalignments are independent of rotational speed. The relationship between radial misalignment and angular misalignment is described below in the section titled “Angular Misalignment”.

Angular Misalignment: $\Delta W_w$

An angular misalignment $\Delta W_w$ is the inclination of the axis of rotation of the driving and the driven side of the coupling. $\Delta K_w$ is the maximum permissible angular misalignment capacity of the coupling and is only valid when used in conjunction with the given values for the maximum axial misalignment. The following equation should be noted in the case of simultaneous radial misalignment $\Delta W_r$ and angular misalignment $\Delta W_w$.

$$\Delta W_r + \frac{\Delta K_r}{\Delta K_w} \cdot \Delta W_w \leq \Delta K_r$$

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Delta W_r$</td>
<td>actual radial misalignment</td>
<td>mm</td>
</tr>
<tr>
<td>$\Delta W_w$</td>
<td>actual angular misalignment</td>
<td>mrad</td>
</tr>
<tr>
<td>$\Delta K_w$</td>
<td>max. angular misalignment in accordance with the Technical Data sheet</td>
<td>mrad</td>
</tr>
<tr>
<td>$\Delta K_r$</td>
<td>max. radial misalignment in accordance with the Technical Data sheet</td>
<td>mm</td>
</tr>
</tbody>
</table>
Axial Reaction Force $F_a$ of SE-Couplings
The axial reaction force $F_a$ is a reaction force, which occurs during axial movement of the coupling under nominal torque. After the coupling has moved in response to an axial force, the coupling’s reaction force returns to zero. The axial reaction force does not depend on the magnitude of the axial movement.

Radial Stiffness $C_r$ of SE-Couplings
As a result of radial misalignments, radial reaction forces $F_r$ are produced. These forces affect the driving and the driven side of the coupling.

$$F_r = C_r \cdot \Delta W_r$$

- $F_r$ radial reaction force kN
- $C_r$ radial stiffness kN/mm
- $\Delta W_r$ radial misalignment mm

Bending Stiffness $C_w$ of SE-Couplings
Angular misalignments produce a reaction torque $M_w$ that affects the driving and driven side of the coupling.

$$M_w = C_w \cdot \Delta W_w$$

- $M_w$ reaction torque Nm
- $C_w$ bending stiffness kNm/rad
- $\Delta W_w$ angular misalignment mrad
### Permissible Misalignment Values of SB+BF-Coupling-Combinations

The SB-Coupling of these coupling combinations is equipped with innerstar fixations, thus all misalignment compensation is handled by the BF-Coupling. The BF-coupling’s lifetime can be theoretically determined by analyzing application load spectrum data (magnitudes and frequencies). In fact, misalignment capacities of the BF-Coupling are defined by predetermined load cycle values. Therefore, the following data tables show angular deflection capacities (transient and continuous) along with their corresponding load cycles. Since the correct coupling selection is predominately influenced by the expected lifetime or load cycles, it is very important to determine accurate values for the required transient and continuous deflections. Permissible combinations of angular and axial deformation of the coupling can be calculated using the formulas in the chapter “Calculation of the Maximum Misalignment Capacity”.

#### Axial Misalignment

An axial misalignment $\Delta W_a$ is the deviation from the theoretical nominal length of the coupling. This deviation in length is caused by axial displacements of the adjoining shafts. Reasons for axial displacements include: errors in assembly distances, shaft movements, variations in foundations (i.e. resiliently mounted engines), or thermal expansion. $\Delta K_{a, \text{max}}$ (transient) is the maximum permissible axial misalignment capacity of one membrane and must not be exceeded during operation. Using the formula given in the selection guidelines, $\Delta K_{a, \text{max}}$ can be calculated from the maximum permissible angular deflection capacity $\Delta K_{w, \text{max}}$ (transient) and the geometry parameter $i$ of the membrane.

#### Radial Misalignment

Radial misalignment $\Delta W_r$ is the movement between driving and the driven shafts in a perpendicular direction (radial) to the axis of rotation. Radial misalignments can only be accommodated by use of two membranes with angular deflection capacity $\Delta K_w$. Causes for radial misalignment are: assembly errors, shaft displacements, thermal expansions or elastically mounted driving or driven shafts. $\Delta K_{w, \text{max}}$ (transient) is the maximum permissible angular deflection capacity of one membrane and must not be exceeded by static and dynamic misalignments during operation. The maximum permissible radial misalignment capacity of the coupling depends on the bending length $L_b$ (distance between the planes of the membranes). Based on the bending length $L_b$, $\Delta K_{w, \text{max}}$ (transient) and the following formulas, the maximum permissible misalignment capacity can be determined.

