Freewheels
Backstops • Overrunning Clutches • Indexing Freewheels

Edition 2020/2021
## Freewheel Technology Introduction

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### Complete Freewheels

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<td>for bolting to the face</td>
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<tr>
<td>F8 with sprags, available in four types</td>
<td></td>
<td>160 000</td>
<td>300</td>
<td>16</td>
</tr>
<tr>
<td>FKh with hydrodynamic sprag lift-off</td>
<td></td>
<td>14 000</td>
<td>95</td>
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<tr>
<td>with mounting flange</td>
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<tr>
<td>FBE with sprags, available in four types</td>
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<td>160 000</td>
<td>300</td>
<td>20</td>
</tr>
<tr>
<td>FGR … R A1A2 with rollers</td>
<td></td>
<td>68 000</td>
<td>150</td>
<td>22</td>
</tr>
<tr>
<td>FGR … R A2A7 with rollers</td>
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<td>68 000</td>
<td>150</td>
<td>24</td>
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<tr>
<td>for keyway connection on the outer ring</td>
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<tr>
<td>BM with rollers or with sprag lift-off X</td>
<td></td>
<td>57 500</td>
<td>150</td>
<td>26</td>
</tr>
<tr>
<td>FGRN … R A5A6 with rollers</td>
<td></td>
<td>6800</td>
<td>80</td>
<td>28</td>
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<tr>
<td>with lever arm</td>
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<tr>
<td>BA with rollers or with sprag lift-off X</td>
<td></td>
<td>57 500</td>
<td>150</td>
<td>30</td>
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<tr>
<td>BC with rollers or with sprag lift-off X</td>
<td></td>
<td>57 500</td>
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<td>32</td>
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<tr>
<td>FGR … R A3A4 with rollers</td>
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<td>68 000</td>
<td>150</td>
<td>34</td>
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<td>FGR … R A2A3 with rollers</td>
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<td>68 000</td>
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<td>36</td>
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<tr>
<td>FA with sprags and grease lubrication</td>
<td></td>
<td>2 500</td>
<td>85</td>
<td>38</td>
</tr>
<tr>
<td>FAV with rollers and grease lubrication</td>
<td></td>
<td>2 500</td>
<td>80</td>
<td>40</td>
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<tr>
<td>with shaft coupling</td>
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<tr>
<td>FBE for small shaft misalignments, with sprags</td>
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<tr>
<td>FBL for large shaft misalignments, with sprags</td>
<td></td>
<td>8 000</td>
<td>140</td>
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### Low Speed Backstops

<table>
<thead>
<tr>
<th>Backstops</th>
<th>Used as</th>
<th>Nominal torques up to Nm</th>
<th>Shaft up to mm</th>
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<tr>
<td>with lever arm</td>
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<tr>
<td>FRHD in inch dimension, with sprags</td>
<td></td>
<td>1215 000</td>
<td>533</td>
<td>46</td>
</tr>
<tr>
<td>FRHN in metric dimensions with sprags</td>
<td></td>
<td>503 550</td>
<td>320</td>
<td>48</td>
</tr>
<tr>
<td>FRSC with rollers</td>
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<td>215 000</td>
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### Housing Freewheels

<table>
<thead>
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<th>Backstops</th>
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<th>Nominal torques up to Nm</th>
<th>Shaft up to mm</th>
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<tbody>
<tr>
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<tr>
<td>for stationary arrangement</td>
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<td></td>
</tr>
<tr>
<td>FH with hydrodynamic roller lift-off</td>
<td></td>
<td>813 500</td>
<td>178</td>
<td>52</td>
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### Basic Freewheels

<table>
<thead>
<tr>
<th>Backstops</th>
<th>Used as</th>
<th>Nominal torques up to Nm</th>
<th>Bore up to mm</th>
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<tbody>
<tr>
<td></td>
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<tr>
<td>for assembly with connecting parts</td>
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<tr>
<td>FGR … R with rollers</td>
<td></td>
<td>68 000</td>
<td>150</td>
<td>56</td>
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<tr>
<td>Integrated Freewheels</td>
<td>Used as</td>
<td>Backstops</td>
<td>Overrunning Clutch</td>
<td>Indexing Freewheel</td>
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<tr>
<td>-----------------------</td>
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<tr>
<td>for bolting to the face</td>
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<tr>
<td>FXM with sprag lift-off X</td>
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<td>FON with sprags, available in three types</td>
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<td>for bolting to the face, with torque limiting</td>
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<td>FXRW with sprag lift-off X</td>
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<td>FXRU with sprag lift-off X and with release function</td>
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<td>Internal Freewheels</td>
<td>Used as</td>
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<td>Overrunning Clutch</td>
<td>Indexing Freewheel</td>
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<tr>
<td>for press fit on the outer ring</td>
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<tr>
<td>FXN with sprag lift-off X</td>
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<tr>
<td>FCN … R with rollers</td>
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<tr>
<td>FDN with sprags</td>
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<tr>
<td>FD with sprags</td>
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<tr>
<td>FZ with sprags and bearing support</td>
<td></td>
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<tr>
<td>FZ … 2RS with sprags, bearing support and seals</td>
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<tr>
<td>FZ … P2RS with sprags, bearing support and seals</td>
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<tr>
<td>FZ … P with sprags and bearing support</td>
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<td>for keyway connection on the outer ring</td>
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<td>FZ … PP with sprags and bearing support</td>
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<tr>
<td>FSN with rollers</td>
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<tr>
<td>FN with rollers</td>
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<tr>
<td>FNR with rollers and bearing support</td>
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<td>Cage Freewheels</td>
<td>Used as</td>
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<td>Overrunning Clutch</td>
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<td>for assembly with inner and outer ring</td>
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<tr>
<td>SF with sprags, available in three types</td>
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<td>SF … P for high run out (T.I.R.), with sprags</td>
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<tr>
<td>Irreversible Locks</td>
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<td>Backstops</td>
<td>Overrunning Clutch</td>
<td>Indexing Freewheel</td>
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<td>bidirectional acting backstop for assembly with connecting parts</td>
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<td>Irreversible lock IR with rollers</td>
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<td>for selecting RINGSPLAN Indexing Freewheels</td>
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<td>for selecting RINGSPLAN Housing Freewheels</td>
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The maximum transmissible torques are 2 times the specified nominal torques.
Issue 08/2020 • Technical details subject to change without notice.
Freewheels are machine elements with particular characteristics:

- In one direction of rotation there is no contact between the inner and outer ring; the freewheel is in freewheeling operation.
- In the other direction of rotation there is contact between the inner and outer ring; in this direction it is possible to transmit high torque.

For example the outer ring of the freewheel shown in figure 4-1 can freewheel clockwise while the inner ring is stationary. If, however, the outer ring is turned in the opposite direction, there is contact between the inner and outer ring and the inner ring is driven (driving operation).

Freewheels are used as:

- Backstops
- Overrunning Clutches
- Indexing Freewheels

Freewheels can fulfill these functions completely automatically in the most diverse machines. No mechanical or hydraulic operating equipment is required, as for example with external actuated clutches or brakes.

Freewheels consist of an inner and an outer ring between which clamping elements are arranged. Clamping elements can be sprags or rollers. We differentiate as follows:

- Freewheels with bearing support and
- Freewheels without bearing support.

For a freewheel to function, the concentric alignment of the inner and outer ring is required. In the case of freewheels without bearing support, concentric alignment like this must be provided by the customer.

RINGSPANN freewheels are an indispensable design element in the machine building industry as well as in the aerospace industry. Many designs are only economical if freewheels are used. The freewheel as an automatic driving element is preferred to conventional solutions because it offers the following significant advantages:

- operating safety,
- efficiency and
- a higher degree of automation.

With more than 50 years experience in the development, production and sales of freewheels, RINGSPANN offers the most comprehensive range of freewheels. A global network of subsidiaries and sales agencies ensures the best possible personal on-site service. Assembly and production facilities in various countries provide fast, reliable delivery.
Applications of Freewheels

**Backstop**
Freewheels are used as backstops if reverse rotation of the operating direction is to be prevented. In many machines and installations, for technical safety or functional reasons, it is necessary to ensure that you are working in just one specified direction of rotation. This is why there are legal stipulations requiring a mechanical safety device for the operation of, e.g. conveyor systems.

The normal operating mode of a backstop is freewheeling operation; the locking (torque transmission) is performed at zero speed. The immediate engagement of the clamping elements ensures the required high operating safety.

**Overrunning Clutch**
The overrunning clutch engages machines or machine parts and automatically interrupts their contact as soon as the driven part of the overrunning clutch is turned faster than the driving part. In many cases, this can replace a more expensive externally actuated clutch.

With overrunning clutches the engagement takes place in the driving operation (torque transmission), while in freewheeling operation the torque transmission between the inner and outer ring is interrupted. In driving operation the speeds of the inner and outer ring are equal, while in freewheeling operation they are different.

**Indexing Freewheel**
The indexing freewheel transmits a back and forth motion into a stepped rotation (indexed feed). The RINGSPANN indexing freewheel works precisely and quietly and enables an infinitely adjustable setting of the feed.
Areas of Application for Freewheels

**Areas of application for Backstops**

Gear units
Electric motors
Gear motors

Inclined conveyors
Elevators
Bucket elevators

The backstop prevents reverse rotation in a drive of a conveyor installation if the power fails or the motor is turned off.

**Areas of application for Overrunning Clutches**

Textile machines
Printing machines

Fans
Ventilators

During normal operation of textile or printing machines, the overrunning clutch separates the barring drive which is used for set up from the main drive.

If fans or ventilators are turned off, the overrunning clutch prevents the flywheel mass from rotating the drive.

**Areas of application for Indexing Freewheels**

Textile machines
Printing machines

Packaging machines
Filling plants

The indexing freewheel generates an indexed feed in textile and printing machines.

The indexing freewheel is used in packaging machines and filling plants for an indexed feed.
Fans
Ventilators

Pumps
Generators

Roller conveyor

In multimotor drives the overrunning clutch disengages the inactive or lower speed drive.

The backstop prevents reverse rotation under the back pressure of the conveyed medium if the motor is turned off.

The backstop prevents reverse rotation under the back pressure of the conveyed medium if the motor is turned off.

In high voltage switches for tensioning a spring, the indexing freewheel is used in the place of a reduction gear.

The indexing freewheel replaces a reduction gear in seed spreader.
Categories of Freewheels

**Complete Freewheels**
- With bearing support between inner or outer ring
- Completely enclosed
- With own lubrication
- Connection to the outer ring and the customer part by:
  - bolting to the face (figure 8-1),
  - mounting flange,
  - keyway connection on the outer ring,
  - lever arm or
  - shaft coupling.

**Low Speed Backstop**
- With bearing support from inner to outer ring
- Completely enclosed
- With own lubrication

**Housing Freewheels**
- With bearing support between inner and outer ring
- Completely enclosed by its own housing
- With own lubrication
- With bearing supported input and output shafts
- Stationary arrangement
**Basic Freewheels**

- With bearing support between inner and outer ring
- For assembly with connecting parts
- Lubrication – if necessary – to be provided by the customer

**Integrated Freewheels**

- Without bearing support. Concentric alignment of inner and outer ring must be provided by the customer.
- Integrating the outer ring on the customer part by bolting to the face
- Lubrication – if necessary – to be provided by the customer

**Internal Freewheels**

- Series both with and without bearing support. In the case of series without bearing support, concentric alignment of the inner and outer ring must be provided by the customer.
- Installing the outer ring in the customer’s housing with press fit or keyway connection. This makes compact, space-saving solutions possible.
- Lubrication – if necessary – to be provided by the customer
Freewheels with Sprags or Rollers

two different designs of freewheels

Design as Sprag Freewheel

The sprag freewheel has outer and inner rings with cylindrical tracks. The individually spring loaded sprags are arranged in between the rings. The freewheel locks without slipping. Different sprag profiles enable a multitude of types. Types are available for:

- High torques
- Contactless freewheeling operation
- High indexing accuracy

Function of Sprag Freewheels

With the sprag arrangement illustrated in figure 10-2 the outer ring can be turned freely clockwise (freewheeling operation), if the inner ring is at a standstill, or it is turned counterclockwise. If the outer ring – e.g. with a stationary inner ring – is turned in the opposite direction, the clamping becomes effective. The sprags clamp without slipping between the tracks. In this direction of rotation high torque can be transmitted (driving operation).

The sprag arrangement in figure 10-2 also enables freewheeling operation while the inner ring is turned counterclockwise and driving operation when turning clockwise.

On the line of influence which links the points of contact of the sprag to the inner track and the sprag to the outer track, in driving operation the clamping generates the forces $F_I$ and $F_A$ (refer to figure 10-3). Because of the equilibrium of forces, these are equal. The forces $F_I$ and $F_A$ can be divided into the normal forces $F_{NI}$ and $F_{NA}$ as well as into the circumferential forces $F_{TI}$ and $F_{TA}$. The line of influence forms against the force $F_{NI}$ or $F_{NA}$ the clamping angle $\epsilon_I$ or $\epsilon_A$, whereby $\epsilon_I > \epsilon_A$. To achieve self-locking, the tangent of the clamping angle $\epsilon_I$ must be less than the friction value $\mu$.

$$\tan \epsilon_I = \frac{F_{TI}}{F_{NI}} \leq \mu$$

Because of the relationship

$$M = z \cdot R_I \cdot F_{TI} = z \cdot R_A \cdot F_{NA} \cdot \tan \epsilon_I$$

$$= z \cdot R_A \cdot F_{TA} = z \cdot R_A \cdot F_{NA} \cdot \tan \epsilon_A$$

with $z$ = number of sprags

the normal forces and the clamping angles adapt automatically to the acting torque $M$. 
Design as a Roller Freewheel

With roller freewheels either the inner or the outer ring has roller ramps. The other ring has a cylindrical track. The individually spring loaded rollers are arranged in between the rings. The freewheel locks without slipping.

Function of Roller Freewheels

With the version illustrated in figure 11-2, the outer ring can be turned freely clockwise (freewheeling operation), if the inner ring
- is at a standstill,
- is turned counterclockwise or
- is turned clockwise slower than the outer ring.

If the outer ring – e.g. with a stationary inner ring – is turned in the opposite direction, the clamping becomes effective. The rollers clamp without slipping between the tracks. In this direction of rotation high torque can be transmitted (driving operation).

The version illustrated in figure 11-2 also enables a freewheeling operation while the inner ring is turned counterclockwise and driving operation when turning clockwise.

On the line of influence which links the points of contact of the roller to the roller ramp and the roller to the outer track, in driving operation the clamping generates the forces $F_I$ and $F_A$ (refer to figure 11-3). Because of the equilibrium of forces, these are equal. The forces $F_I$ and $F_A$ can be divided into the normal forces $F_{NI}$ and $F_{NA}$ as well as into the circumferential forces $F_{TI}$ and $F_{TA}$. The line of influence forms against the force $F_{NA}$ or $F_{NI}$ the clamping angle $\varepsilon$. To achieve self-locking, the tangent of the clamping angle must be less than the friction value $\mu$. E.g., for the contact point of the roller to the outer track this means:

$$\tan \varepsilon = \frac{F_{TA}}{F_{NA}} \leq \mu$$

Because of the relationship

$$M = z \cdot R_A \cdot F_{TA} = z \cdot R_A \cdot F_{NA} \cdot \tan \varepsilon$$

with $z =$ number of rollers

the normal force and the clamping angle adapt automatically to the acting torque $M$. 
Types for Extended Service Life

<table>
<thead>
<tr>
<th>Standard type</th>
<th>Type with sprag lift-off X</th>
<th>Type with sprag lift-off Z</th>
<th>Type with RIDUVIT®</th>
<th>Type with hydrodynamic sprag lift-off</th>
</tr>
</thead>
<tbody>
<tr>
<td>For universal use</td>
<td>For extended service life using sprag lift-off at high speed rotating inner ring</td>
<td>For extended service life using sprag lift-off at high speed rotating outer ring</td>
<td>For extended service life using coated sprags</td>
<td>For extended service life using sprag lift-off at high speed rotating outer ring</td>
</tr>
</tbody>
</table>

### Use as

- **Backstop**
  - Up to medium speeds during freewheeling operation (inner or outer ring freewheels)
  - Up to very high speeds during freewheeling operation (inner ring freewheels)
  - Up to very high speeds during freewheeling operation (inner ring freewheels)
  - Up to high speeds during freewheeling operation (inner or outer ring freewheels)

- **Overrunning Clutch**
  - Up to very high speeds in driving operation (outer or inner ring drives)
  - Up to very high speeds in driving operation (outer or inner ring drives)
  - Up to very high speeds in driving operation (outer or inner ring drives)
  - Up to very high speeds in driving operation (outer or inner ring drives)

- **Indexing Freewheel Overrunning Clutch**
  - Up to a medium total number of actuations
  - Up to a high total number of actuations

In addition the standard type, RINGSPANN has developed four other types for extended service life for freewheels with sprags. The table above lists the recommended application conditions for these types.

### Type with sprag lift-off X

The sprag lift-off X is used for backstops and overrunning clutches, provided that in freewheeling operation the inner ring is rotating at high speed and providing with overrunning clutches that the driving operation is conducted at low speed. In freewheeling operation, the centrifugal force $F_C$ causes the sprag to lift off from the outer track. In this operating state, the freewheel works wear-free, i.e. with unlimited service life.

Figure 12-1 shows a freewheel with sprag lift-off X in freewheeling operation. The sprags, which are supported in a cage connected with the inner ring, rotate with the inner ring. The centrifugal force $F_C$ that is applied in the center of gravity $S$ of the sprag turns the sprag counterclockwise and rests against the support ring of the cage. This results in the gap $a$ between the sprag and the outer track; the freewheel works without contact. If the inner ring speed decreases to such an extent that the effect of the centrifugal force on the sprag is less than that of the spring force $F_F$, the sprag again rests on the outer ring and the freewheel is ready to lock (figure 12-2). If used as an overrunning clutch, the driving speed must not exceed 40% of the lift-off speed.

### Type with sprag lift-off Z

The sprag lift-off Z is applied for backstops and overrunning clutches, provided in freewheeling operation the outer ring is rotating at high speed, and providing with overrunning clutches the driving operation is conducted at low speed. In freewheeling operation, the centrifugal force $F_C$ causes the sprag to lift off from the inner track. In this operating state, the freewheel works wear-free, i.e. with unrestricted service life.

Figure 12-3 shows a freewheel with sprag lift-off Z in freewheeling operation. The sprags rotate with the outer ring. The centrifugal force $F_C$ that is applied in the center of gravity $S$ of the sprag turns the sprag counterclockwise and rests against the outer ring. This results in the gap $a$ between the sprag and the inner track; the freewheel works without contact. If the outer ring speed decreases to such an extent that the effect of the centrifugal force on the sprag is less than that of the spring force $F_F$, the sprag again rests on the inner ring and the freewheel is ready to lock (figure 12-4). If used as an overrunning clutch, the driving speed must not exceed 40% of the lift-off speed.
Type RIDUVIT®

RINGSPANN sprags are made from chrome steel, the same material as used for the balls in ball bearings. The high compressive strength, elasticity and tensile strength of this material is required for the sprags in a locked state. In freewheeling operation, however, it is able to cope with utmost wear resistance on the points of contact of the sprag with the inner track. All of these requirements are perfectly fulfilled by using a chrome steel sprag with RIDUVIT® coating. The RIDUVIT® coating lends the sprag a resistance to wear akin to that of hard metal. The technology used here is based on state-of-the-art tribology research. RIDUVIT® sprags are used in backstages and overruning clutches and considerably increase the service life.

Type with hydrodynamic sprag lift-off

The hydrodynamic sprag lift-off is the ideal solution for overruning clutches at high speeds, not only in freewheeling operation, but also in the driving operation, as can occur, for example, in multimotor drives. In the case of the hydrodynamic sprag lift-off, the lifting force is generated by an oil flow. The relative speed between the inner and outer rings is decisive for the lifting-off function. Compared to the freewheels with sprag lift-off X or Z, here the driving speed can be just as high as the freewheeling speed.

The freewheels with hydrodynamic sprag lift-off (series FKh) include an oil pump that is based on the pitot tube principle. The pitot tubes are connected with the inner ring. When the outer ring is rotating, an oil ring forms in the oil chamber, into which the pitot tubes are immersed. As soon as the outer ring overruns the inner ring, the pitot tubes pump the oil under pressure into the ring chamber and the oil then seeps out through the ring gap at high speed axially into the intermediate areas of the sprags. Depending on the relative speed between the outer and inner ring, the oil flow does not flow axially into the intermediate areas of the sprags, but at an angle. This creates a reaction force on the sprags. This reaction force overcomes the contact force of the sprag springs, and the sprags lift off from the inner ring. This process is supported by a hydrodynamic wedge formation. If the relative speed between the outer and inner rings reduces, the lifting force also reduces. Before achieving synchronous running, the sprags are brought safely to rest on the inner ring and are ready to lock. This guarantees immediate torque transfer once the synchronous speed has been reached. The hydrodynamic sprag lift-off enables a virtually wear-free freewheeling operation.
Selection torque for Backstops

Bringing a loaded inclined conveyor, an elevator or a pump to a standstill is a highly dynamic process that incurs high peak torques. These peak torques are decisive for the selection of the backstop. The prior determination of the occurring torque in the case of locking is carried out most safely by using a rotational vibration analysis of the entire system. This, however, requires a knowledge of the rotating masses, the rotational rigidity and all of the excitation moments that occur on the system. In many cases, a vibrational calculation is too time consuming or you may not have all the necessary data in the configuration phase available. In this case, the selection torque $M_A$ of the backstop should be determined as follows:

$$M_A = 1.75 \cdot M_L \text{ [Nm]}$$

Often you only have the figures for the motor nominal output $P_0$ [kW] available. Then:

$$M_A = 1.75 \cdot F^2 \cdot 9550 \cdot P_0/n_{SP} \text{ [Nm]}$$

In these equations:
- $M_A = $ Selection torque of the backstop [Nm]
- $M_L = 9550 \cdot F \cdot P_L/n_{SP} \text{ [Nm]}$
  - $F = $ Selection factor
- $P_L = $ Lifting capacity of the conveyor system at full load [kW]
- $n_{SP} = $ Speed of backstop shaft [min$^{-1}$]
- $F = $ Selection factor (refer to table)

After calculating $M_A$ the backstop size must be selected in accordance with the catalogue tables in such a way that in all cases this applies:

$$M_N \geq M_A$$

$$M_N =\text{ Nominal torque of the backstop in accordance with the table values [Nm]}$$

It must be noted that, with a direct motor start in the locking direction of a backstop, very high peak torques can occur which in turn can destroy the backstop.

Approximate values for $F$:

<table>
<thead>
<tr>
<th>Type of installation</th>
<th>$F$</th>
<th>$F^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conveyor belts, angle up to 6°</td>
<td>0.71</td>
<td>0.50</td>
</tr>
<tr>
<td>Conveyor belts, angle up to 8°</td>
<td>0.78</td>
<td>0.61</td>
</tr>
<tr>
<td>Conveyor belts, angle up to 10°</td>
<td>0.83</td>
<td>0.69</td>
</tr>
<tr>
<td>Conveyor belts, angle up to 12°</td>
<td>0.86</td>
<td>0.74</td>
</tr>
<tr>
<td>Screw pumps</td>
<td>0.93</td>
<td>0.87</td>
</tr>
<tr>
<td>Ball mills, drying drums</td>
<td>0.85</td>
<td>0.72</td>
</tr>
<tr>
<td>Bucket conveyors, elevators</td>
<td>0.92</td>
<td>0.85</td>
</tr>
<tr>
<td>Hammer mills</td>
<td>0.93</td>
<td>0.87</td>
</tr>
<tr>
<td>Fans, Ventilators</td>
<td>0.53</td>
<td>0.28</td>
</tr>
</tbody>
</table>

Selection torque for Overrunning Clutches

In many cases where overrunning clutches are being used, dynamic processes occur that cause high peak torques. In the case of overrunning clutches, the torques that occur during start up must be observed. The peak torques when starting up can, in the case of asynchronous motors – especially when accelerating large masses and when using elastic couplings – significantly exceed the torque calculated from the motor pull-over torque. The conditions for internal combustion engines are similar. Even in normal operation, on account of their degree of irregularity, peak torques can occur that are way in excess of the nominal torque.

The prior determination of the maximum occurring torque is carried out most safely by using a rotational vibration analysis of the entire system. This, however, requires a knowledge of the rotating masses, the rotational rigidity and all of the excitation moments that occur on the system. In many cases, a vibrational calculation is too time consuming or you may not have all the necessary data in the configuration phase available. In this case, the selection torque $M_A$ of the overrunning clutch should be determined as follows:

$$M_A = K \cdot M_L$$

In this equation:
- $M_A = $ Selection torque of the freewheel
- $K = $ Operating factor (refer to table)
- $M_L = $ Load torque for constant rotating freewheel:
  - $= 9550 \cdot P_0/n_{FR}$
- $P_0 = $ Nominal power of motor [kW]
- $n_{FR} = $ Speed of the freewheel in driving operation [min$^{-1}$]

After calculating $M_A$ the freewheel size must be selected in accordance with the catalogue tables in such a way that in all cases this applies:

$$M_N \geq M_A$$

$$M_N = \text{ Nominal torque of the freewheel in accordance with the table values [Nm]}$$

Approximate values for operating factor $K$:

<table>
<thead>
<tr>
<th>Type of driver</th>
<th>$K$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric motors with low start up impact (e.g. DC motors, asynchronous motors with slip rings or soft start couplings), steam turbines, gas turbines</td>
<td>0.8 to 2.5</td>
</tr>
<tr>
<td>Electric motors with considerable start up impact (e.g. synchronous or asynchronous motors with direct start)</td>
<td>1.25 to 2.5</td>
</tr>
<tr>
<td>Piston engines with more than two cylinders, water turbines, hydraulic motors</td>
<td>1.25 to 3.15</td>
</tr>
<tr>
<td>Piston engines with one or two cylinders</td>
<td>1.6 to 3.15</td>
</tr>
</tbody>
</table>

The operating factor $K$ depends on the properties of the driver and the machine. The general rules of mechanical engineering apply here. We know from practice that applications are known where the operating factor $K$ can also assume values of up to 20, e.g. with a direct start-up of asynchronous electric motors in connection with elastic couplings.

Selection torque for Indexing Freewheels

The selection torque for indexing freewheels is, among other things, dependent upon how the back and forth motion is generated (crank operation, hydraulic cylinders, pneumatic cylinders etc.). It cannot be specified in a simple equation. When stating the maximum torque to be transmitted, we are happy to advise you regarding the selection torque.
The selection of the correct freewheel depends on several criteria. In order to make an optimum freewheel selection for you, we ask that you complete the respective questionnaire on pages 106 to 109 and send it to us.

If you wish to select the freewheel yourself, then we recommend - without liability for possible errors that could occur during selection - that you proceed as follows:

1. Determine the application of the Freewheel as a
   - Backstop
   - Overrunning Clutch
   - Indexing Freewheel
   Refer to page 5.

2. Determine the suitable category of the Freewheel as
   - Complete Freewheel
   - Low Speed Backstop,
   - Housing Freewheel,
   - Basic Freewheel,
   - Integrated Freewheel or
   - Internal Freewheel.
   Refer to pages 8 and 9.

3. Determine the selection torque of the Freewheel
   Refer to page 14.

   The nominal torques, specified in the catalogue are designed for the application of freewheels on solid shafts and the specified minimum thickness of the housing or the outer rings. When using freewheels on hollow shafts or with lower outer wall thickness, the transmissible torque should be checked by RINGSPANN.

4. Determine the suitable type of the Freewheel as
   - Standard type,
   - Type with sprag lift-off X
   - Type with sprag lift-off Z
   - Type with RIDUVIT®
   - Type with hydrodynamic sprag lift-off
   Refer to pages 12 and 13.

5. Choose the suitable Freewheel
   Refer to the table of contents on pages 2 and 3, the representations of the different series on pages 16 to 97 as well as the technical points on pages 102 to 105.
Complete Freewheels FB
for bolting to the face
with sprags, available in four types

Application example
Two Complete Freewheels FB 82 SFT as overrunning clutches in the drive of an edge trimming shear in a wide strip roll train. When trimming the edges of the strip, the trimming rollers are driven by the drive of the edge trimming shear. By doing so, the two freewheels work in driving operation. As soon as the sheet metal strip is gripped by the next pair of rollers, they pull the strip at an increased speed and the inner rings overrun the slower turning drive of the edge trimming shear. By doing so, the freewheels work in freewheeling operation. The RIDUVIT® sprags give the freewheels an extended service life.

Application as
- Backstop
- Overrunning Clutch
- Indexing Freewheel

Features
Complete Freewheels FB are sealed sprag freewheels with ball bearings. They are supplied oil-filled and ready for installation. In addition to the standard type, three other types are available for extended service life. Nominal torques up to 160,000 Nm. Bores up to 300 mm. A multitude of standardized bore diameters are available with short delivery times.

Mounting
The customer attachment part is on the external diameter D and then bolted on to the face. The tolerance of the shaft must be ISO h6 or j6 and the tolerance of the pilot diameter D of the attachment part must be ISO H7 or J7.

Example for ordering
Freewheel size FB 72, type with sprag lift-off Z and 40 mm bore:
- FB 72 LZ, d = 40 mm
When ordering freewheel size FB 340 and FB 440, please also specify the freewheeling direction of the inner ring when viewed in direction X:
- counterclockwise free or
- clockwise free
# Complete Freewheels FB

**for bolting to the face**

**with sprags, available in four types**

---

**FREEWHEELS FB**

<table>
<thead>
<tr>
<th>Freewheel Size</th>
<th>Standard type</th>
<th>Type with RIDUVIT®</th>
<th>Type with spray lift-off X</th>
<th>Type with spray lift-off Z</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>For universal use</td>
<td>For extended service life using coated sprags</td>
<td>For extended service life using sprag lift-off at high speed rotating inner ring</td>
<td>For extended service life using sprag lift-off at high speed rotating outer ring</td>
</tr>
</tbody>
</table>

---

<table>
<thead>
<tr>
<th>Size FB 24 to FB 270</th>
<th>Size FB 340 to FB 440</th>
</tr>
</thead>
<tbody>
<tr>
<td>17-1</td>
<td>17-2</td>
</tr>
</tbody>
</table>

---

<table>
<thead>
<tr>
<th>Freewheel Size</th>
<th>Type</th>
<th>Nominal torque $M_N$ Nm</th>
<th>Max. speed at inner ring drives $L_{min}$</th>
<th>Max. speed at outer ring drives $L_{min}$</th>
<th>Nominal torque $M_N$ Nm</th>
<th>Spur lift-off at inner ring speed $L_{min}$</th>
<th>Max. speed at outer ring drives $L_{min}$</th>
<th>Nominal torque $M_N$ Nm</th>
<th>Spur lift-off at outer ring speed $L_{min}$</th>
<th>Max. speed at inner ring drives $L_{min}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>FB 24</td>
<td>CF</td>
<td>45</td>
<td>4 800</td>
<td>5 500</td>
<td>45</td>
<td>4 800</td>
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<td>160</td>
<td>270</td>
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<tr>
<td>FB 29</td>
<td>CF</td>
<td>80</td>
<td>3 500</td>
<td>4 000</td>
<td>80</td>
<td>3 500</td>
<td>4 000</td>
<td>12</td>
<td>112</td>
<td>282</td>
</tr>
<tr>
<td>FB 37</td>
<td>SF</td>
<td>200</td>
<td>2 500</td>
<td>2 600</td>
<td>200</td>
<td>2 500</td>
<td>2 600</td>
<td>18</td>
<td>175</td>
<td>425</td>
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<tr>
<td>FB 44</td>
<td>SF</td>
<td>320</td>
<td>1 900</td>
<td>2 200</td>
<td>320</td>
<td>1 900</td>
<td>2 200</td>
<td>16</td>
<td>168</td>
<td>356</td>
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<tr>
<td>FB 57</td>
<td>SF</td>
<td>630</td>
<td>1 400</td>
<td>1 750</td>
<td>630</td>
<td>1 400</td>
<td>1 750</td>
<td>12</td>
<td>127</td>
<td>277</td>
</tr>
<tr>
<td>FB 72</td>
<td>SF</td>
<td>1 250</td>
<td>1 120</td>
<td>1 600</td>
<td>1 250</td>
<td>1 120</td>
<td>1 600</td>
<td>12</td>
<td>127</td>
<td>277</td>
</tr>
<tr>
<td>FB 82</td>
<td>SF</td>
<td>1 800</td>
<td>1 025</td>
<td>1 450</td>
<td>1 800</td>
<td>1 025</td>
<td>1 450</td>
<td>10</td>
<td>107</td>
<td>257</td>
</tr>
<tr>
<td>FB 107</td>
<td>SF</td>
<td>2 500</td>
<td>880</td>
<td>1 250</td>
<td>2 500</td>
<td>880</td>
<td>1 250</td>
<td>8</td>
<td>83</td>
<td>173</td>
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<tr>
<td>FB 127</td>
<td>SF</td>
<td>5 000</td>
<td>800</td>
<td>1 150</td>
<td>5 000</td>
<td>800</td>
<td>1 150</td>
<td>5</td>
<td>57</td>
<td>115</td>
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<tr>
<td>FB 140</td>
<td>SF</td>
<td>10 000</td>
<td>750</td>
<td>1 100</td>
<td>10 000</td>
<td>750</td>
<td>1 100</td>
<td>3</td>
<td>31</td>
<td>63</td>
</tr>
<tr>
<td>FB 200</td>
<td>SF</td>
<td>20 000</td>
<td>630</td>
<td>900</td>
<td>20 000</td>
<td>630</td>
<td>900</td>
<td>2</td>
<td>21</td>
<td>42</td>
</tr>
<tr>
<td>FB 270</td>
<td>SF</td>
<td>40 000</td>
<td>510</td>
<td>750</td>
<td>40 000</td>
<td>510</td>
<td>750</td>
<td>1</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>FB 340</td>
<td>SF</td>
<td>80 000</td>
<td>630</td>
<td>1000</td>
<td>80 000</td>
<td>630</td>
<td>1000</td>
<td>5</td>
<td>52</td>
<td>104</td>
</tr>
<tr>
<td>FB 440</td>
<td>SF</td>
<td>160 000</td>
<td>650</td>
<td>550</td>
<td>160 000</td>
<td>650</td>
<td>550</td>
<td>5</td>
<td>52</td>
<td>104</td>
</tr>
</tbody>
</table>

The maximum transmissible torque is 2 times the specified nominal torque. See page 14 for determination of selection torque.

---

**Keyway according to DIN 6685, page 1 - Tolerance of keyway width J510.**

*Keyway according to DIN 6685, page 3 - Tolerance of keyway width J510.*

**Z = Number of tapped holes G on pitch circle T.**
Application example

Two Complete Freewheels FKh 28 ATR as over-running clutches in the drive system of a fan. The fan can be driven either by an electric motor or by a turbine. The freewheels between the fan and the two drive assemblies automatically engage the working drive with the fan and in each case disengage the drive that is no longer giving power. The freewheels replace actuated clutches, which require an additional activation when changing over from one drive to another. The hydrodynamic sprag lift-off is the most suitable type for a wear-free freewheeling operation if the speeds in driving operation are the same or similarly high to those speeds in freewheeling operation.

Application as

➤ Overrunning Clutch
at high speeds, which are the same or similar in freewheeling operation and in driving operation.

Features

Complete Freewheels FKh with hydrodynamic sprag lift-off are typically used in installations where an assembly can be driven from two or more motors or turbines at the same or similar high speed. Complete Freewheels FKh are sealed sprag freewheels with ball bearings. They are supplied oil-filled and ready for installation.
Nominal torques up to 14 000 Nm.
Bores up to 95 mm.
### Complete Freewheels FKh

**for bolting to the face**  
**with hydrodynamic sprag lift-off for multimotor drives**

---

**Mounting**

The customer attachment part is centered on the diameter R and then bolted on to the face.

The installation must invariably take place in such a way that the drive (driving operation) is carried out via the inner ring and the outer ring overruns in freewheeling operation.

The tolerance of the shaft must be ISO h6 or j6 and the tolerance of the pilot diameter R of the attachment part must be ISO H7 or J7.

---

### Example for ordering

Frewheel size FKh 28, type with hydrodynamic sprag lift-off and 45 mm bore:

- **FKh 28 ATR, d = 45 mm**

When ordering, please also specify the freewheel direction of the outer ring when viewed in direction X:

- counterclockwise free
- clockwise free

---

### Dimensions

**Type with hydrodynamic sprag lift-off**  
For extended service life using sprag lift-off at high speed rotating outer ring

| Freewheel Size | Nominal Torque \( \text{Nm} \) | Outer Ring Overruns \( \text{min}^{-1} \) | Inner Ring Drives \( \text{min}^{-1} \) | Bore \( \text{d} \) (mm) | B (mm) | D (mm) | F (mm) | G** (mm) | H (mm) | K (mm) | L (mm) | R (mm) | T (mm) | Z** (Number of tapped holes) | Weight (kg) |
|----------------|-------------------------------|---------------------------------------------|----------------------------------------|----------------|--------|--------|--------|----------|--------|--------|--------|--------|--------|--------|---------------------------|----------|
| FKh 24         | ATR 1 100                      | 3 000                                       | 3 000                                   | 35            | 40°    | 90     | 170    | 1,0      | M 10   | 11     | 9      | 95     | 135    | 115    | 6                         | 9,6      |
| FKh 28         | ATR 1 800                      | 2 000                                       | 2 000                                   | 45            | 50°    | 103    | 186    | 1,0      | M 10   | 11     | 11     | 105    | 135    | 115    | 12                        | 14,0     |
| FKh 94         | ATR 2 500                      | 1 800                                       | 1 800                                   | 60            | 60°    | 112    | 210    | 7,0      | M 10   | 16     | 9      | 120    | 170    | 150    | 10                        | 19,0     |
| FKh 106        | ATR 4 200                      | 1 600                                       | 1 600                                   | 70            | 75°    | 116    | 250    | 7,5      | M 12   | 18     | 8      | 125    | 200    | 180    | 12                        | 25,0     |
| FKh 148        | ATR 7 000                      | 1 600                                       | 1 600                                   | 80            | 95°    | 156    | 291    | 7,5      | M 16   | 25     | 9      | 165    | 250    | 225    | 12                        | 52,0     |
| FKh 2.53       | ATR 14 000                     | 1 600                                       | 1 600                                   | 90            | 95°    | 241    | 345    | 2,0      | M 16   | 25     | 6      | 245    | 250    | 220    | 16                        | 98,0     |

The maximum transmissible torque is 2 times the specified nominal torque. See page 14 for determination of selection torque.