#### Angular Misalignment

The angular misalignment $\Delta W_w$ is defined as the inclination of the axis of rotation between the driving- and the driven-side of the coupling. Angular misalignment $\Delta W_w$ can be compensated by using one membrane with a given angular deflection capacity $\Delta K_w$. $\Delta K_{w, \text{max}}$ (transient) is defined as the maximum permissible angular deflection of one membrane and should not be exceeded during operation. The relationship between axial and angular misalignments is shown in the formulae of the following chapter.
**Calculation of the Maximum Misalignment Capacity of the BF-Coupling**

**W-Arrangement**

This combination compensates for axial $\Delta W_a$ and angular $\Delta W_w$ misalignments. For both membranes, it must be proven that the maximum angular misalignment does not exceed the coupling’s maximum permissible angular deflection capacity.

\[ \Delta W_{w,1} + \frac{|\Delta W_a|}{i} \leq \Delta K_w \]

Continuous

\[ \Delta W_{w,2} + \frac{|\Delta W_a|}{i} \leq \Delta K_w \]

\[ \Delta W_{w,1} + \frac{|\Delta W_a|}{i} \leq \Delta K_{w, \text{max}} \]

Transient

\[ \Delta W_{w,2} + \frac{|\Delta W_a|}{i} \leq \Delta K_{w, \text{max}} \]

- $\Delta W_a$ axial misalignment mm
- $\Delta W_{w,1}$ angle between input and intermediate shaft rad
- $\Delta W_{w,2}$ angle between intermediate and output shaft rad
- $i$ geometric parameter of the membrane mm
- $\Delta K_w$ max. angular deflection of one membrane (continuous) rad
- $\Delta K_{w, \text{max}}$ max. angular deflection of one membrane (transient) rad
- 1 First membrane
- 2 Second membrane

($\Delta K_w$, $\Delta K_{w, \text{max}}$ and $i$, see chapter ‘Technical Data’)
Z-Arrangement

This combination compensates axial $\Delta W_a$ and radial $\Delta W_r$ misalignments

Continuous

$$\frac{|\Delta W_a|}{L_b} + \frac{|\Delta W_a|}{i} \leq \Delta K_w$$

Transient

$$\frac{\Delta W_a}{L_b} + \frac{\Delta W_a}{i} \leq \Delta K_w, \text{ max}$$

$\Delta W_a$ axial misalignment $\text{mm}$

$\Delta W_w$ angular misalignment $\text{rad}$

$\Delta W_r$ radial misalignment $\text{mm}$

$i$ geometric parameter of the membrane $\text{mm}$

$\Delta K_w$ max. angular deflection of one membrane (continuous) $\text{rad}$

$\Delta K_w, \text{ max}$ max. angular deflection of one membrane (transient) $\text{rad}$

$L_b$ bending length of the coupling $\text{mm}$
**Membrane’s Spring Rates**

**Torsional Stiffness \( C_T \)**

The BF-Coupling can be considered as torsional stiff. Values for the torsional stiffness of membranes and intermediate shafts are given in the ‘Technical Data’ section.

**Bending Stiffness \( C_w \)**

The angular deflection \( \Delta W_w \) of one BF-membrane produces a reaction moment \( M_b \) which acts as a bending moment on the driving and driven shafts. The bending moment is proportional to the bending stiffness \( C_w \) of the membrane.

The reaction moment \( M_b \) can be calculated as follows:

\[
M_b = C_w \Delta W_w
\]

\( M_b \) reaction moment \quad kNm
\( C_w \) bending stiffness \quad kNm/rad
\( \Delta W_w \) angular deflection \quad rad

**Axial Stiffness \( C_a \)**

The axial deflection \( \Delta W_a \) of the BF-membrane produces a reaction force \( F_a \) which acts as an axial force on the driving and driven shafts. The axial force is proportional to the axial stiffness \( C_a \) of the membrane.

\[
F_a = C_a \Delta W_a
\]

\( F_a \) axial reaction force \quad N
\( C_a \) axial stiffness \quad N/mm
\( \Delta W_a \) axial deflection \quad mm
### Reaction Forces of Different BF-Coupling Deflection Arrangements

In the following chapter, the calculation of membrane reaction forces, due to torque and elastic deflection, are shown for different BF-Coupling deflection arrangements.