Keyway according to DIN 6885, page 1 - Tolerance of keyway width J510.

* Keyway according to DIN 6885, page 3 - Tolerance of keyway width J510.

** Z = Number of tapped holes G on pitch circle T.**
Application example
Complete Freewheel FBF 72 DX as an overrunning clutch in the drive of a meat processing machine (chopper). During the mixing process, the gear motor drives the bowl via the gear wheel drive and simultaneously the knife shaft via the belt drive and the locked freewheel. In the cutting process, the knife shaft is driven by a second motor at high speed. By doing so, the inner ring overruns the outer ring that is driven by the gear motor and the gear motor is automatically disengaged. With the high speed of the inner ring in freewheeling operation, the type sprag lift-off X is used; the sprags work in freewheeling operation without contact and hence are wear-free.

Mounting
The customer attachment part is centered on the external diameter D and then bolted on to the face via the flange.
The tolerance of the shaft must be ISO h6 or j6 and the tolerance of the pilot diameter D of the attachment part must be ISO H7 or J7.

Example for ordering
Freewheel size FBF 72, type with sprag lift-off X and 40 mm bore:
- FBF 72 DX, d = 40 mm

When ordering, please also specify the freewheeling direction of the inner ring when viewed in direction X:
- counterclockwise free or
- clockwise free
Complete Freewheels FBF

with mounting flange

with sprags, available in four types

Size FBF 24 to FBF 270

Size FBF 340 to FBF 440

The maximum transmissible torque is 2 times the specified nominal torque. See page 14 for determination of selection torque.

Keyway according to DIN 6885, page 1 • Tolerance of keyway width JS10.

* Keyway according to DIN 6885, page 3 • Tolerance of keyway width JS10.

** Z = Number of fastening holes for screws G (DIN EN ISO 4762) on pitch circle T.

The maximum transmissible torque is 2 times the specified nominal torque. See page 14 for determination of selection torque.
Complete Freewheels FGR ... R A1A2
with mounting flange
with rollers

Application example
Complete Freewheel FGR 50 R A1A2, used in a hydraulically released, spring actuated multi-disk brake for winch drives. When the load is lifted, the multiple-disk brake is closed and the inner ring is freewheeling. At a standstill, the freewheel functions as a backstop. The load is held by the brake and the locked freewheel. When lowering, the brake is released with control and the load is lowered via the locked freewheel. By using the freewheel, the hydraulic control could be designed in an simpler and more cost-effective manner.

Application as
- Backstop
- Overrunning Clutch
- Indexing Freewheel

Features
Complete Freewheels FGR ... R A1A2 with mounting flange are sealed roller freewheels with ball bearings. They are oil lubricated. Nominal torques up to 68 000 Nm. Bores up to 150 mm.
Complete Freewheels FGR ... R A1A2

with mounting flange
with rollers

The maximum transmissible torque is 2 times the specified nominal torque. See page 14 for determination of selection torque.

Keyway according to DIN 6885, page 1 • Tolerance of keyway width JS10.

* Z = Number of fastening holes for screws G (DIN EN ISO 4762) on pitch circle T.

Example for ordering

Freewheel size FGR 25, standard type with flange A1 and cover A2:

• FGR 25 R A1A2

Basic Freewheel, flange, cover, seals and screws are supplied loose unless otherwise stated in the order. If assembled, oil-filled, Complete Freewheels are to be supplied, this must be specified in the order. When ordering, please also specify the freewheeling direction of the inner ring when viewed in direction X:

• counterclockwise free or
• clockwise free

Mounting

Basic Freewheel, flange, cover, seals and screws are supplied loose. These must be assembled by the customer with regard to the required freewheeling direction into the Complete Freewheel. Prior to commissioning, the freewheel must be filled with oil of the specified quality. Upon request, assembled Complete Freewheels already oil-filled can be supplied.

The customer attachment part is centered on the external diameter D and bolted on via flange A1.

The tolerance of the shaft must be ISO h6 or j6 and the tolerance of the pilot diameter D of the attachment part must be ISO H7 or J7.
Application example

Complete Freewheel FGR 50 R A2A7 in a feed unit for sheet material. The drive is transmitted via the inner ring of the freewheel, which drives the feed rollers of the sprocket. Hence the sheet material is transported with the help of the freewheel. During the handover of the material into the next machine the material is able to overrun the drive unit.

Application as

- Backstop
- Overrunning Clutch
- Indexing Freewheel

Features

Complete Freewheels FGR … R A2A7 with mounting flange are sealed roller freewheels with ball bearings. They are oil lubricated. Nominal torques up to 68 000 Nm. Bores up to 150 mm.
Complete Freewheels FGR … R A2A7

with mounting flange
with rollers

Mounting

Basic Freewheel, flange, cover, seals and screws are supplied loose. These must be assembled by the customer with regard to the required freewheeling direction into the Complete Freewheel. Prior to commissioning, the freewheel must be filled with oil of the specified quality. Upon request, assembled Complete Freewheels already oil-filled can be supplied.

The customer attachment part is centered on the pilot diameter \( R \) and bolted on to the face via flange A7. Hence, Complete Freewheels FGR … R A2A7 are particularly suitable for attaching smaller and narrower parts (sprockets, gear wheels etc.).

The tolerance of the shaft must be ISO h6 or j6 and the tolerance of the pilot diameter \( R \) of the attachment part must be ISO H7 or J7.

Example for ordering

Freewheel size FGR 25, standard type with cover A2 and flange A7:
- FGR 25 R A2A7

Basic Freewheel, flange, cover, seals and screws are supplied loose provided nothing else is stated in the order.

If assembled, oil-filled, Complete Freewheels are to be supplied, this must be specified in the order. When ordering, please also specify the freewheeling direction of the inner ring when viewed in direction X:
- counterclockwise free or
- clockwise free

| Freewheel Size | Type | Flange and cover combination | Nominal torque \( N_m \) Nm | Max. inner ring speed \( n_m \) min\(^{-1} \) | Outer ring speed \( n_M \) min\(^{-1} \) | Bore \( D \) mm | Flange A7 \( A \) mm | Cover A2 \( A_2 \) mm | Seals \( K \) | Screws \( L \) mm | Outer ring \( LL_1 \) mm | Inner ring \( N_1 \) mm | T \( Z^* \) Weight kg |
|---------------|------|-------------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------|-----------------|-----------------|-------------|----------------|-----------------|-------------|---------|-----------|
| FGR 13 | R | A2A7 | 55 | 2 500 | 5-400 | 12 | 92 | 62 | 1 | M5 | 3.0 | 42 | 10.0 | 42 | 72 | 3 | 1.2 |
| FGR 15 | R | A2A7 | 130 | 2 200 | 4-800 | 15 | 92 | 68 | 1 | M5 | 3.0 | 52 | 11.0 | 47 | 78 | 3 | 1.6 |
| FGR 20 | R | A2A7 | 180 | 1 900 | 4-100 | 20 | 98 | 75 | 1 | M5 | 3.0 | 57 | 10.5 | 55 | 85 | 4 | 1.9 |
| FGR 25 | R | A2A7 | 290 | 1 550 | 3-350 | 25 | 118 | 90 | 1 | M6 | 3.0 | 60 | 11.5 | 68 | 104 | 4 | 2.9 |
| FGR 30 | R | A2A7 | 500 | 1 400 | 3-050 | 30 | 128 | 100 | 1 | M6 | 3.0 | 68 | 11.5 | 75 | 114 | 6 | 3.9 |
| FGR 35 | R | A2A7 | 730 | 1 300 | 2-850 | 35 | 140 | 110 | 1 | M6 | 3.5 | 74 | 13.0 | 80 | 124 | 6 | 4.9 |
| FGR 40 | R | A2A7 | 1 000 | 1 150 | 2-500 | 40 | 160 | 125 | 1 | M8 | 3.5 | 86 | 15.0 | 90 | 142 | 6 | 7.5 |
| FGR 45 | R | A2A7 | 1 150 | 1 100 | 2-400 | 45 | 165 | 130 | 1 | M8 | 3.5 | 86 | 15.0 | 95 | 146 | 8 | 7.8 |
| FGR 50 | R | A2A7 | 2 100 | 950 | 2-050 | 50 | 185 | 150 | 1 | M8 | 4.0 | 94 | 13.0 | 110 | 166 | 8 | 10.8 |
| FGR 55 | R | A2A7 | 2 600 | 900 | 1-900 | 55 | 204 | 160 | 1 | M10 | 4.0 | 104 | 17.0 | 115 | 182 | 8 | 14.0 |
| FGR 60 | R | A2A7 | 3 500 | 800 | 1-800 | 60 | 214 | 170 | 1 | M10 | 4.0 | 114 | 16.0 | 125 | 192 | 10 | 16.8 |
| FGR 70 | R | A2A7 | 6 000 | 700 | 1-600 | 70 | 234 | 190 | 1 | M10 | 4.0 | 134 | 17.5 | 140 | 212 | 10 | 20.8 |
| FGR 80 | R | A2A7 | 6 800 | 600 | 1-400 | 80 | 254 | 210 | 1 | M10 | 4.0 | 144 | 18.0 | 160 | 232 | 10 | 27.0 |
| FGR 90 | R | A2A7 | 11 000 | 500 | 1-300 | 90 | 278 | 230 | 1 | M12 | 4.5 | 158 | 19.0 | 180 | 254 | 10 | 40.0 |
| FGR 100 | R | A2A7 | 20 000 | 350 | 1-100 | 100 | 335 | 270 | 1 | M16 | 5.0 | 182 | 28.0 | 210 | 305 | 10 | 67.0 |
| FGR 130 | R | A2A7 | 31 000 | 250 | 900 | 130 | 380 | 310 | 1 | M16 | 5.0 | 212 | 27.0 | 240 | 345 | 12 | 94.0 |
| FGR 150 | R | A2A7 | 68 000 | 200 | 700 | 150 | 485 | 400 | 1 | M20 | 5.0 | 246 | 24.0 | 310 | 445 | 12 | 187.0 |

*The maximum transmissible torque is 2 times the specified nominal torque. See page 14 for determination of selection torque.
*

Key word according to DIN 6885, page 1 • Tolerance of keyway width JS10.

* Z = Number of fastening holes for screws G (DIN EN ISO 4762) on pitch circle T.
Complete Freewheels BM

for keyway connection on the outer ring
with rollers or with sprag lift-off X

Application as
- Backstop
- Overrunning Clutch
- Indexing Freewheel

Features

Complete Freewheels BM are sealed freewheels with ball bearings. They are supplied oil-filled and ready for installation.

Besides the standard type, the type with sprag lift-off X is available for wearfree freewheeling operation at high speed rotating inner ring.

Nominal torques up to 57 500 Nm.

Bores up to 150 mm. A multitude of standardized bore diameters are available with short delivery times.

Application example

Complete Freewheel BM 60 SX as a backstop, arranged at the end of the intermediate shaft of a spur gearbox. The freewheel is used without the radial seal rings on each side, and is lubricated by the gearbox oil. A radial holding pin engages in the keyway of the outer ring. The backdriving torque is supported by the holding pin in the stationary housing. By removing the radial holding pin, the installation can be turned in both directions in order to carry out maintenance work. With the high shaft speed in normal operation (freewheeling operation), the type with sprag lift-off X is used; the sprags work in freewheeling operation without contact and hence are wear-free.
Complete Freewheels BM

for keyway connection on the outer ring with rollers or with sprag lift-off X

Mounting

The customer attachment part is connected via a keyway connection with the outer ring. The customer must provide the key required for assembling the attachment part.

The tolerance of the shaft must be ISO h6 or j6 and the tolerance of the pilot diameter D of the attachment part must be ISO H7 or J7.

Example for ordering

Frewheel size BM 20, standard type and 30 mm bore:

- BM 20, R = 30 mm
Application example

Complete Freewheel FGRN 45 R as an overrunning clutch on the shaft end of a mobile fan. In normal operation, the fan is driven by a diesel motor via the V-belt drive. By doing so, the freewheel works in driving operation. When the motor is turned off, the freewheel automatically disengages the rotating flywheel mass of the fan from the drive. In this operating state, the inner ring overruns the stationary outer ring; the freewheel works in freewheeling operation.
Complete Freewheels FGRN … R A5A6
for keyway connection on the outer ring with rollers

Mounting

Basic Freewheel, covers, seals and screws are supplied loose. These must be assembled by the customer with regard to the required freewheeling direction into the Complete Freewheel. Prior to commissioning, the freewheel must be filled with oil of the specified quality. Upon request, assembled Complete Freewheels already oil-filled can be supplied.

The customer attachment part is connected via a keyway connection with the outer ring. The customer must provide the key required for assembling the attachment part.

The tolerance of the shaft must be ISO h6 or j6 and the tolerance of the pilot diameter D of the attachment part must be ISO H7 or J7.

Example for ordering

Freewheel size FGRN 60, standard type with flange A5 and cover A6:
- FGRN 60 R A5A6

Basic Freewheel, covers, seals and screws are supplied loose provided nothing else is stated in the order. If assembled, oil-filled, Complete Freewheels are to be supplied, this must be specified in the order. When ordering, please also specify the freewheeling direction of the inner ring when viewed in direction X:
  - counterclockwise free
  - clockwise free
Complete Freewheels BA

with lever arm
with rollers or with sprag lift-off X

Application as

➤ Backstop

Features

Complete Freewheels BA with lever arm are sealed freewheels with ball bearings. The freewheels BA have an end cover and are fitted to shaft ends. The oil filling is carried out after the freewheel has been fitted to the end of the shaft. Besides the standard type, the type with sprag lift-off X is available for wearfree freewheeling operation at high speed rotating inner ring. Nominal torques up to 57 500 Nm. Bores up to 150 mm. A multitude of standardized bore diameters are available with short delivery times.

Application example

Complete Freewheel BA 45 SX as a backstop, arranged at the end of the intermediate shaft of a spur gearbox. The backdriving torque is supported by the lever arm with holding pin on the gearbox housing. If the holding pin is removed, the shaft can be turned in both directions. With the high shaft speed in normal operation (freewheeling operation), the type with sprag lift-off X is used; the sprags work in freewheeling operation without contact and hence are wear-free.
**Complete Freewheels BA**

with lever arm
with rollers or with sprag lift-off X

---

### Mounting

The backdriving torque is supported by the lever arm with holding pin. The holding pin engages in a slot or bore in the frame of the machine. It must have 0.5 to 2 mm play in the axial and radial directions.

If the holding pin is removed, the shaft can be turned in both directions.

The tolerance of the shaft must be ISO h6 or j6. For freewheels BA, the inner ring must be secured axially with the supplied retainer plate. Prior to commissioning, the freewheel must be filled with oil of the specified quality.

### Example for ordering

Freewheel size BA 30, type with sprag lift-off X and 50 mm bore:
- BA 30 DX, d = 50 mm

When ordering, please also specify the freewheeling direction of the inner ring when viewed in direction X:
- counterclockwise free or
clockwise free

---

### Dimensions

| Freewheel Size | Type | Nominal Torque $N_m$ Nm | Max. speed at high speed rotating inner ring $N_m$ min⁻¹ | Max. speed Intereng Inner ring $N_m$ min⁻¹ | Bore d Standard mm | A max mm | C mm | D mm | E mm | H mm | K mm | L mm | N mm | O mm | P mm | Q mm | R mm | S mm | Weight kg |
|---------------|------|------------------------|-------------------------------------------------------|------------------------------------------------|-------------------|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| BA 12         | R    | 150                    | 1750                                                  |                                                  | 15 15 71          | 50 71 8 53   | 45 68 9 91 11,5 | 42 45 | M6 2 |
| BA 15         | R    | 200                    | 1650                                                  |                                                  | 20 20 81          | 60 81 8 62   | 45 70 9 93 13,5 | 50 50 | M6 3 |
| BA 18         | R    | 340                    | 1550                                                  |                                                  | 25 25 96          | 70 96 8 73   | 45 70 9 96 15,5 | 60 60 | M10 4 |
| BA 20         | R    | 420                    | 1450                                                  |                                                  | 30 30 110         | 90 106 8 80   | 25 77 11 104 19,5 | 65 70 | M10 5 |
| BA 25         | R    | 800                    | 1250                                                  |                                                  | 40 40 126         | 100 126 8 90   | 25 93 11 125 19,5 | 75 80 | M12 8 |
| BA 28         | R    | 1 200                  | 1 100                                                 |                                                  | 45 45 140         | 110 134 10 105 3,5 | 95 14 129 24,5 | 85 90 | M12 9 |
| BA 30         | R    | 1 600                  | 1 000                                                 |                                                  | 50 50 155         | 120 151 10 120 3,5 | 102 16 140 27,5 | 95 100 | M16 12 |
| BA 35         | R    | 1 800                  | 900                                                   |                                                  | 55 55 170         | 130 161 10 140 3,5 | 110 19 151 33,5 | 112 110 | M16 15 |
| BA 40         | R    | 3 500                  | 800                                                   |                                                  | 60 60 190         | 150 181 12 160 5,5 | 116 22 160 37,5 | 130 120 | M16 20 |
| BA 45         | R    | 7 100                  | 750                                                   |                                                  | 70 70 210         | 160 196 14 175 7,0 | 130 26 176 41,5 | 140 130 | M16 25 |
| BA 50         | R    | 7 500                  | 700                                                   |                                                  | 75 75 220         | 180 206 14 185 7,0 | 132 26 178 41,5 | 150 140 | M16 30 |
| BA 52         | R    | 9 300                  | 650                                                   |                                                  | 80 80 230         | 190 216 14 200 4,5 | 150 26 208 41,5 | 160 150 | M20 35 |
| BA 55         | R    | 12 500                 | 600                                                   |                                                  | 90 90 255         | 200 246 15 210 3,5 | 170 29 228 49,5 | 170 160 | M20 50 |
| BA 60         | R    | 14 500                 | 550                                                   |                                                  | 100 100 295       | 220 291 20 250 8,5 | 206 35 273 60,0 | 200 190 | M24 91 |
| BA 70         | R    | 22 500                 | 425                                                   |                                                  | 120 120 335       | 260 321 25 280 14,0 | 215 39 291 65,0 | 225 210 | M24 115|
| BA 80         | R    | 25 000                 | 375                                                   |                                                  | 130 130 360       | 280 351 30 280 18,5 | 224 39 302 65,0 | 225 220 | M24 150|
| BA 90         | R    | 33 500                 | 350                                                   |                                                  | 140 140 385       | 300 371 35 310 22,5 | 236 55 314 70,0 | 250 240 | M30 180|
| BA 95         | R    | 35 000                 | 300                                                   |                                                  | 150 150 400       | 350 391 40 310 27,5 | 249 55 337 70,0 | 250 250 | M30 225|
| BA 100        | R    | 57 500                 | 250                                                   |                                                  | 160 160 435       | 411 45 435 31,5 | 276 60 372 80,0 | 280 270 | M30 260|

The maximum transmissible torque is 2 times the specified nominal torque. See page 14 for determination of selection torque. Keyway according to DIN 6885, page 1 • Tolerance of keyway width JS10.
Complete Freewheels BC
with lever arm
with rollers or with sprag lift-off X

Application as
➤ Backstop

Features
Complete Freewheels BC with lever arm are sealed freewheels with ball bearings. Freewheels BC are supplied oil-filled and ready for installation. They are arranged on through shafts or shaft ends. Besides the standard type, the type with sprag lift-off X is available for wearfree freewheeling operation at high speed rotating inner ring. Nominal torques up to 57,500 Nm. Bores up to 150 mm. A multitude of standardized bore diameters are available with short delivery times.

Application example
Complete Freewheel BC 90 R as a backstop on the end of a transport roller. The backdriving torque is supported by the lever arm with holding pin on the base. If the holding pin is removed, the shaft can be turned in both directions.
Complete Freewheels BC
with lever arm
with rollers or with sprag lift-off X

Mounting
The backdriving torque is supported by the lever arm with holding pin. The holding pin engages in a slot or bore in the frame of the machine. It must have 0,5 to 2 mm play in the axial and radial directions.

If the holding pin is removed, the shaft can be turned in both directions.

The tolerance of the shaft must be ISO h6 or j6. The freewheels BC are supplied oil-filled and ready for installation.

Example for ordering
Freewheel size BC 30, standard type and 50 mm bore:

- BC 30 R, d = 50 mm

When ordering, please also specify the freewheeling direction of the inner ring when viewed in direction X:

- counterclockwise free
- clockwise free
**Application example**

Complete Freewheel FGR 45 R A3A4 as a backstop on the opposite ends of the drive shaft of a bucket conveyor. In the case of a motor stop, the bucket conveyor must be held securely so that the conveyor goods do not pull the belt backwards and, in doing so, drive the motor quickly. The backdriving torque is supported by the lever arm with holding pin on the housing.

If the holding pin is removed, the belt shaft can be turned in both directions.

**Features**

Complete Freewheel FGR ... R A3A4 with lever arm are sealed roller freewheels with ball bearings. They are oil lubricated.

The freewheels FGR ... R A3A4 have an end cover and are fitted to shaft ends.

The oil filling is carried out after the freewheel has been installed.

Nominal torques up to 68 000 Nm.

Bores up to 150 mm.

**Application as**

- Backstop

for applications with low to medium speeds in freewheeling operation.
Complete Freewheels FGR … R A3A4

with lever arm
with rollers

Mounting

The backdriving torque is supported by the lever arm with holding pin. The holding pin engages in a slot or bore in the frame of the machine. It must have 0.5 to 2 mm play in the axial and radial directions. If the holding pin is removed, the shaft can be turned in both directions.

Example for ordering

Basic Freewheel, lever arm, cover, seals and screws are supplied loose provided nothing else is stated in the order.

Frewheel size FGR 25, standard type with lever arm A3 and cover A4:
- FGR 25 R A3A4
Complete Freewheels FGR … R A2A3

with lever arm
with rollers

Application example

Complete Freewheel FGR … R A2A3 as backstop at the end of an inclined conveyor belt. The backdriving torque is held by lever arm with holding pin on the fundament. When the holding pin is dismounted the conveyor belt can be turned in both directions.

Application as

➤ Backstop

for applications with low to medium speeds in freewheeling operation.

Features

Complete Freewheel FGR … R A2A3 with lever arm are sealed roller freewheels with ball bearings. They are oil lubricated.

The freewheels FGR … R A2A3 are arranged on through shafts or shaft ends.

Nominal torques up to 68 000 Nm.

Bores up to 150 mm.

Features

Complete Freewheel FGR … R A2A3 with lever arm are sealed roller freewheels with ball bearings. They are oil lubricated.

The freewheels FGR … R A2A3 are arranged on through shafts or shaft ends.

Nominal torques up to 68 000 Nm.

Bores up to 150 mm.
Complete Freewheels FGR … R A2A3

with lever arm
with rollers

---

**Mounting**

The backdriving torque is supported by the lever arm with holding pin. The holding pin engages in a slot or bore in the frame of the machine. It must have 0.5 to 2 mm play in the axial and radial directions. If the holding pin is removed, the shaft can be turned in both directions.

The tolerance of the shaft must be ISO h6 or j6.

---

**Example for ordering**

Basic Freewheel, lever arm, cover, seals and screws are supplied loose provided nothing else is stated in the order.

Freewheel size FGR 25, standard type with cover A2 and lever arm A3:
- FGR 25 R A2A3

If assembled, oil-filled, Complete Freewheels FGR … R A2A3 are to be supplied, this must be specified in the order. When ordering, please also specify the freewheeling direction of the inner ring when viewed in direction X:
- counterclockwise free
- clockwise free
**Application example**

Complete Freewheel FA 82 SFT as an indexing freewheel for the material feed of a punch. The freewheel is driven by a bell crank. The RIDUVIT® sprags give the freewheel an extended service life.
Complete Freewheels FA

with lever arm
with sprags and grease lubrication

When used as a backstop, the backdriving torque is supported by the lever arm. The lever arm must not be clamped into position. It must have 0.5 to 2 mm play in the axial and radial directions.

When used as an indexing freewheel, the lever arm serves as the indexing lever. The lever arm is not heat treated enabling the customer to provide their own holes. The tolerance of the shaft must be ISO h6 or j6.

Example for ordering
Frewheel size FA 57, type with RIDUVIT® and 40 mm bore:
• FA 57 SFT, d = 40 mm

The maximum transmissible torque is 2 times the specified nominal torque. See page 14 for determination of selection torque.

Keyway according to DIN 6885, page 1 • Tolerance of keyway width JS10.

* Keyway according to DIN 6885, page 3 • Tolerance of keyway width JS10.

### Dimensions

<table>
<thead>
<tr>
<th>Freewheel Size</th>
<th>Type</th>
<th>Nominal Torque $M_N$ Nm</th>
<th>Max. speed Inner ring freewheels $\text{min}^{-1}$</th>
<th>Nominal Torque $M_N$ Nm</th>
<th>Max. speed Inner ring freewheels $\text{min}^{-1}$</th>
<th>Bore $d$ Standard mm</th>
<th>C mm</th>
<th>D mm</th>
<th>E mm</th>
<th>H mm</th>
<th>L mm</th>
<th>N mm</th>
<th>Weight kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>FA 37 SF</td>
<td>SFT</td>
<td>230</td>
<td>500</td>
<td>20</td>
<td>25*</td>
<td>35</td>
<td>90</td>
<td>35</td>
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<td>340</td>
<td>40</td>
<td>42*</td>
<td>50</td>
<td>100</td>
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<td>14.5</td>
<td>2.5</td>
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<tr>
<td>FA 82 SF</td>
<td>SFT</td>
<td>1600</td>
<td>260</td>
<td>50</td>
<td>65*</td>
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<td>21.0</td>
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<tr>
<td>FA 107 SF</td>
<td>SFT</td>
<td>2500</td>
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<td>70</td>
<td>85*</td>
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<td>22.5</td>
<td>8.5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Standard type
- For universal use

### Type with RIDUVIT®
- For extended service life with coated sprags
Complete Freewheels FAV
with lever arm
with rollers and grease lubrication

Application as

- Backstop
- Indexing Freewheel

For application as backstop in installations with low speeds in freewheeling operation.
For application as indexing freewheel in installations with low to medium total number of actuations.

Features

Complete Freewheels FAV with lever arm are roller freewheels with sleeve bearings. They are grease-lubricated and therefore maintenance-free.
Nominal torques up to 2 500 Nm.
Bores up to 80 mm.

Application example

Two Complete Freewheels FAV 50 in the roller feed of a sheet metal processing machine. The indexing freewheel arranged on the left is driven via a bell crank with an adjustable lift. This enables an infinite setting of the feed. The backstop arranged on the right prevents the indexing rollers from running backwards while the indexing freewheel carries out its back stroke. Often, an additional small brake is provided in order to prevent the accelerated sheet metal strip from advancing.
Complete Freewheels FAV
with lever arm
with rollers and grease lubrication

### Dimensions

| Freewheel Size | Nominal Torque $M_{N\text{Nm}}$ | Max. speed innerring freewheels | Bore $d$ | C | D | E | H | L | N | P | Q | R | Weight |
|----------------|-------------------------------|--------------------------------|---------|---|---|---|---|---|---|---|---|---|---|---------|
| FAV 20         | 220                           | 500                            | 20      | 40 | 83| 12 | 90| 35| 11.5| 35| 85| 15| 1.3    |
| FAV 25         | 220                           | 500                            | 25      | 40 | 83| 12 | 90| 35| 11.5| 35| 85| 15| 1.3    |
| FAV 30         | 1025                          | 350                            | 30      | 40 | 118| 15 | 110| 54| 19.5| 35| 102| 15| 3.5    |
| FAV 35         | 1025                          | 350                            | 35      | 40 | 118| 15 | 110| 54| 19.5| 35| 102| 15| 3.4    |
| FAV 40         | 1025                          | 350                            | 40      | 40 | 118| 15 | 110| 54| 19.5| 35| 102| 15| 3.3    |
| FAV 45         | 1600                          | 250                            | 45      | 80 | 155| 20 | 140| 54| 17.0| 35| 130| 18| 5.5    |
| FAV 50         | 1600                          | 250                            | 50      | 80 | 155| 20 | 140| 54| 17.0| 35| 130| 18| 5.5    |
| FAV 55         | 1600                          | 250                            | 55      | 80 | 155| 20 | 140| 54| 17.0| 35| 130| 18| 5.5    |
| FAV 60         | 1600                          | 250                            | 60      | 80 | 155| 20 | 140| 54| 17.0| 35| 130| 18| 5.2    |
| FAV 65         | 1600                          | 250                            | 70      | 80 | 155| 20 | 140| 54| 17.0| 35| 130| 18| 5.0    |
| FAV 80         | 2500                          | 220                            | 80      | 80 | 190| 20 | 155| 64| 22.0| 40| 145| 20| 9.0    |

The maximum transmissible torque is 2 times the specified nominal torque. See page 14 for determination of selection torque.

Keyway according to DIN 6885, page 1 • Tolerance of keyway width J510.

### Mounting

When used as a backstop, the backdriving torque is supported by the lever arm. The lever arm must not be clamped into position. It must have 0.5 to 2 mm play in the axial and radial directions.

When used as an indexing freewheel, the lever arm serves as the indexing lever.

The tolerance of the shaft must be ISO h6 or j6.

### Example for ordering

Freewheel size FAV 60, standard type:

- FAV 60
Complete Freewheels FBE
with shaft coupling for small shaft misalignments
with sprags, available in three types

Application example
Two Complete Freewheels FBE 72 with shaft coupling as an overrunning clutch in the drive unit of a tube mill with additional auxiliary drive. A freewheel FBE 72 SF, standard type (freewheel 1) is arranged between the main drive and the angular gear. However, a freewheel FBE 72 LZ, type with sprag lift-off Z (freewheel 2) is arranged between the auxiliary drive and the angular gear. If the gear motor is driving in the auxiliary power mode, freewheel 2 works in driving operation and freewheel 1 overruns at a low speed (freewheeling operation). When driving via the main motor, the unit is driven via freewheel 1 (driving operation). Freewheel 2 overruns and automatically disengages the auxiliary drive (freewheeling operation). With the high speed, the type with sprag lift-off Z is used; the sprags work in freewheeling operation without contact and hence are wear-free.

Example for ordering
Freewheel size FBE 107, standard type with 60 mm bore in the freewheel and 55 mm bore in the shaft coupling:
• FBE 107 SF, d1 = 60 mm, d3 = 55 mm
When ordering freewheel size FBE 340 and FBE 440, please also specify the freewheeling direction of the inner ring when viewed in direction X:
• counterclockwise free or
• clockwise free

Mounting
The shaft coupling including the fastening screws are supplied loose. Depending on the desired freewheeling direction, the shaft coupling can be fitted on the right or the left of the freewheel.
The tolerance of the shaft must be ISO h6 or j6.

Application as
➔ Overrunning Clutch

Features
Complete Freewheels FBE with flexible shaft coupling are sealed sprag freewheels with ball bearings for coupling two aligned shafts. They are supplied oil-filled and ready for installation.
In addition to the standard type, two other types are available for extended service life.
Nominal torques up to 160 000 Nm.
Bores up to 300 mm. Many standard bores are available.
The material of the flexible coupling element is oil-resistant. We can provide you with performance data for the flexible shaft coupling upon request.

Complete Freewheels FBE with shaft coupling for small shaft misalignments with sprags, available in three types

Application as
➔ Overrunning Clutch

Features
Complete Freewheels FBE with flexible shaft coupling are sealed sprag freewheels with ball bearings for coupling two aligned shafts. They are supplied oil-filled and ready for installation.
In addition to the standard type, two other types are available for extended service life.
Nominal torques up to 160 000 Nm.
Bores up to 300 mm. Many standard bores are available.
The material of the flexible coupling element is oil-resistant. We can provide you with performance data for the flexible shaft coupling upon request.

Application example
Two Complete Freewheels FBE 72 with shaft coupling as an overrunning clutch in the drive unit of a tube mill with additional auxiliary drive. A freewheel FBE 72 SF, standard type (freewheel 1) is arranged between the main drive and the angular gear. However, a freewheel FBE 72 LZ, type with sprag lift-off Z (freewheel 2) is arranged between the auxiliary drive and the angular gear. If the gear motor is driving in the auxiliary power mode, freewheel 2 works in driving operation and freewheel 1 overruns at a low speed (freewheeling operation). When driving via the main motor, the unit is driven via freewheel 1 (driving operation). Freewheel 2 overruns and automatically disengages the auxiliary drive (freewheeling operation). With the high speed, the type with sprag lift-off Z is used; the sprags work in freewheeling operation without contact and hence are wear-free.

Example for ordering
Freewheel size FBE 107, standard type with 60 mm bore in the freewheel and 55 mm bore in the shaft coupling:
• FBE 107 SF, d1 = 60 mm, d3 = 55 mm
When ordering freewheel size FBE 340 and FBE 440, please also specify the freewheeling direction of the inner ring when viewed in direction X:
• counterclockwise free or
• clockwise free

Mounting
The shaft coupling including the fastening screws are supplied loose. Depending on the desired freewheeling direction, the shaft coupling can be fitted on the right or the left of the freewheel.
The tolerance of the shaft must be ISO h6 or j6.
Complete Freewheels FBE

with shaft coupling for small shaft misalignments
with sprags, available in three types

<table>
<thead>
<tr>
<th>Freewheel Size</th>
<th>Type</th>
<th>Standard max. Torque $M_N$ Nm</th>
<th>Max. Inner ring drives min-1</th>
<th>Max. Outer ring drives min-1</th>
<th>Max. speed overruns min-1</th>
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The maximum transmissible torque is 2 times the specified nominal torque. See page 14 for determination of selection torque.

The maximum transmissible torque is 2 times the specified nominal torque. See page 14 for determination of selection torque.
Application example

Complete Freewheel FBL 82 SFZ as an overrunning clutch in the drive unit of a conveyor belt system with additional creep drive. The freewheel with shaft coupling is arranged in between the main motor and the creep drive. When the creep drive operates, the freewheel is in driving operation and drives the belt at low speed. In normal operation (freewheeling operation), the main motor drives and the outer ring overruns, whereupon the creep drive is automatically disengaged. With the high speed here, the type sprag lift-off Z is used; the sprags work in freewheeling operation without contact and hence are wear-free.

Features

Complete Freewheels FBL with RINGSPANN Shaft Coupling are sealed sprag freewheels with ball bearings for coupling two shafts. They are supplied oil-filled and ready for installation. In addition to the standard type, two other types are available for extended service life. Nominal torques up to 8 000 Nm. Bores up to 140 mm. Many standard bores are available.

The torsionally stiff RINGSPANN Shaft Coupling can accept large radial and angular misalignments, without reactive forces affecting neighbouring bearings. We can provide you with performance data upon request.
Complete Freewheels FBL
with shaft coupling for large shaft misalignments with sprags, available in three types

**Mounting**

The flexible disk of the shaft coupling must be axially free when fitted so that the ball bearings in the freewheel are not distorted due to heat expansion.

The shaft coupling including the fastening screws are supplied loose. Depending on the desired freewheeling direction, the shaft coupling can be fitted on the right or the left of the freewheel.

The tolerance of the shaft must be ISO h6 or j6.

**Example for ordering**

Frewheel size FBL 72, type with sprag lift-off Z and 40 mm bore in the freewheel and 50 mm bore in the shaft coupling:

- FBL 72 LZ, d1 = 40 mm, d3 = 50 mm
Application example

Backstop FRHD 900 on the head drum shaft of an inclined conveyor belt system. The lever arm is bolted to the freewheel. The backdriving torque is supported by the lever arm on the base plate. When the conveyor belt is without any load, the drum shaft can be turned in both directions during maintenance by removing the bolts.

Mounting

The backdriving torque is supported by the lever arm. The lever arm must not be clamped into position. It must have 0,5 inch play in the axial and in the radial direction. The tolerance of the shaft must be ISO h6 or j6.

Example for ordering

Freewheel size FRHD 800 with a 3,500 inch bore:

- FRHD 800, d = 3,5 inch
Low Speed Backstops FRHD

with lever arm

in inch dimension, with sprags

The maximum transmissible torque is 2 times the specified nominal torque. See page 14 for determination of selection torque.