**W-Arrangement**

![Diagram](image)

\[
\begin{align*}
M_{b,1} &= C_w \Delta W_{w,1} \\
M_{b,2} &= C_w \Delta W_{w,2} \\
F &= \frac{(M_{b,1} - M_{b,2})}{L_b} \\
F_a &= C_a \Delta W_a \\
M_{t,1} &= T \Delta W_{w,1} \\
M_{t,2} &= T \Delta W_{w,2}
\end{align*}
\]

- \( M_b \): reaction moment due to the membrane’s bending stiffness \( \text{kNm} \)
- \( F \): radial reaction force \( \text{N} \)
- \( F_a \): axial reaction force \( \text{N} \)
- \( T \): mean torque \( \text{kNm} \)
- \( M_t \): reaction moment due to the mean torque \( T \) \( \text{kNm} \)
- \( C_w \): bending stiffness \( \text{kNm/rad} \)
- \( C_a \): axial stiffness \( \text{N/mm} \)
- \( \Delta W_a \): axial misalignment \( \text{mm} \)
- \( \Delta W_{w,1}, \Delta W_{w,2} \): angular misalignment \( \text{rad} \)
- \( L_b \): bending length \( \text{m} \)
Z-Arrangement

\[ M_{b,1} = C_a \Delta W_{a,1} \]
\[ M_{b,2} = C_a \Delta W_{a,2} \]
\[ F = \frac{(M_{b,1} + M_{b,2})}{L_b} \]
\[ C_a = \frac{2C_w}{L_b^2} \]
\[ F_a = C_a \Delta W_a \]
\[ M_{t,1} = T \Delta W_{w,1} \]
\[ M_{t,2} = T \Delta W_{w,2} \]

- \( M_b \): reaction moment due to the membrane’s bending stiffness, kN·m
- \( F \): radial reaction force, N
- \( F_a \): axial reaction force, N
- \( T \): mean torque, kN·m
- \( M_t \): reaction moment due to mean the torque \( T \), kN·m
- \( C_w \): bending stiffness, kN·m/rad
- \( C_a \): axial stiffness, N/mm
- \( C_r \): radial stiffness, N/mm
- \( \Delta W_a \): axial misalignment, mm
- \( \Delta W_{w,1}, \Delta W_{w,2} \): angular misalignment, rad
- \( L_b \): bending length, m
- **Maximum Rotational Speed** $n_{\text{max}}$
  The maximum permissible speed is given in the ‘Technical Data’ section.

- **Temperature and Humidity**
  Proper selection of raw materials for the couplings depends on the desired service temperature and humidity. Normally, the couplings are designed for an ambient temperature of 80°C continuous engine room operation and 100°C for short term engine room environment. Higher temperature resistant raw materials can be delivered upon request.

- **Connections**
  **Connection to flywheel:**
  The Geislinger standard SAE-coupling (designations.../S..) is designed with a standard flange and drillings used for inch-bolts fitting to the standardized SAE-flywheels.

  If metric bolts are used instead of inch bolts or the bolt size or the number of connecting bolts is differing from the SAE-standard then a Geislinger SAE-coupling can be ordered with customized drillings for the bolts (designations .../M./).

  In any case the customer has the responsibility for the bolt connection. The sum of the maximum static torque, the maximum vibratory torque according to the torsional vibration calculation, other maximum eventually occurring peak torques like arising from gearbox clutch engagement, reaction forces and static and dynamic forces when an additional mass moment of inertia is attached to the flywheel bolt connection have to be considered multiplied with a certain safety factor. When required by classification societies the connection must be designed to meet the respective classification rules.

  **Connection to driving side:**
  The spline connection of the SE-Coupling to the driven part is standardized and cannot be changed. If a connection differing from the standard spline is needed, please contact Geislinger for offering a customized adapter.

  In order to connect the BF-Coupling to a flange or shaft by the best possible method, predefined flange designs are available. In addition, Geislinger is always prepared to manufacture other connections, if economically and technically feasible. Should other assembly dimensions be required, please contact Geislinger. The type of the adapter will have an effect on the torsional vibration behaviour of the system.
# Technical Data SE-Coupling

## SE-Couplings Series 41

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### SE-Couplings Series 50

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All technical data are without warranty. Dimensions and design modifications reserved.
# SE-Couplings Series 60

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All technical data are without warranty. Dimensions and design modifications reserved.
Dimensions SE-Coupling

- **Standard-Coupling Series 41**
  
  All technical data are without warranty. Technical data have to be seen as a guideline, detailed data are available as tabular drawing on request. Modifications of dimensions and design reserved.