Keyway dimensions upon request by customers. • Conversion factors: 1 lb-ft = 1,35 Nm, 1 inch = 25,4 mm, 1 lbs = 0,453 kg.

| Freewheel Size | Nominal torque $M_N$ (lb-ft) | Max. Speed Inner ring freewheels $n_{max}$ (min$^{-1}$) | Bore $d$ (max. inch) | A (inch) | C (inch) | D (inch) | E (inch) | H (inch) | L (inch) | O (inch) | P (inch) | Q (inch) | Weight (lbs) |
|----------------|-----------------------------|-------------------------------------------------|--------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| FRHD 700       | 3,750           | 3,44                                           | 8,00               | 6,00  | 5,25  | 0,50  | 38,00 | 6,00  | 6,75  | 16,38 | 32,00 | 135 |
| FRHD 775       | 7,500           | 3,75                                           | 9,75               | 8,00  | 9,50  | 1,00  | 42,88 | 7,50  | 9,00  | 20,38 | 38,00 | 310 |
| FRHD 800       | 12,000          | 4,50                                           | 10,50              | 10,00 | 7,00  | 1,00  | 43,25 | 8,00  | 9,50  | 22,13 | 38,00 | 360 |
| FRHD 900       | 18,500          | 5,44                                           | 12,00              | 10,00 | 8,00  | 1,50  | 54,00 | 7,63  | 9,38  | 22,75 | 48,00 | 480 |
| FRHD 950       | 23,000          | 7,00                                           | 14,00              | 12,00 | 10,00 | 1,50  | 69,00 | 8,00  | 10,00 | 25,00 | 62,00 | 530 |
| FRHD 1 000     | 28,000          | 7,00                                           | 17,00              | 8,00  | 9,00  | 4,13  | 80,38 | 8,75  | 12,50 | 29,00 | 72,00 | 550 |
| FRHD 1 050     | 36,000          | 7,00                                           | 14,00              | 12,00 | 10,00 | 1,50  | 79,00 | 10,50 | 12,50 | 29,00 | 72,00 | 600 |
| FRHD 1 100     | 45,000          | 7,00                                           | 17,00              | 8,00  | 9,00  | 4,13  | 80,38 | 10,00 | -     | 23,13 | 72,00 | 795 |
| FRHD 1 200     | 62,000          | 9,00                                           | 23,00              | 10,00 | 12,00 | 4,94  | 89,00 | 11,00 | -     | 28,00 | 76,00 | 1300 |
| FRHD 1 300     | 90,000          | 10,00                                          | 25,00              | 12,00 | 14,00 | 5,25  | 95,00 | 12,00 | -     | 30,00 | 82,88 | 1674 |
| FRHD 1 400     | 140,000         | 12,00                                          | 30,00              | 18,00 | 16,00 | 6,25  | 107,00| 13,00 | -     | 36,00 | 94,00 | 2200 |
| FRHD 1 450     | 190,000         | 12,00                                          | 30,00              | 18,00 | 16,00 | 6,25  | 107,00| 15,00 | -     | 36,00 | 94,00 | 2500 |
| FRHD 1 500     | 230,000         | 12,00                                          | 31,00              | 18,00 | 15,13 | 6,25  | 107,00| 17,62 | -     | 36,00 | 94,00 | 2440 |
| FRHD 1 600     | 270,000         | 14,00                                          | 32,50              | 20,00 | 17,63 | 6,25  | 124,00| 19,25 | -     | 34,04 | 108,00| 3400 |
| FRHD 1 700     | 325,000         | 14,00                                          | 42,50              | 24,50 | 23,00 | 7,88  | 140,00| 20,00 | -     | 48,00 | 120,00| 7000 |
| FRHD 1 800     | 375,000         | 18,00                                          | 42,50              | 24,50 | 23,00 | 7,88  | 140,00| 23,00 | -     | 54,00 | 144,00| 12000|
Application example

Backstop FRHN 1 200 on the head drum shaft of an inclined conveyor belt system. The lever arm is bolted to the freewheel. The backdriving torque is supported by the lever arm on the base plate. When the conveyor belt is without any load, the drum shaft can be turned in both directions during maintenance by removing the bolts.

Mounting

The backdriving torque is supported by the lever arm. The lever arm must not be clamped into position. It must have 12.7 mm play in the axial and in the radial direction.

The tolerance of the shaft must be ISO h6 or j6.

Example for ordering

Freewheel size FRHN 1 200 with a 230 mm bore:

- FRHN 1 200, d = 230 mm
## Low Speed Backstops FRHN

with lever arm
in metric dimensions with sprags

---

### Standard type

For universal use

### Dimensions

| Freewheel Size | Nominal Torque $M_u$ Nm | Max. Speed Inner ring freewheels $n_{min}$ min\(^{-1}$ | Bore $d'$ max. mm | A mm | C mm | D mm | E mm | H mm | L mm | P mm | Q mm | Weight kg |
|----------------|------------------------|---------------------------------|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------|
| FR-HN1 200     | 125 000                |                                 | 230             | 586 | 280 | 300 | 124 | 2239| 280 | 712 | 1974 | 620 |
| FR-HN1 400     | 189 000                |                                 | 280             | 760 | 450 | 380 | 154 | 2590| 330 | 758 | 2268 | 1000 |
| FR-HN1 600     | 503 550                |                                 | 320             | 826 | 500 | 400 | 160 | 3104| 490 | 772 | 2742 | 1600 |

The maximum transmissible torque is 2 times the specified nominal torque. See page 14 for determination of selection torque.

Keyway dimensions upon request by customers.
Application as

Backstop for installations with low speeds. The freewheels are designed for the use in inclined conveyorbels, elevators or pumps.

Features

Low Speed Backstops FRSC with lever arm are sealed roller freewheels with ball bearings. They are supplied oil-filled and ready for installation. The Low Speed Backstops FRSC are arranged on through shafts or shaft ends. Nominal torques up to 215,500 Nm. Bores up to 300 mm.

Application example

Backstop FRSC 900 on the head drum shaft of an inclined conveyor belt system. The lever arm is bolted to the freewheel. The backdriving torque is supported by the lever arm on the base plate. When the conveyor belt is without any load, the drum shaft can be turned in both directions during maintenance by removing the bolts.

Mounting

The backdriving torque is supported by the lever arm. The positioning of the lever arm can be adjusted at any angle. The lever arm must not be clamped into position. It must have 12,7 mm play in the axial and in the radial direction. The tolerance of the shaft must be ISO h6 or j6.

Example for ordering

Freewheel size FRSC 800 with a 115 mm bore:

• FRSC 800, d = 115 mm
### Low Speed Backstops FRSC

**with lever arm**
**with rollers**

**Backstop**  
For universal use

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Backstop</th>
<th>Standard type</th>
</tr>
</thead>
</table>

#### Freewheel Size

<table>
<thead>
<tr>
<th>Freewheel Size</th>
<th>Nominal torque $W_m$ Nm</th>
<th>Max. Speed Inerring freewheels</th>
<th>Bore $d$ max.</th>
<th>A</th>
<th>C</th>
<th>E</th>
<th>H</th>
<th>L</th>
<th>P</th>
<th>Q</th>
<th>Weight kg</th>
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<th>Max. Speed Inerring freewheels</th>
<th>Bore $d$ max.</th>
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<th>C</th>
<th>E</th>
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The maximum transmissible torque is 2 times the specified nominal torque. See page 14, catalogue „Freewheels“ for determination of selection torque.

Keyway dimensions upon request by customers.
Housing Freewheels FH
for stationary arrangement in multimotor drives
with hydrodynamic roller lift-off for extended service life

Application as
➔ Overrunning Clutch
at high speeds, which are the same or similar in freewheeling operation and in driving operation.

Features
Housing Freewheels FH with hydrodynamic roller lift-off are typically used in cases where an assembly can be driven from two or more motors or turbines at the same or similar high speed. They allow a continuous plant operation in the event that one of the energy sources or a drive line fails as well as energy saving in the case of partial load operation.

The Housing Freewheels FH are completely enclosed freewheels for stationary arrangement with input and output shaft.

Advantages
• Nominal torques up to 81 350 Nm
• Shaft diameter up to 178 mm
• Wear-free operation
• Low noise
• Low power dissipation
• Integrated oil filtration system
• Integrated locking brake
• Oil change without down time

Hydrodynamic roller lift-off
Housing Freewheels FH are equipped with hydrodynamic roller lift-off. The hydrodynamic roller lift-off is the ideal solution for overrunning clutches at high speeds, not only in freewheeling operation, but also in the driving operation, as can occur, for example, in multimotor drives.

In the case of hydrodynamic roller lift-off, the lifting force is generated by an oil film applied during freewheeling operation by centrifugal force exerted on the outer ring race. This provides for practically wear-free freewheeling operation. The speed differential between the inner and outer rings is the decisive factor affecting the lift-off function. If the speed differential decreases, the lift-off force also decreases. Before achieving synchronous running, the clamping rollers guided in a cage are positioned with the aid of the central spring system against the outer ring race and are then ready to lock. This guarantees immediate torque transfer once the synchronous speed has been reached. The hydrodynamic roller lift-off enables a virtually wear-free freewheeling operation.
Selection torque for Housing Freewheels FH

In many cases where overrunning clutches are being used, dynamic processes occur that cause high peak torques. In the case of overrunning clutches, the torques that occur during start up must be observed. The peak torques when starting up can, in the case of asynchronous motors - especially when accelerating large masses and when using elastic couplings - significantly exceed the torque calculated from the motor pullover torque. The conditions for internal combustion engines are similar. Even in normal operation, on account of their degree of irregularity, peak torques can occur that are way in excess of the nominal torque.

The prior determination of the maximum occurring torque is carried out most safely by using a rotational vibration analysis of the entire system. This, however, requires a knowledge of the rotating masses, the rotational rigidity and all of the excitation moments that occur on the system. In many cases, a vibrational calculation is too time consuming or you may not have all the necessary data in the configuration phase available. In this case, the selection torque $M_A$ of the overrunning clutch should be determined as follows:

$$M_A = K \cdot M_L$$

In this equation:

- $M_A$ = Selection torque of the freewheel
- $K$ = Operating factor
- $M_L$ = Load torque for constant rotating freewheel:
  $$M_L = 9550 \cdot P_0 / n_{FR}$$
- $P_0$ = Nominal power of motor [kW]
- $n_{FR}$ = Speed of the freewheel in driving operation [min$^{-1}$]

After calculating $M_A$, the freewheel size must be selected in accordance with the catalogue tables in such a way that in all cases this applies:

$$M_N \geq M_A$$

$M_N$ = Nominal torque of the Housing Freewheel FH in accordance with the table values [Nm]

The operating factor $K$ depends on the properties of the driver and the machine. The general rules of mechanical engineering apply here. We recommend using an operating factor $K$ of at least 1.5. We will be pleased to check your selection.
Housing Freewheels FH
for stationary arrangement in multimotor drives
with hydrodynamic roller lift-off for extended service life
Housing Freewheels FH

for stationary arrangement in multimotor drives
with hydrodynamic roller lift-off for extended service life

<table>
<thead>
<tr>
<th>Freewheel Size</th>
<th>Type</th>
<th>Nominal torque (Nm)</th>
<th>Output shaft speed (min⁻¹)</th>
<th>Max. torque (Nm)</th>
<th>Output shaft overruns</th>
<th>Input shaft drives</th>
<th>Shaft d₁ and d₂</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>H</th>
<th>K</th>
<th>O</th>
<th>Q</th>
<th>R</th>
<th>S</th>
<th>Weight (kg)</th>
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<td>18 1/4</td>
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<td>20</td>
<td>17 1/4</td>
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<td>29 1/4</td>
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<td>2822</td>
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</tbody>
</table>

Locking brake

During freewheeling operation, the stationary input shaft of the Housing Freewheel is effected by a drag torque from the freewheeling output shaft. By manually activation of the in the housing freewheel integrated locking brake the driving parts are prevented from being carried along.

Mounting

The Housing Freewheel must be mounted in such a way that shaft d₁ is the input shaft and shaft d₂ the output shaft.

We recommend the use of torsionally stiff shaft couplings generating only low reactive forces. On indication of the reactive forces that occur we are well prepared to check the usable life of the bearings installed.

Example for ordering

Prior to ordering, please complete the questionnaire on page 109 by specifying the direction of rotation in driving operation when viewed in direction X so that we can check the selection.

Keyway according to USAS B17.1-1967

The maximum transmissible torque is 2 times the specified nominal torque. See page 14 for determination of selection torque.
Basic Freewheels FGR … R
for assembly with connecting parts with rollers

Application example
Basic Freewheel FGR 25 R as a backstop on a reduction gear in the drive of an inclined conveyor of an assembly train. When the unit stops, the conveyor belt must be held securely so that it does not run backwards by the weight of the assembly parts. A brake disk is fitted to the outer ring of the freewheel alongside a manually operated RINGSPANN brake caliper. The back-driving torque is maintained by the freewheel and the closed brake. During set-up it must be possible to move the installation in both directions of rotation. To do this, the brake caliper is opened manually.
### Basic Freewheels FGR … R

for assembly with connecting parts with rollers

#### Mounting

The customer connecting parts are centered on the ball bearing external diameter F and assembled via the outer ring.

The tolerance of the shaft must be ISO h6 or j6 and the tolerance of the pilot diameter F of the connecting part must be ISO H7 or J7. The centering depth C must be observed.

#### Lubrication

An oil lubrication of the specified quality must be provided. Two flat seals are supplied for sealing between the faces of the outer ring and the connecting parts.

#### Example for ordering

Frewheel size FGR 35, standard type: FGR 35 R

---

### Dimensions

<table>
<thead>
<tr>
<th>Freewheel Size</th>
<th>Type</th>
<th>Nominal Torque $M_{nu}$/ Nm</th>
<th>Max. Speed Inner ring freewheels/overspins min⁻¹</th>
<th>Max. Speed Outer ring freewheels/overspins min⁻¹</th>
<th>Bored d</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G**</th>
<th>H</th>
<th>L</th>
<th>T</th>
<th>Z**</th>
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</table>

The maximum transmissible torque is 2 times the specified nominal torque. See page 14 for determination of selection torque.

Keyway according to DIN 6885, page 1 • Tolerance of keyway width j510.

** Z = Number of tapped holes or mounting holes G on pitch circle T.

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### Standard/For universal use

#### Bore

○ Dimensions

- $B$, $C$, $D$, $E$, $F$, $G^\ast \ast$, $H$, $L$, $T$, $Z^\ast$ Weight

---

**Example for ordering**

Freewheel size FGR 35, standard type: FGR 35 R
Integrated Freewheels FXM
for bolting to the face
with sprag lift-off X

Application as

- Backstop
- Overrunning Clutch

For application as backstop in installations with high speeds in freewheeling operation.
For application as overrunning clutch in installations with low speeds in driving operation.

Features

Integrated Freewheels FXM are sprag freewheels without bearing support and with sprag lift-off X.
The sprag lift-off X ensures a wear-free freewheeling operation when the inner ring rotates at high speed.
Nominal torques up to 1230000 Nm.
Bores up to 500 mm. A multitude of standardized bore diameters are available with short delivery times.

Sprag lift-off X

Integrated Freewheels FXM are equipped with sprag lift-off X. The sprag lift-off X is used for backstops and overrunning clutches, provided that in freewheeling operation the inner ring is rotating at high speed and providing with overrunning clutches that the driving operation is conducted at low speed. In freewheeling operation, the centrifugal force $F_C$ causes the sprag to lift off from the outer track. In this operating state, the freewheel works wear-free, i.e. with unlimited service life.

Figure 58-2 shows a freewheel with sprag lift-off X in freewheeling operation. The sprags, which are supported in a cage connected with the inner ring, rotate with the inner ring. The centrifugal force $F_C$ that is applied in the center of gravity $S$ of the sprag turns the sprag counterclockwise and rests against the support ring of the cage. This results in the gap $a$ between the sprag and the outer track; the freewheel works without contact. If the inner ring speed decreases to such an extent that the effect of the centrifugal force on the sprag is less than that of the spring force $F_F$, the sprag again rests on the outer ring and the freewheel is ready to lock (figure 58-3). If used as an overrunning clutch, the driving speed must not exceed 40% of the lift-off speed.
Integrated Freewheels FXM
for bolting to the face
with sprag lift-off X

Application example
Integrated Freewheel FXM 170 - 63 MX with end cover as backstop fitted to the end of the first intermediate shaft of a spur gearbox in the drive of an inclined conveyor belt. In the case of a motor stop, the conveyor belt must be held securely so that the conveyor goods do not pull the belt backwards and possibly cause serious damage. Due to the high shaft speeds in normal operation (freewheeling operation), the sprag lift-off X ensures a contactless and hence wear-free continuous operation.

Application example
Two Integrated Freewheels FXM 120 – 50 MX in the gearbox unit of a vertical bucket conveyor. Alongside the main drive, the bucket conveyor has a creep drive, which can be moved at a low speed if maintenance work needs to be carried out. The freewheel arranged between the creep drive and the main drive works as an overrunning clutch. When the creep drive operates, the freewheel is in driving operation. In normal operation, when driving via the main drive, the inner ring of the freewheel overruns at high speed and automatically disengages the creep drive. The second freewheel that is arranged on the end of the first intermediate shaft of the main gearbox, works as a backstop and prevents the bucket conveyor from running back when the unit is at a standstill.

Application example
Integrated Freewheel FXM 76-25 NX as an overrunning clutch between the creep drive and the main drive of a cement mixer. When the creep drive operates, the outer ring is driven by the shaft coupling. The freewheel works in driving operation and drives the unit at a low speed via the main gearbox. In normal operation (freewheeling operation), the inner ring overruns at high speed and the creep drive is automatically disengaged. With the high shaft speed, the type sprag lift-off X is used; the sprags work in freewheeling operation without contact and hence are wear-free. The arrangement of the seals between the freewheel and the main gearbox is advantageous. In freewheeling operation, this is at a standstill and hence generates no additional friction-related temperature rise.
Integrated Freewheels FXM … NX and FXM … MX
for bolting to the face
with sprag lift-off X

**Mounting**

Integrated Freewheels FXM are without bearing support. Concentric alignment of inner and outer ring must be provided by the customer. The permissible run out (T.I.R.) must be observed.

The integrated Freewheel FXM is centered via the outer track F on the customer attachment part and bolted to this (refer to figure 61-1). The tolerance of the pilot diameter of the attachment part must be ISO h6 or h7.

The tolerance of the shaft must be ISO h6 or j6.

For fitting to shaft ends, end covers can be supplied upon request (refer to figure 61-3).

The maximum transmissible torque is 2 times the specified nominal torque. See page 14 for determination of selection torque.

The theoretical nominal torque applies only for ideal concentricity between the inner and outer ring. In practice, the concentricity is affected by the bearing play and centering errors of the neighbouring parts. Then the nominal torques specified in the table apply, whilst taking into consideration the existing run out (T.I.R.).

Higher speeds upon request.

---

### Theoretical nominal torque

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<tr>
<th>Freewheel Size</th>
<th>Type</th>
<th>Theoretical nominal torque [Nm]</th>
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<tbody>
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<td>FXM 31-17</td>
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<td>110</td>
</tr>
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<td>FXM 38-17</td>
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</tr>
<tr>
<td>FXM 46-25</td>
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<td>460</td>
</tr>
<tr>
<td>FXM 51-25</td>
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<tr>
<td>FXM 200-63</td>
<td>MX</td>
<td>2500</td>
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</table>
Integrated Freewheels FXM ... NX and FXM ... MX
for bolting to the face
with sprag lift-off X

Lubrication
At speeds in excess of the sprag lift-off speed, no special lubrication is required; the freewheel functions maintenance-free.

When operating below the sprag lift-off speed, an oil lubrication of the specified oil quality must be provided.

Example for ordering
Frewheel size FXM 140 - 50, type with sprag lift-off X and 90 mm bore and end cover:
- FXM 140 - 50 MX, d = 90 mm, with end cover

Keyway according to DIN 6885, page 1 • Tolerance of keyway width JS10.
* Keyway according to DIN 6885, page 3 • Tolerance of keyway width JS10.
** Z = Number of fastening holes for screws G on pitch circle T.

---

### Table

<table>
<thead>
<tr>
<th>Freewheel Size</th>
<th>Type</th>
<th>Standard</th>
<th>Bore d</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G**</th>
<th>J</th>
<th>L</th>
<th>P</th>
<th>T</th>
<th>U</th>
<th>V</th>
<th>W</th>
<th>Z**</th>
<th>Weight</th>
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Keyway according to DIN 6885, page 1 • Tolerance of keyway width JS10.
* Keyway according to DIN 6885, page 3 • Tolerance of keyway width JS10.
** Z = Number of fastening holes for screws G on pitch circle T.
**Integrated Freewheels FXM ... LX**

for bolting to the face

with sprag lift-off X

---

The maximum transmissible torque is 2 times the specified nominal torque. See page 14 for determination of selection torque.

The theoretical nominal torque applies only for ideal concentricity between the inner and outer ring. In practice, the concentricity is affected by the bearing play and centering errors of the neighbouring parts. Then the nominal torques specified in the table apply, whilst taking into consideration the existing run out (T.I.R.).

Higher speeds upon request.

### Mounting

Integrated Freewheels FXM are without bearing support. Concentric alignment of inner and outer ring must be provided by the customer. The permissible run out (T.I.R.) must be observed.

The Integrated Freewheel FXM is centered via the outer track F on the customer attachment part and bolted to this (refer to figure 63-1). The tolerance of the pilot diameter of the attachment part must be ISO h6 or h7.

The tolerance of the shaft must be ISO h6 or j6.

---

<table>
<thead>
<tr>
<th>Freewheel Size</th>
<th>Type</th>
<th>Theoretical nominal torque [N·m]</th>
<th>Nominal torque at existing run out (T.I.R.) [N·m]</th>
<th>Sprag lift off at inner ring</th>
<th>Max. speed</th>
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The integrated Freewheel FXM is centered via the outer track F on the customer attachment part and bolted to this (refer to figure 63-1). The tolerance of the pilot diameter of the attachment part must be ISO h6 or h7.

The tolerance of the shaft must be ISO h6 or j6.
Integrated Freewheels FXM ... LX

for bolting to the face
with sprag lift-off X

Lubrication
At speeds in excess of the sprag lift-off speed, no special lubrication is required; the freewheel functions maintenance-free.

When operating below the sprag lift-off speed, an oil lubrication of the specified oil quality must be provided.

Example for ordering
Freewheel size FXM 240 - 63, type with sprag lift-off X and 185 mm bore:
• FXM 240 - 63 LX, d = 185 mm
Integrated Freewheels FON
for bolting to the face
with sprags, available in three types

Application as
- Backstop
- Overrunning Clutch
- Indexing Freewheel

Features
Integrated Freewheels FON are sprag freewheels without bearing support.
In addition to the standard type, two other types are available for extended service life and indexing accuracy.
Nominal torques up to 25,000 Nm.
Bores up to 155 mm. A multitude of standardized bore diameters are available with short delivery times.

Application example
Integrated Freewheel FON 57 SFT as an overrunning clutch, arranged on the main drive shaft of a packaging machine. The outer ring is connected to a creep drive by means of a gear wheel. This drive is used during set-up. In this operating state, the freewheel works in driving operation and drives the machine at a very low speed via the main shaft. In normal operation (freewheeling operation), the inner ring overruns and the creep drive is automatically disengaged. The RIDUVIT® sprags give the freewheel an extended service life.

Mounting
Integrated Freewheels FON are without bearing support. Concentric alignment of inner and outer ring must be provided by the customer. The permissible run out (T.I.R.) must be observed.
The Integrated Freewheel FON is centered via the outer track F on the customer attachment part and bolted to this. The tolerance of the pilot diameter of the attachment part must be ISO h6.
The tolerance of the shaft must be ISO h6 or j6.

Lubrication
In the case of standard type and type with RIDUVIT®, an oil lubrication of the specified oil quality must be provided.
In the case of the type with sprag lift-off Z, at speeds in excess of the sprag lift-off speed, no special lubrication is required; the freewheel functions maintenance-free. When operating below the sprag lift-off speed, an oil lubrication of the specified oil quality must be provided.

Example for ordering
Freewheel size FON 72, type with RIDUVIT® and 45 mm bore:
- FON 72 SFT, d = 45 mm
Integrated Freewheels FON

for bolting to the face
with sprags, available in three types

The maximum transmissible torque is 2 times the specified nominal torque. See page 14 for determination of selection torque.

The specified maximum speeds apply for installation conditions as given with Complete Freewheels. Knowing the actual installation conditions higher speeds can be permitted under some circumstances.

Freewheel Size | Standard | Bored A | Bored B | Bored D | Bored F | G** | J | L | P | T | Z** | Weight kg
<table>
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<td>200</td>
<td>85</td>
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<td>1,5</td>
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Keyway according to DIN 6885, page 1 • Tolerance of keyway width JS10.
* Keyway according to DIN 6885, page 3 • Tolerance of keyway width JS10.
** Z = Number of fastening holes for screws G on pitch circle T.

As of F = 180
Up to F = 145
Integrated Freewheels FXR …

for bolting to the face

with sprag lift-off X and torque limiting

Application as

➤ Backstop

for continuous conveyor installations with multiple drives in which each drive is equipped with a backstop.

Features

Integrated Freewheels FXR … are sprag freewheels without bearing support and with sprag lift-off X. They consist of the Integrated Freewheels FXM (refer to pages 58 to 63) with additional torque limiter.

The sprag lift-off X ensures a wear-free freewheeling operation when the inner ring rotates at high speed.

In continuous conveyor installations with multiple drives it is important to consider the problem of the unequal distribution of backdriving torque to the individual drives and backstops. As soon as the installation comes to a standstill, the entire backdriving torque is applied primarily to a single backstop, due to differences in the play and elasticity of the drives involved. In installations equipped with backstops without torque limiters, the individual gearboxes and the corresponding backstops must be designed to accommodate the entire backdriving torque of the conveyor installation in order to ensure safety.

The problem of the unequal distribution of backdriving torque is solved by using backstops FXR … with torque limiting. The torque limiter which is built into the backstop slips temporarily when the specified torque is exceeded until the other backstops engage in succession. In this way, the entire backdriving torque of the conveyor installation is distributed to the individual gearboxes and backstops. Furthermore, dynamic peak torques which occur during the locking process are reduced, thereby protecting the gearboxes against damaging peak torques. For this reason the use of backstops FXR … with torque limiting in continuous conveyor installations with multiple drives enables the application of gearboxes with smaller dimensions.

Advantages

• Protection of gearboxes from overload by unequal load distribution in multiple drives
• Protection of gearboxes from dynamic peak torques during the locking process
• Smaller gearboxes can be used without negatively effecting the safety
• Protection of the backstops, as dynamic peak torques are reduced by temporarily slipping
The backstops with controllable release function are used if a controlled relaxing of the belt or the unit – perhaps in the case of a jam on the pulley drum – or a limited reverse movement of the conveyor system is required.

The following determination of the selection torque applies to multiple-drives installations in which each drive has the same motor power. Please contact us in case of different motor powers.

If the backdriving torque $M_L$ per drive is known, then the selection torque $M_A$ for the particular backstop should be determined as follows:

$$M_A = 1,2 \cdot M_L [\text{Nm}]$$

If, however, only the nominal power per drive $P_0 [\text{kW}]$ is known, then this applies:

$$M_A = 1,2 \cdot 9550 \cdot \frac{F^2}{n_{SP}} \cdot P_0 [\text{Nm}]$$

In these equations:
- $M_A$ = Selection torque of the particular backstop [Nm]
- $M_L$ = Static backdriving torque of the load for each drive referring to the particular backstop shaft [Nm]
- $F$ = Selection factor
- $P_L$ = Lifting capacity per drive at full load [kW]
- $P_0$ = Nominal power of motor [kW]
- $n_{SP}$ = Speed of backstop shaft [min⁻¹]
- $F_2$ = Selection factor
- $F_L$ = Lifting capacity + Power loss

After calculating $M_A$, the size of the particular backstop must be selected in accordance with the catalogue tables in such a way that in all cases this applies:

$$M_R \geq M_A$$

The backstops with controllable release function are used if a controlled relaxing of the belt or the unit – perhaps in the case of a jam on the pulley drum – or a limited reverse movement of the conveyor system is required.

Example

Dual-drive system

Motor power per drive: $P_0 = 630 \text{ kW}$

Type of installation:
- Conveyor belt with 8° incline => $F^2 = 0,61$
- Speed per backstop shaft: $n_{SP} = 360 \text{ min}^{-1}$

Selection torque of the particular backstop:

$$M_A = 1,2 \cdot 9550 \cdot 0,61 \cdot 630 / 360 \ [\text{Nm}] = 12234 \text{ Nm}$$

The following rule applies in all cases:

$$M_R \geq M_A$$

=> FXRU or FXRW 140 - 63 MX are the suitable, economical backstop sizes.

### Integrated Freewheels FXRW with torque limiting and without release function

This series of backstops with torque limiting is the basic version. The design and the available standard sizes are shown on page 68.

### Integrated Freewheels FXRU with torque limiting and with release function

This series is designed in the same way as series FXRW; as an addition, a finely controllable release function is built in. The design, the description of the release function and the available standard sizes are shown on page 69.

### Approximate values for $F$

<table>
<thead>
<tr>
<th>Type of installation</th>
<th>$F$</th>
<th>$F^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conveyor belts, angle up to 6°</td>
<td>0,71</td>
<td>0,50</td>
</tr>
<tr>
<td>Conveyor belts, angle up to 8°</td>
<td>0,78</td>
<td>0,61</td>
</tr>
<tr>
<td>Conveyor belts, angle up to 10°</td>
<td>0,83</td>
<td>0,69</td>
</tr>
<tr>
<td>Conveyor belts, angle up to 12°</td>
<td>0,86</td>
<td>0,74</td>
</tr>
<tr>
<td>Conveyor belts, angle up to 15°</td>
<td>0,89</td>
<td>0,79</td>
</tr>
<tr>
<td>Screw pumps</td>
<td>0,93</td>
<td>0,87</td>
</tr>
<tr>
<td>Ball mills, drying drums</td>
<td>0,85</td>
<td>0,72</td>
</tr>
<tr>
<td>Bucket conveyors, elevators</td>
<td>0,92</td>
<td>0,85</td>
</tr>
<tr>
<td>Hammer mills</td>
<td>0,93</td>
<td>0,87</td>
</tr>
</tbody>
</table>

In each case, the sum of the slipping torques of the particular backstops must be 1,2 times higher than the static backdriving torque of the installation (also at overload). The torques specified in the tables are maximum values. Lower values can be set upon request. If in doubt, please contact us stating the precise description of the installation and the operating conditions. It is preferable to use the questionnaire on page 106.

### Selection torque

The following determination of the selection torque applies to multiple-drives installations in which each drive has the same motor power. Please contact us in case of different motor powers.

If the backdriving torque $M_L$ per drive is known, then the selection torque $M_A$ for the particular backstop should be determined as follows:

$$M_A = 1,2 \cdot M_L [\text{Nm}]$$

If, however, only the nominal power per drive $P_0 [\text{kW}]$ is known, then this applies:

$$M_A = 1,2 \cdot 9550 \cdot \frac{F^2}{n_{SP}} \cdot P_0 [\text{Nm}]$$

In these equations:
- $M_A$ = Selection torque of the particular backstop [Nm]
- $M_L$ = Static backdriving torque of the load for each drive referring to the particular backstop shaft [Nm]
- $F$ = Selection factor
- $P_L$ = Lifting capacity per drive at full load [kW]
- $P_0$ = Nominal power of motor [kW]
- $n_{SP}$ = Speed of backstop shaft [min⁻¹]
- $F^2$ = Selection factor
- $F_L$ = Lifting capacity + Power loss

After calculating $M_A$, the size of the particular backstop must be selected in accordance with the catalogue tables in such a way that in all cases this applies:

$$M_R \geq M_A$$

The backstops with controllable release function are used if a controlled relaxing of the belt or the unit – perhaps in the case of a jam on the pulley drum – or a limited reverse movement of the conveyor system is required.
### Integrated Freewheels FXRW

**for bolting to the face**

**with sprag lift-off X and torque limiting**

---

#### Torques

The Integrated Freewheels FXRW are supplied with a set slipping torque \( M_R \) of the torque limiter. The static backdriving torque \( M_R \) of the installation (also in the case of an overload) must under no circumstances exceed the sum of the slipping torques \( M_R \) of the provided Integrated Freewheels. The slipping torques \( M_R \) specified in the table are maximum values; lower values can be set.

#### Mounting

The Integrated Freewheels FXRW are without bearing support, therefore it must be ensured that the run out (T.I.R.) between the pilot diameter \( R \) and the shaft diameter \( d \) does not exceed the value 0,25 mm.

Dimension C applies for the Integrated Freewheel. The centering depth of the customer attachment part must be at least \( C + 0,2 \) mm. The tolerance of the pilot diameter \( R \) of the attachment part must be ISO H7.

The tolerance of the shaft must be ISO h6 or j6.

#### Example for ordering

Freewheel size FXRW 170 - 63 MX, type with sprag lift-off X, 130 mm bore and slipping torque 19 000 Nm:

- FXRW 170 - 63 MX, \( d = 130 \) mm, \( M_R = 19 000 \) Nm

---

#### Dimensions

| Freewheel Size | Type | Slipping torque \( M_R \) | Nm | Spray lift-off at inner ring | speed | mm/s | \( B \) | \( C \) | \( D \) | \( G \) | \( H \) | \( K \) | \( L \) | \( O \) | \( R \) | \( S \) | \( T \) | \( U \) | \( V \) | \( Z \) | Weight | kg |
|---------------|------|--------------------------|----|-----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| FXRW 85 - 50 | MX   | 3 300                    | 430| 6 000                        | 65    | 330   | 176   | 6     | 285   | M12   | 54    | 67,5  | 60    | 151   | 280   | 110   | 308   | 165   | 215   | 38    | 6     | 60    |
| FXRW 100 - 50| MX   | 4 700                    | 400| 4 500                        | 80    | 350   | 181   | 6     | 305   | M12   | 59    | 67,5  | 70    | 156   | 300   | 125   | 328   | 180   | 240   | 34    | 6     | 73    |
| FXRW 120 - 50| MX   | 7 300                    | 320| 4 000                        | 95    | 400   | 192   | 6     | 345   | M16   | 69    | 77,5  | 70    | 167   | 340   | 145   | 373   | 200   | 260   | 34    | 6     | 101   |
| FXRW 140 - 63| MX   | 12 500                   | 320| 3 000                        | 110   | 430   | 227   | 6     | 375   | M16   | 79    | 89,5  | 80    | 192   | 375   | 165   | 403   | 220   | 280   | 48    | 6     | 133   |
| FXRW 170 - 63| MX   | 19 000                   | 250| 2 700                        | 110   | 500   | 232   | 6     | 445   | M16   | 89    | 100   | 80    | 205   | 425   | 196   | 355   | 220   | 280   | 48    | 6     | 197   |
| FXRW 200 - 63| MX   | 30 000                   | 240| 2 500                        | 150   | 555   | 250   | 6     | 500   | M16   | 99    | 110   | 80    | 223   | 495   | 226   | 328   | 275   | 495   | 43    | 6     | 274   |
| FXRW 240 - 96| LX   | 56 000                   | 220| 2 100                        | 185   | 710   | 312   | 8     | 625   | M20   | 107   | 120   | 120   | 277   | 630   | 290   | 670   | 355   | 630   | 61    | 12    | 525   |
| FXRW 260 - 96| LX   | 65 000                   | 210| 2 500                        | 210   | 750   | 327   | 8     | 660   | M20   | 117   | 130   | 120   | 277   | 630   | 290   | 670   | 355   | 630   | 61    | 12    | 619   |
| FXRW 290 - 96| LX   | 90 000                   | 200| 2 250                        | 230   | 850   | 340   | 8     | 735   | M24   | 127   | 140   | 120   | 302   | 730   | 145   | 375   | 220   | 280   | 48    | 6     | 128   |
| FXRW 310 - 96| LX   | 107 000                  | 195| 2 100                        | 240   | 900   | 352   | 10    | 785   | M24   | 127   | 150   | 120   | 322   | 775   | 355   | 850   | 435   | 775   | 72    | 12    | 1016  |

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**Keyway according to DIN 6885, page 1 • Tolerance of keyway width JS10.** * Keyway according to DIN 6885, page 3 • Tolerance of keyway width JS10. ** \( Z \) = Number of fastening holes for screws G (DIN EN ISO 4762) on pitch circle T. *** Area for O-ring sealing. Other freewheel sizes upon request.
Integrated Freewheels FXRU

for bolting to the face

with sprag lift-off X, torque limiting and release function

### Torques

The Integrated Freewheels FXRU are supplied with a set slipping torque $M_R$ of the torque limiter. The static backdriving torque $M_L$ of the installation (also in the case of an overload) must under no circumstances achieve the sum of the slipping torques $M_R$ of the provided Integrated Freewheels. The slipping torques $M_R$ specified in the table are maximum values; lower values can be set.

### Mounting

The Integrated Freewheels FXRU are without bearing support, therefore it must be ensured that the run out (T.I.R.) between the pilot diameter $R$ and the shaft diameter $d$ does not exceed the value $0.25$ mm.

Dimension $C$ applies for the Integrated Freewheel. The centering depth of the customer attachment part must be at least $C + 0.2$ mm. The tolerance of the pilot diameter $R$ of the attachment part must be ISO H7.

The tolerance of the shaft must be ISO h6 or j6.

### Release function

The finely controllable release function consists basically of three special screws (2) that are located in the spring pocket (1), safety tabs (3) and wedge systems (5). To release the backstop, first of all the special screws (2) and hexagon screws (4) have to be unscrewed slightly. Then the safety tabs (3) have to be turned outwards and in this position fixed with the hexagon screws (4). The special screws (2) can then be tightened, whereupon, with the aid of the wedge system (5) the release procedure is finely initiated.