<table>
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<td>kg</td>
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### Standard-Coupling Series 50

All technical data are without warranty. Technical data have to be seen as a guideline, detailed data are available as tabular drawing on request. Modifications of dimensions and design reserved.

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<td>SE 50/2/90NC3/..</td>
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## Standard-Coupling Series 60

All technical data are without warranty. Technical data have to be seen as a guideline, detailed data are available as tabular drawing on request. Modifications of dimensions and design reserved.

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<td>D</td>
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<td>SE 60/3.1/60UC3/..</td>
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<td>S21</td>
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Technical Data & Dimensions SB + BF – Coupling-Combination

### SB + BF – Coupling-Combination Series 50

All technical data are without warranty. Technical data have to be seen as a guideline, detailed data are available as tabular drawing on request. Modifications of dimensions and design reserved.

<table>
<thead>
<tr>
<th>Series 50</th>
<th>Parameter</th>
<th>Normal torque</th>
<th>Bending length</th>
<th>Torsional stiffness</th>
<th>Torsional stiffness intermediate shaft</th>
<th>Bending stiffness membrane</th>
<th>Axial stiffness membrane</th>
<th>Maximum speed</th>
<th>Perm. thermal load</th>
<th>Inertia</th>
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</thead>
<tbody>
<tr>
<td>SB Size</td>
<td>BF Size</td>
<td>( T_{KN} ) kNm</td>
<td>( i^* ) mm</td>
<td>( L_i ) mm</td>
<td>( C_{ri} ) MNm/rad</td>
<td>( C_{ri}^* ) MNm/rad</td>
<td>( C_w ) kNm/rad</td>
<td>( C^* ) N/mm</td>
<td>( n ) l/min</td>
<td>( P_{KW} ) kW</td>
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<tr>
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<td>11</td>
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<td>BF 50/50/2USO</td>
<td>18</td>
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<td>320</td>
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* value for one half of the Gesilco coupling

** value depending on design of flange hub (acc. to customer request)
<table>
<thead>
<tr>
<th>SB Size</th>
<th>BF Size</th>
<th>( T_{ck} )</th>
<th>( i^* )</th>
<th>( L_1 )</th>
<th>( C_{1r} )</th>
<th>( C_{1r}* )</th>
<th>( C_{1r}** )</th>
<th>( C_{a}^* )</th>
<th>( a_{c} )</th>
<th>( n )</th>
<th>( P_{aw} )</th>
<th>( I_1 )</th>
<th>( I_2 )</th>
<th>( I_3 )</th>
<th>( I_4 )</th>
<th>( I_5 )</th>
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<tbody>
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<td>2.23</td>
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<td>0.07</td>
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* value for one half of the Gesilco coupling

** value depending on design of flange hub (acc. to customer request)
### Series 50

<table>
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<th>BF Size</th>
<th>Dimensions</th>
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<td>S18, BF 50/50/2USO</td>
<td>B 24.5, C 34, D 500, E 294, F 25, H 8, I 250, K 496, L 542.92, M 571.50</td>
<td>N x A 6x 5/8&quot;, O 252, P max 120, R 92, S 154</td>
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<tr>
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<td>S21, BF 50/50/2USO</td>
<td>B 24.5, C 34, D 500, E 294, F 25, H 8, I 250, K 496, L 641.35, M 673.10</td>
<td>N x A 12x 5/8&quot;, O 252, P max 120, R 92, S 154</td>
</tr>
</tbody>
</table>

** value depending on design of flange hub (acc. to customer request)
**SB + BF – Coupling-Combination Series 58**

All technical data are without warranty. Technical data have to be seen as a guideline, detailed data are available as tabular drawing on request. Modifications of dimensions and design reserved.