---

**Table:**

| Freewheel Size | Type | Slipping torque $M_R$ Nm | Sprag lift off at inner ring speed $m/s$ | Max. speed Inner ring freewheels $min^{-1}$ | Bore Standard | A | B | C | D | G$^*$ | H | K | L | O | R | S | T | U$^{***}$ | V$^{**}$ | Weight kg |
|----------------|------|--------------------------|------------------------------------------|---------------------------------------------|--------------|---|---|---|---|-----|---|---|---|---|---|---|---|---|---|---|------|
| FXRU 85 - 50   | MX   | 3.300                    | 4.300                                    | 6.000                                       | 65           | 330| 176| 6  | 285| M12 | 54 | 67,5| 60 | 151 | 280| 110| 308| 165| 215| 38  | 6    | 62  |
| FXRU 100 - 50  | MX   | 4.700                    | 5.000                                    | 80$^*$                                      | 350          | 181| 6  | 305| M12 | 59 | 67,5| 70 | 156 | 300| 125| 328| 180| 240| 33  | 6    | 74  |
| FXRU 120 - 50  | MX   | 7.300                    | 6.000                                    | 4.000                                       | 400          | 192| 6  | 345| M16 | 69 | 77,5| 70 | 167 | 340| 145| 373| 200| 260| 34  | 6    | 101 |
| FXRU 140 - 63  | MX   | 12.500                   | 3.200                                    | 3.000                                       | 110          | 430| 227| 6  | 375| M16 | 79 | 89,5| 80 | 192 | 375| 165| 403| 220| 280| 48  | 6    | 133 |
| FXRU 170 - 63  | MX   | 19.000                   | 2.700                                    | 1.100                                       | 500          | 232| 6  | 445| M16 | 89 | 100| 80 | 205 | 425| 196| 473| 250| 425| 36  | 6    | 197 |
| FXRU 200 - 63  | MX   | 30.000                   | 2.100                                    | 1.500                                       | 555          | 250| 6  | 500| M16 | 99 | 110| 80 | 223 | 495| 226| 528| 275| 495| 43  | 6    | 275 |
| FXRU 240 - 96  | LX   | 56.000                   | 2.250                                    | 2.500                                       | 185          | 710| 312| 8  | 625| M20| 107| 120| 120| 277 | 630| 290| 670| 355| 630| 61  | 12   | 526 |
| FXRU 260 - 96  | LX   | 65.000                   | 2.250                                    | 2.250                                       | 205          | 750| 327| 8  | 660| M20| 117| 130| 120| 277 | 630| 290| 670| 355| 630| 61  | 12   | 526 |
| FXRU 290 - 96  | LX   | 90.000                   | 2.250                                    | 2.250                                       | 230          | 850| 340| 8  | 735| M24| 127| 140| 120| 302 | 730| 330| 800| 405| 730| 65  | 12   | 853 |
| FXRU 310 - 96  | LX   | 107.000                  | 2.100                                    | 1.950                                       | 240          | 900| 352| 10 | 785| M24| 127| 150| 120| 322 | 775| 355| 850| 435| 775| 72  | 12   | 1017|

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**Notes:**

- Keyway according to DIN 6885, page 1 • Tolerance of keyway width JS10.
- Keyway according to DIN 6885, page 3 • Tolerance of keyway width JS10.
- **Z** = Number of fastening holes for screws G (DIN EN ISO 4762) on pitch circle T.
- **Area for O-ring sealing.**

Other freewheel sizes upon request.
Internal Freewheels FXN

for press fit on the outer ring with sprag lift-off X

Application as

- Backstop
- Overrunning Clutch

For application as backstop in installations with high speeds in freewheeling operation.
For application as overrunning clutch in installations with low speeds in driving operation.

Features

Internal Freewheels FXN are sprag freewheels without bearing support and with sprag lift-off X.
The sprag lift-off X ensures a wear-free freewheeling operation when the inner ring rotates at high speed.
The outer ring is pressed into the customer housing. This makes compact, space-saving fitting solutions possible.
Nominal torques up to 20 500 Nm. The torque is transmitted on the outer ring by press fit.
Bores up to 130 mm. A multitude of standardized bore diameters are available with short delivery times.

Sprag lift-off X

Internal Freewheels FXN are equipped with sprag lift-off X. The sprag lift-off X is used for backstops and overrunning clutches, provided that in freewheeling operation the inner ring is rotating at high speed and providing with overrunning clutches that the driving operation is conducted at low speed. In freewheeling operation, the centrifugal force $F_C$ causes the sprag to lift off from the outer track. In this operating state, the freewheel works wear-free, i.e. with unlimited service life.

Figure 70-2 shows a freewheel with sprag lift-off X in freewheeling operation. The sprags, which are supported in a cage connected with the inner ring, rotate with the inner ring. The centrifugal force $F_C$ that is applied in the center of gravity $S$ of the sprag turns the sprag counterclockwise and rests against the support ring of the cage. This results in the gap $a$ between the sprag and the outer track; the freewheel works without contact. If the inner ring speed decreases to such an extent that the effect of the centrifugal force on the sprag is less than that of the spring force $F_F$, the sprag again rests on the outer ring and the freewheel is ready to lock (figure 70-3). If used as an overrunning clutch, the driving speed must not exceed 40% of the lift-off speed.
Internal Freewheels FXN
for press fit on the outer ring
with sprag lift-off X

Application example
Internal Freewheel FXN 38 - 17/70 NX as a backstop, arranged in a housing adapter to attach to an electric motor. The thin outer ring that is pressed into the housing enables a space-efficient fitting solution. Due to the high shaft speeds in normal operation (freewheeling operation), the sprag lift-off X ensures a contactless and hence wear-free continuous operation.

Application example
Internal Freewheel FXN 66 - 25/100 NX as an overrunning clutch in the creep drive of a textile machine. The freewheel installation is compactly solved by means of the thin outer ring that is pressed into the worm wheel. During setup, the machine is driven by the worm gear and the freewheel that is working in driving operation. In normal operation (freewheeling operation), the inner ring that is located on the high speed main drive shaft overruns and automatically disengages the creep drive. With the high overrunning speed of the inner ring, the type with sprag lift-off X is used; the sprags work in freewheeling operation without contact and hence are wear-free.

Application example
Internal Freewheel FXN 85 - 40/140 M X as a backstop fitted to the end of the first intermediate shaft of a spur gearbox in the drive of an inclined conveyor belt. In the case of a motor stop the conveyor belt must be held securely so that the conveyor goods do not pull the belt backwards and possibly cause serious damage. Due to the high shaft speeds in normal operation (freewheeling operation), the sprag lift-off X ensures a contactless and hence wear-free continuous operation.
## Internal Freewheels FXN

for press fit on the outer ring with sprag lift-off X

<table>
<thead>
<tr>
<th>Freewheel Size</th>
<th>Type</th>
<th>Theoretical Nominal torque</th>
<th>Nominal torque at existing run out T.I.R.</th>
<th>Sprag lift-off at inner ring speed min⁻¹</th>
<th>Max. Speed</th>
<th>Outer ring drives min⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FXN 31 - 17/60</td>
<td>NX</td>
<td>Nm 110</td>
<td>Nm 110</td>
<td>Nm 105</td>
<td>Nm 100</td>
<td>Nm 890</td>
</tr>
<tr>
<td>FXN 31 - 17/70</td>
<td>NX</td>
<td>Nm 110</td>
<td>Nm 110</td>
<td>Nm 105</td>
<td>Nm 100</td>
<td>Nm 890</td>
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<td>NX</td>
<td>Nm 560</td>
<td>Nm 550</td>
<td>Nm 540</td>
<td>Nm 530</td>
<td>Nm 750</td>
</tr>
<tr>
<td>FXN 56 - 25/90</td>
<td>NX</td>
<td>Nm 660</td>
<td>Nm 650</td>
<td>Nm 640</td>
<td>Nm 630</td>
<td>Nm 730</td>
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<tr>
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<td>NX</td>
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<td>Nm 500</td>
<td>Nm 480</td>
<td>Nm 460</td>
<td>Nm 750</td>
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<td>NX</td>
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<td>Nm 930</td>
<td>Nm 910</td>
<td>Nm 890</td>
<td>Nm 700</td>
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<tr>
<td>FXN 66 - 25/110</td>
<td>NX</td>
<td>Nm 950</td>
<td>Nm 930</td>
<td>Nm 910</td>
<td>Nm 890</td>
<td>Nm 700</td>
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<tr>
<td>FXN 76 - 25/115</td>
<td>NX</td>
<td>Nm 1200</td>
<td>Nm 1170</td>
<td>Nm 1140</td>
<td>Nm 1110</td>
<td>Nm 670</td>
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<tr>
<td>FXN 76 - 25/120</td>
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<td>Nm 1200</td>
<td>Nm 1170</td>
<td>Nm 1140</td>
<td>Nm 1110</td>
<td>Nm 670</td>
</tr>
<tr>
<td>FXN 86 - 25/125</td>
<td>NX</td>
<td>Nm 1600</td>
<td>Nm 1550</td>
<td>Nm 1500</td>
<td>Nm 1450</td>
<td>Nm 630</td>
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<tr>
<td>FXN 86 - 25/130</td>
<td>NX</td>
<td>Nm 1600</td>
<td>Nm 1550</td>
<td>Nm 1500</td>
<td>Nm 1450</td>
<td>Nm 630</td>
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<td>FXN 101 - 25/140</td>
<td>NX</td>
<td>Nm 2100</td>
<td>Nm 2050</td>
<td>Nm 2000</td>
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<td>Nm 2100</td>
<td>Nm 2050</td>
<td>Nm 2000</td>
<td>Nm 1950</td>
<td>Nm 610</td>
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<td>FXN 85 - 40/140</td>
<td>MX</td>
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<td>Nm 2500</td>
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<td>Nm 5100</td>
<td>Nm 5000</td>
<td>Nm 5000</td>
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<td>Nm 7600</td>
<td>Nm 7300</td>
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<td>Nm 10000</td>
<td>Nm 9800</td>
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<td>Nm 20500</td>
<td>Nm 20000</td>
<td>Nm 19500</td>
<td>Nm 19000</td>
<td>Nm 19000</td>
</tr>
</tbody>
</table>

The maximum transmissible torque is 2 times the specified nominal torque. See page 14 for determination of selection torque.

The theoretical nominal torque applies only for ideal concentricity between the inner and outer ring. In practice, the concentricity is affected by the bearing play and centering errors of the neighboring parts. Then the nominal torques specified in the table apply, whilst taking into consideration the existing run out (T.I.R.).

Higher speeds upon request.

### Mounting

Internal Freewheels FXN are without bearing support. Concentric alignment of inner and outer ring must be provided by the customer. The permissible run out (T.I.R.) must be observed.

The torque is transmitted on the outer ring by press fit. In order to transmit the torques specified in the table, the outer ring must be accommodated in a housing with an external diameter K. The housing is made of steel or grey cast iron in minimum quality GG-20. When using other housing materials or smaller external diameters, we urge you to contact us regarding the transmissible torque.

The tolerance of the housing bore is specified in the table under dimension D.

The tolerance of the shaft must be ISO h6 or j6.
Internal Freewheels FXN
for press fit on the outer ring
with sprag lift-off X

Lubrication
At speeds in excess of the sprag lift-off speed, no special lubrication is required; the freewheel functions maintenance-free.

When operating below the sprag lift-off speed, an oil lubrication of the specified quality must be provided.

Example for ordering
Freewheel size FXN 61-19/95, type with sprag lift-off X and 35 mm bore:
• FXN 61-19/95 NX, d = 35 mm

<table>
<thead>
<tr>
<th>Freewheel size</th>
<th>Type</th>
<th>Bore d mm</th>
<th>Standard mm</th>
<th>Standard max. mm</th>
<th>B mm</th>
<th>D mm</th>
<th>F mm</th>
<th>J mm</th>
<th>K min. mm</th>
<th>L mm</th>
<th>Weight kg</th>
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<tbody>
<tr>
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<td>20*</td>
<td>25</td>
<td>60</td>
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<td>20*</td>
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<td>45*</td>
<td>95</td>
<td>85</td>
<td>61</td>
<td>120</td>
<td>35</td>
<td>0,8</td>
<td></td>
</tr>
<tr>
<td>FXN 61 - 19/95</td>
<td>NX</td>
<td>35</td>
<td>40</td>
<td>45</td>
<td>106</td>
<td>95</td>
<td>85</td>
<td>120</td>
<td>25</td>
<td>1,2</td>
<td></td>
</tr>
<tr>
<td>FXN 61 - 19/106</td>
<td>NX</td>
<td>35</td>
<td>40</td>
<td>45</td>
<td>106</td>
<td>95</td>
<td>85</td>
<td>120</td>
<td>25</td>
<td>1,2</td>
<td></td>
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<tr>
<td>FXN 66 - 25/100</td>
<td>NX</td>
<td>30</td>
<td>35</td>
<td>40</td>
<td>100</td>
<td>80</td>
<td>66</td>
<td>132</td>
<td>35</td>
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</tr>
<tr>
<td>FXN 66 - 25/110</td>
<td>NX</td>
<td>40</td>
<td>45</td>
<td>48</td>
<td>110</td>
<td>90</td>
<td>66</td>
<td>132</td>
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<td></td>
</tr>
<tr>
<td>FXN 66 - 25/115</td>
<td>NX</td>
<td>50</td>
<td>55</td>
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<td>115</td>
<td>100</td>
<td>76</td>
<td>140</td>
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<td>1,7</td>
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</tr>
<tr>
<td>FXN 76 - 25/120</td>
<td>NX</td>
<td>50</td>
<td>55</td>
<td>60</td>
<td>120</td>
<td>100</td>
<td>76</td>
<td>140</td>
<td>35</td>
<td>1,8</td>
<td></td>
</tr>
<tr>
<td>FXN 86 - 25/125</td>
<td>NX</td>
<td>50</td>
<td>60</td>
<td>70</td>
<td>125</td>
<td>110</td>
<td>86</td>
<td>150</td>
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</tr>
<tr>
<td>FXN 86 - 25/130</td>
<td>NX</td>
<td>50</td>
<td>60</td>
<td>70</td>
<td>130</td>
<td>110</td>
<td>86</td>
<td>150</td>
<td>40</td>
<td>2,6</td>
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</tr>
<tr>
<td>FXN 101 - 25/140</td>
<td>NX</td>
<td>75</td>
<td>80*</td>
<td>45</td>
<td>140</td>
<td>125</td>
<td>101</td>
<td>175</td>
<td>50</td>
<td>3,1</td>
<td></td>
</tr>
<tr>
<td>FXN 101 - 25/150</td>
<td>NX</td>
<td>75</td>
<td>80*</td>
<td>45</td>
<td>150</td>
<td>125</td>
<td>101</td>
<td>175</td>
<td>50</td>
<td>3,6</td>
<td></td>
</tr>
<tr>
<td>FXN 85 - 40/140</td>
<td>MX</td>
<td>60</td>
<td>65</td>
<td>45</td>
<td>140</td>
<td>125</td>
<td>85</td>
<td>175</td>
<td>60</td>
<td>3,2</td>
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</tr>
<tr>
<td>FXN 85 - 40/150</td>
<td>MX</td>
<td>60</td>
<td>65</td>
<td>45</td>
<td>150</td>
<td>125</td>
<td>85</td>
<td>175</td>
<td>60</td>
<td>4,2</td>
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</tr>
<tr>
<td>FXN 100 - 40/160</td>
<td>MX</td>
<td>70</td>
<td>80*</td>
<td>50</td>
<td>160</td>
<td>140</td>
<td>100</td>
<td>190</td>
<td>60</td>
<td>5,1</td>
<td></td>
</tr>
<tr>
<td>FXN 105 - 50/165</td>
<td>MX</td>
<td>80</td>
<td>85</td>
<td>50</td>
<td>165</td>
<td>145</td>
<td>105</td>
<td>195</td>
<td>62</td>
<td>5,8</td>
<td></td>
</tr>
<tr>
<td>FXN 120 - 50/198</td>
<td>MX</td>
<td>80</td>
<td>95</td>
<td>70</td>
<td>198</td>
<td>160</td>
<td>120</td>
<td>210</td>
<td>70</td>
<td>8,6</td>
<td></td>
</tr>
<tr>
<td>FXN 140 - 50/215</td>
<td>MX</td>
<td>90</td>
<td>110</td>
<td>80</td>
<td>215</td>
<td>180</td>
<td>140</td>
<td>245</td>
<td>70</td>
<td>14,0</td>
<td></td>
</tr>
<tr>
<td>FXN 170 - 63/258</td>
<td>MX</td>
<td>100</td>
<td>130</td>
<td>80</td>
<td>258</td>
<td>210</td>
<td>170</td>
<td>290</td>
<td>80</td>
<td>21,0</td>
<td></td>
</tr>
</tbody>
</table>

Keyway according to DIN 6885, page 1 • Tolerance of keyway width JS10.
* Keyway according to DIN 6885, page 3 • Tolerance of keyway width JS10.
Application example

Internal Freewheel FCN 30 R as overrunning freewheel in the drive of the roof brush of an automatic car washing facility. The freewheel is arranged in the hub of a shaft coupling that connects the motor and the reduction gear. The freewheel prevents the drive from pushing the roof brush uncontrolled down onto the car roof in the event of a fault. The roof brush is raised by the freewheels that are working in driving operation. The direction of motor rotation changes in order to lower the brush. The downwards movement of the roof brush is performed by its own weight at the speed specified by the motor. In the case of an uncontrolled lowering of the roof brush on the car roof, the drive is automatically disengaged via the freewheel. The brush rests on the roof under its own weight, while the freewheel which is working in driving operation enables the drive to continue to turn in the lowering direction without causing any damage.

Features

Internal Freewheels FCN … R are roller freewheels without bearing support and with series 62 ball bearing dimensions.

The outer ring is pressed into the customer housing. This makes compact, space-saving fitting solutions possible.

Nominal torques up to 840 Nm. The torque is transmitted on the outer ring by press fit.

Bores up to 80 mm.

Application as

- Backstop
- Overrunning Clutch
- Indexing Freewheel
Internal Freewheels FCN ... R
for press fit on the outer ring
with rollers

Mounting
Internal freewheels FCN ... R are without bearing support. Concentric alignment of inner and outer ring must be provided by the customer. The torque is transmitted on the outer ring by press fit. In order to transmit the torques specified in the table, the outer ring must be accommodated in a housing with an external diameter K. The housing is made of steel or grey cast iron in minimum quality GG-20. When using other housing materials or smaller external diameters, we urge you to contact us regarding the transmissible torque.

The tolerance of the housing bore D must be ISO H7 or J6 and the tolerance of the shaft must be ISO h6 or j6.

Lubrication
An oil lubrication of the specified quality must be provided.