Continuous, angular deflection capacity \( \Delta K_w = 12 \text{ mrad} \)

Transient, angular deflection capacity \( \Delta K_{w, \text{max}} = 24 \text{ mrad} \)

Shock angular deflection capacity \( \Delta K_{w, \text{max}} = 36 \text{ mrad} \)

Undimensioned damping factor membrane \( \mu_{d_1} = 0.0064 \)

Undimensioned damping factor interm. shaft \( \mu_{Z} = 0.008 \)

### Series 58


**value depending on design of flange hub (acc. to customer request)**
| SB Size          | BF Size          | \( T_{kw} \) kNm | \( i^* \) | \( L_0 \) mm | \( C_{i} \) MN/m.rad | \( C_{r} \)* MN/m.rad | \( C_{r} \)* MN/m.rad | \( C_{v} \)* kNm/m.rad | \( n \) 1/min | \( P_{kw} \) kW | \( I_1 \) kgm² | \( I_2 \) kgm² | \( I_3 \) kgm² | \( I_4 \) kgm² |
|-----------------|------------------|------------------|--------|-------------|----------------------|----------------------|----------------------|----------------------|-------------|-------------|---------------|---------------|---------------|---------------|---------------|
| SB 58/2.2/60UC3/14/S21 | BF 63/50/2USO    | 21               | 14     | 0.233      | 21                   | 20                   | 22                   | 12.2                 | 304         | 4.2         | 3.52          | 0.13          | 0.65          | 0.27          |
| SB 58/2.2/60UC3/14/S24 | BF 63/50/2USO    | 24               | 14     | 0.154      | 21                   | 20                   | 22                   | 12.2                 | 304         | 4.3         | 4.28          | 4.13          | 4.89          | 0.24          |
| SB 58/2.2/60UC3/14/S21  | BF 63/50/2USO    | 21               | 15     | 0.250      | 21                   | 20                   | 22                   | 12.2                 | 304         | 4.2         | 3.52          | 4.13          | 4.89          | 0.24          |
| SB 58/2.2/60UC3/14/S24  | BF 63/50/2USO    | 24               | 15     | 0.165      | 24                   | 20                   | 22                   | 12.2                 | 304         | 4.3         | 4.28          | 4.13          | 4.89          | 0.24          |
| SB 58/2.2/60UC3/14/S21  | BF 63/50/2USO    | 21               | 16     | 0.266      | 21                   | 20                   | 22                   | 12.2                 | 304         | 4.2         | 3.52          | 4.13          | 4.89          | 0.24          |
| SB 58/2.2/60UC3/14/S24  | BF 63/50/2USO    | 24               | 16     | 0.176      | 24                   | 20                   | 22                   | 12.2                 | 304         | 4.3         | 4.28          | 4.13          | 4.89          | 0.24          |
| SB 58/2.2/60UC3/14/S21  | BF 63/50/2USO    | 21               | 18     | 0.300      | 21                   | 20                   | 22                   | 12.2                 | 304         | 4.2         | 3.52          | 4.13          | 4.89          | 0.24          |
| SB 58/2.2/60UC3/14/S24  | BF 63/50/2USO    | 24               | 18     | 0.198      | 24                   | 20                   | 22                   | 12.2                 | 304         | 4.3         | 4.28          | 4.13          | 4.89          | 0.24          |
| SB 58/2.2/60UC3/20/S21  | BF 63/50/2USO    | 21               | 20     | 0.333      | 21                   | 20                   | 22                   | 12.2                 | 304         | 4.2         | 3.52          | 4.13          | 4.89          | 0.24          |
| SB 58/2.2/60UC3/20/S24  | BF 63/50/2USO    | 24               | 20     | 0.220      | 24                   | 20                   | 22                   | 12.2                 | 304         | 4.3         | 4.28          | 4.13          | 4.89          | 0.24          |

* value for one half of the Gesilco coupling  
** value depending on design of flange hub (acc. to customer request)
<table>
<thead>
<tr>
<th>Series 58</th>
<th>Dimensions</th>
<th>Weight</th>
</tr>
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<tbody>
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<td>B</td>
</tr>
<tr>
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<td>SB 58/3/190NC3/...</td>
<td>21.5</td>
</tr>
</tbody>
</table>

** value depending on design of flange hub (acc. to customer request)
Examples

- Standard Geislinger SE-Coupling
- Standard Geislinger SE-Coupling with additional mass (optional part in green) for fine-tuning of torsional vibrations
- Standard Geislinger SE-Coupling with split ring flange connection (optional parts in green) for radial disassembly/assembly
Standard Geislinger SE-Coupling between keyway connection and flange connection (optional parts in green)
- Standard Geislinger SE-Coupling with flange connection (optional part in green)
- Standard Geislinger SE-Coupling with conical connection (optional part in green)
- Standard Geislinger SE-Coupling with conical connection (optional part in green) for flange mounted gearbox
- Standard Geislinger SB + BF – Coupling-Combination with conical flange hub connection (optional part in green)
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