Example for ordering
Freewheel size FCN 30, standard type:
• FCN 30 R

<table>
<thead>
<tr>
<th>Freewheel Size</th>
<th>Type</th>
<th>Nominal torque N_em [Nm]</th>
<th>Max. speed</th>
<th>Bore d [mm]</th>
<th>B [mm]</th>
<th>D [mm]</th>
<th>K [mm]</th>
<th>Weight [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>FCN 8</td>
<td>R</td>
<td>3,2</td>
<td>4,500</td>
<td>8</td>
<td>8</td>
<td>24</td>
<td>28</td>
<td>0,02</td>
</tr>
<tr>
<td>FCN 10</td>
<td>R</td>
<td>7,3</td>
<td>3,500</td>
<td>10</td>
<td>9</td>
<td>30</td>
<td>35</td>
<td>0,03</td>
</tr>
<tr>
<td>FCN 12</td>
<td>R</td>
<td>11,0</td>
<td>3,200</td>
<td>12</td>
<td>10</td>
<td>32</td>
<td>37</td>
<td>0,05</td>
</tr>
<tr>
<td>FCN 15</td>
<td>R</td>
<td>12,0</td>
<td>2,800</td>
<td>15*</td>
<td>11</td>
<td>35</td>
<td>40</td>
<td>0,08</td>
</tr>
<tr>
<td>FCN 20</td>
<td>R</td>
<td>40,0</td>
<td>2,300</td>
<td>20*</td>
<td>14</td>
<td>47</td>
<td>54</td>
<td>0,12</td>
</tr>
<tr>
<td>FCN 25</td>
<td>R</td>
<td>50,0</td>
<td>1,900</td>
<td>25*</td>
<td>15</td>
<td>52</td>
<td>60</td>
<td>0,15</td>
</tr>
<tr>
<td>FCN 30</td>
<td>R</td>
<td>90,0</td>
<td>1,600</td>
<td>30*</td>
<td>16</td>
<td>62</td>
<td>70</td>
<td>0,24</td>
</tr>
<tr>
<td>FCN 35</td>
<td>R</td>
<td>135,0</td>
<td>1,350</td>
<td>35*</td>
<td>17</td>
<td>72</td>
<td>80</td>
<td>0,32</td>
</tr>
<tr>
<td>FCN 40</td>
<td>R</td>
<td>170,0</td>
<td>1,200</td>
<td>40*</td>
<td>18</td>
<td>80</td>
<td>90</td>
<td>0,40</td>
</tr>
<tr>
<td>FCN 45</td>
<td>R</td>
<td>200,0</td>
<td>1,150</td>
<td>45*</td>
<td>19</td>
<td>85</td>
<td>96</td>
<td>0,45</td>
</tr>
<tr>
<td>FCN 50</td>
<td>R</td>
<td>220,0</td>
<td>1,050</td>
<td>50*</td>
<td>20</td>
<td>90</td>
<td>100</td>
<td>0,50</td>
</tr>
<tr>
<td>FCN 60</td>
<td>R</td>
<td>420,0</td>
<td>850</td>
<td>60*</td>
<td>22</td>
<td>110</td>
<td>122</td>
<td>0,80</td>
</tr>
<tr>
<td>FCN 80</td>
<td>R</td>
<td>840,0</td>
<td>690</td>
<td>80*</td>
<td>26</td>
<td>140</td>
<td>155</td>
<td>1,40</td>
</tr>
</tbody>
</table>

The maximum transmissible torque is 2 times the specified nominal torque. See page 14 for determination of selection torque.
Keyway according to DIN 6885, page 1 - Tolerance of keyway width J510.
* Keyway according to DIN 6885, page 3 - Tolerance of keyway width J510.
Internal Freewheels FDN
for press fit on the outer ring with sprags

Application as
- Backstop
- Overrunning Clutch
- Indexing Freewheel

Features
Internal Freewheels FDN are sprag freewheels with anti-friction bearing dimensions.
The standard type does not have bearing support. In the case of the standard type, every second sprag has been replaced by a cylindrical roller; this freewheel can accept radial forces.
Nominal torques up to 2 400 Nm. The torque is transmitted on the outer ring by press fit.
Bores up to 80 mm. A multitude of standardized bore diameters are available with short delivery times.

Application example
Internal Freewheel FDN 40 CFR in standard type with bearing support as an overrunning clutch on the shaft end of the main drive of a textile machine. The gear wheel is linked to an auxiliary drive. In normal operation (freewheeling operation) the inner ring overruns and the gear wheel with the pressed-in outer ring is at a standstill. During set-up, the machine is driven by the slowly running auxiliary drive via the gear wheel and the freewheel that is working in driving operation.
Internal Freewheels FDN
for press fit on the outer ring with sprags

Mounting
Internal freewheels FDN in standard type are without bearing support. Concentric alignment of inner and outer ring must be provided by the customer. The permissible run out (T.I.R.) must be observed.

The torque is transmitted on the outer ring by press fit. In order to transmit the torques specified in the table, the outer ring must be accommodated in a housing with an external diameter K. The housing is made of steel or grey cast iron in minimum quality GG-20. When using other housing materials or smaller external diameters, we urge you to contact us regarding the transmissible torque.

The tolerance of the housing bore D must be ISO P6 and the tolerance of the shaft must be ISO h6 or j6.

The permissible operating temperature of the freewheel is -40 °C to 80 °C.

Lubrication
An oil lubrication of the specified quality must be provided.

Example for ordering
Freewheel size FDN 30, standard type with 20 mm bore:
• FDN 30 CFH, d = 20 mm
Internal Freewheels FD
for press fit on the outer ring with sprags

**Application as**
- Backstop
- Overrunning Clutch
- Indexing Freewheel

**Features**
Internal Freewheels FD are sprag freewheels without an inner ring. The customers hardened and ground shaft is used as the inner track. The standard type does not have bearing support. In the case of the standard type, every second sprag has been replaced by a cylindrical roller; this freewheel can accept radial forces.
Nominal torques up to 2 400 Nm. The torque is transmitted on the outer ring by press fit.

**Application example**
Two Internal Freewheels FD 40 CFR of standard type with bearing support as overrunning clutches in the drive of the transport rollers in a packaging distribution unit. In normal operation, the transport rollers are driven by means of the freewheels that are working in driving operation. At the withdrawal station, the arriving packages can easily slip off as the drive is overrun by the freewheel (freewheeling operation).
### Internal Freewheels FD

*for press fit on the outer ring with sprags*

The tolerance of the housing bore D must be ISO P6. Please note the technical points on page 102 regarding the sprag track (shaft). The permissible operating temperature of the freewheel is -40 °C to 80 °C.

### Mounting

Internal freewheels FD in type standard are without bearing support. Concentric alignment of inner and outer ring must be provided by the customer. The permissible run out (T.I.R.) must be observed.

The torque is transmitted on the outer ring by press fit. In order to transmit the torques specified in the table, the outer ring must be accommodated in a housing with an external diameter K. The housing is made of steel or grey cast iron in minimum quality GG-20. When using other housing materials or smaller external diameters, we urge you to contact us regarding the transmissible torque.

### Lubrication

An oil lubrication of the specified quality must be provided.

### Example for ordering

Freewheel size FD 12, standard type:
- FD 12 CFH

---

#### Table: Freewheels FD with internal freewheels/overruns

<table>
<thead>
<tr>
<th>Freewheel Size</th>
<th>Type</th>
<th>Nominal torque $M_n$ Nm</th>
<th>Max. speed Inner ring</th>
<th>Max. speed Outer ring</th>
<th>Load rating of bearing support dynamic $C$ N</th>
<th>Load rating static $C_0$ N</th>
<th>J mm</th>
<th>B mm</th>
<th>D mm</th>
<th>K mm</th>
<th>Weight kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>FD 12</td>
<td>CFH</td>
<td>11</td>
<td>4.225</td>
<td>4.250</td>
<td>7.600</td>
<td>4.200</td>
<td>12</td>
<td>16</td>
<td>34</td>
<td>45</td>
<td>0.1</td>
</tr>
<tr>
<td>FD 15</td>
<td>CFH</td>
<td>16</td>
<td>3.875</td>
<td>3.925</td>
<td>7.800</td>
<td>4.200</td>
<td>15</td>
<td>20</td>
<td>37</td>
<td>50</td>
<td>0.1</td>
</tr>
<tr>
<td>FD 20</td>
<td>CFH</td>
<td>28</td>
<td>3.785</td>
<td>3.450</td>
<td>8.320</td>
<td>4.200</td>
<td>15</td>
<td>20</td>
<td>42</td>
<td>55</td>
<td>0.1</td>
</tr>
<tr>
<td>FD 25</td>
<td>CFH</td>
<td>48</td>
<td>2.900</td>
<td>3.050</td>
<td>10.700</td>
<td>5.600</td>
<td>25</td>
<td>20</td>
<td>47</td>
<td>60</td>
<td>0.1</td>
</tr>
<tr>
<td>FD 30</td>
<td>CFH</td>
<td>75</td>
<td>2.525</td>
<td>2.675</td>
<td>12.900</td>
<td>7.000</td>
<td>30</td>
<td>20</td>
<td>52</td>
<td>65</td>
<td>0.1</td>
</tr>
<tr>
<td>FD 40</td>
<td>CFH</td>
<td>160</td>
<td>1.900</td>
<td>2.150</td>
<td>15.000</td>
<td>8.400</td>
<td>40</td>
<td>22</td>
<td>62</td>
<td>80</td>
<td>0.1</td>
</tr>
<tr>
<td>FD 50</td>
<td>CFH</td>
<td>260</td>
<td>1.475</td>
<td>1.775</td>
<td>18.400</td>
<td>11.300</td>
<td>50</td>
<td>22</td>
<td>72</td>
<td>95</td>
<td>0.2</td>
</tr>
<tr>
<td>FD 65</td>
<td>CFH</td>
<td>430</td>
<td>1.200</td>
<td>1.550</td>
<td>21.400</td>
<td>14.100</td>
<td>65</td>
<td>25</td>
<td>90</td>
<td>120</td>
<td>0.3</td>
</tr>
<tr>
<td>FD 80</td>
<td>CFH</td>
<td>650</td>
<td>0.950</td>
<td>1.350</td>
<td>23.800</td>
<td>17.800</td>
<td>80</td>
<td>25</td>
<td>110</td>
<td>140</td>
<td>0.6</td>
</tr>
<tr>
<td>FD 105</td>
<td>CFH</td>
<td>2.400</td>
<td>0.800</td>
<td>1.175</td>
<td>48.600</td>
<td>45.000</td>
<td>105</td>
<td>35</td>
<td>130</td>
<td>165</td>
<td>0.7</td>
</tr>
</tbody>
</table>

Freewheels FD are available with short delivery times.

The maximum transmissible torque is 2 times the specified nominal torque. See page 14 for determination of selection torque.

The maximum speed values listed above apply to installation conditions as they are given for Complete Freewheels. If the actual installation conditions are known, higher speeds may be permitted under certain circumstances.
Internal Freewheels FZ …

with ball bearing properties

Application as

- Backstop
- Overrunning Clutch
- Indexing Freewheel

Features

Internal Freewheels FZ … are sprag freewheels with bearing support and ball bearing properties. The freewheels are supplied grease-filled for normal operating conditions.

The freewheel is built into the customer housing. This makes compact, space-saving fitting solutions possible.

Nominal torques up to 420 Nm. The torque is transmitted on the inner ring and/or on the outer ring by press fit or keyway connection.

Bores up to 40 mm.

The following series are available:

<table>
<thead>
<tr>
<th>Series</th>
<th>Torque transmission</th>
<th>2RS-seals</th>
</tr>
</thead>
<tbody>
<tr>
<td>FZ</td>
<td>Outer ring by keyway</td>
<td>P</td>
</tr>
<tr>
<td>FZ ... 2RS</td>
<td>Inner ring by keyway</td>
<td>P</td>
</tr>
<tr>
<td>FZ ... P2RS</td>
<td>Outer ring by press fit</td>
<td>P2RS</td>
</tr>
<tr>
<td>FZ ... P</td>
<td>Inner ring by press fit</td>
<td>P2RS</td>
</tr>
<tr>
<td>FZ ... PP</td>
<td>Outer ring by press fit</td>
<td>P2RS</td>
</tr>
<tr>
<td>FZ ... P2PP</td>
<td>Inner ring by press fit</td>
<td>P2RS</td>
</tr>
</tbody>
</table>

Internal Freewheels FZ 6201 to FZ 6207, FZ 6201 P to FZ 6207 P and FZ 6202 PP to FZ 6207 PP have the same dimensions as the respective ball bearings of series 62. The freewheel sizes FZ 6208, FZ 6208 P and FZ 6208 PP as well as the series FZ … 2RS and FZ … P2RS have a different width B.

The series FZ … 2RS and FZ … P2RS have 2RS seals.

Application example

Two Internal Freewheels FZ 6206 as indexing freewheels in the drive of the metering roller of a seed spreader. The freewheels are built in an infinitely variable oil bath gearbox. Two cam disks that are set off by 180° are arranged on the gearbox shaft. By means of lever arms, these drive the outer rings of the two adjacent Internal Freewheels, which then gradually turn the metering shaft. The infinite speed settings of the gearbox’s drive shaft are executed by means of the respective pivoting of the roller support plate, so that the lever arms can execute lifts of differing amounts.
Internal Freewheels FZ

for press fit on the outer ring
with sprags and bearing support

Mounting
The torque is transmitted on the inner and outer ring by press fit. In order to transmit the torques specified in the table, the outer ring must be accommodated in a housing with an external diameter K. The housing is made of steel or grey cast iron in minimum quality GG-20. When using other housing materials or smaller external diameters, we urge you to contact us regarding the transmissible torque.

The tolerance of the housing bore D must be ISO N6 and the tolerance of the shaft must be ISO n6.

The permissible operating temperature of the freewheel is -40 °C to 80 °C.

Lubrication
The freewheels are supplied grease-filled for normal operating conditions. However, the freewheels can also be connected to the customer’s oil lubrication system; this is particularly recommended in the case of higher speeds.

Example for ordering
Freewheel size FZ 6202, standard type:
• FZ 6202
Internal Freewheels FZ … 2RS

Mounting
The torque is transmitted on the inner and outer ring by press fit. In order to transmit the torques specified in the table, the outer ring must be accommodated in a housing with an external diameter K. The housing is made of steel or grey cast iron in minimum quality GG-20. When using other housing materials or smaller external diameters, we urge you to contact us regarding the transmissible torque.

The tolerance of the housing bore D must be ISO N6 and the tolerance of the shaft must be ISO n6.

The permissible operating temperature of the freewheel is -20 °C to +80 °C. Please contact us if the temperature is different to the given values.

Lubrication
The freewheels are supplied grease-filled and with 2 RS seals.

Example for ordering
Frewheel size FZ 6203 2RS, standard type:
• FZ 6203 2RS

The maximum transmissible torque is 2 times the specified nominal torque. See page 14 for determination of selection torque.

* The width of freewheel size from FZ 6201 2RS to FZ 6208 2RS is different to the corresponding ball bearings of series 62.
Internal Freewheels FZ ... P2RS

for press fit on the outer ring
with sprags, bearing support and sealing

Mounting
The torque is transmitted on the inner ring by keyway connection and on the outer ring by press fit. In order to transmit the torques specified in the table, the outer ring must be accommodated in a housing with an external diameter K. The housing is made of steel or grey cast iron in minimum quality GG-20. When using other housing materials or smaller external diameters, we urge you to contact us regarding the transmissible torque.

The tolerance of the housing bore D must be ISO N6 and the tolerance of the shaft must be ISO k6.

The permissible operating temperature of the freewheel is -20 °C to +80 °C. Please contact us if the temperature is different to the given values.

Lubrication
The freewheels are supplied grease-filled and with 2 RS seals.

Example for ordering
Freewheel size FZ 6205 P2RS, standard type:
• FZ 6205 P2RS

The maximum transmissible torque is 2 times the specified nominal torque. See page 14 for determination of selection torque.

Keyway according to DIN 6885, page 3 • Tolerance of keyway width JS10.

* The width of freewheel size from FZ 6201 P2RS to FZ 6208 P2RS is different to the corresponding ball bearings of series 62.
### Internal Freewheels FZ … P

**for press fit on the outer ring with sprags and bearing support**

#### Mounting

The torque is transmitted on the inner ring by keyway connection and on the outer ring by press fit. In order to transmit the torques specified in the table, the outer ring must be accommodated in a housing with an external diameter K. The housing is made of steel or grey cast iron in minimum quality GG-20. When using other housing materials or smaller external diameters, we urge you to contact us regarding the transmissible torque.

The tolerance of the housing bore D must be ISO N6 and the tolerance of the shaft must be ISO k6.

The permissible operating temperature of the freewheel is -40 °C to +80 °C. Please contact us if the temperature is different to the given values.

#### Lubrication

The freewheels are supplied grease-filled.

#### Example for ordering

Freewheel size FZ 6203 P, standard type:
- FZ 6203 P

---

<table>
<thead>
<tr>
<th>Freewheel Size</th>
<th>Nominal torque $M_N$ Nm</th>
<th>Maximum speed $n_{min}$</th>
<th>Load rating of bearing support</th>
<th>Bore $d$ (mm)</th>
<th>B (mm)</th>
<th>D (mm)</th>
<th>K (mm)</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FZ 6201 P</td>
<td>9</td>
<td>10 000</td>
<td>5 140</td>
<td>2 370</td>
<td>10</td>
<td>32</td>
<td>39</td>
<td>0.04</td>
</tr>
<tr>
<td>FZ 6202 P</td>
<td>21</td>
<td>8 400</td>
<td>5 160</td>
<td>2 410</td>
<td>11</td>
<td>35</td>
<td>42</td>
<td>0.06</td>
</tr>
<tr>
<td>FZ 6203 P</td>
<td>32</td>
<td>7 350</td>
<td>5 650</td>
<td>2 860</td>
<td>17</td>
<td>40</td>
<td>51</td>
<td>0.07</td>
</tr>
<tr>
<td>FZ 6204 P</td>
<td>88</td>
<td>6 000</td>
<td>6 890</td>
<td>4 190</td>
<td>14</td>
<td>47</td>
<td>58</td>
<td>0.11</td>
</tr>
<tr>
<td>FZ 6205 P</td>
<td>100</td>
<td>5 200</td>
<td>7 230</td>
<td>4 660</td>
<td>15</td>
<td>52</td>
<td>63</td>
<td>0.14</td>
</tr>
<tr>
<td>FZ 6206 P</td>
<td>230</td>
<td>4 200</td>
<td>7 730</td>
<td>5 660</td>
<td>16</td>
<td>62</td>
<td>73</td>
<td>0.21</td>
</tr>
<tr>
<td>FZ 6207 P</td>
<td>330</td>
<td>3 600</td>
<td>8 170</td>
<td>6 630</td>
<td>17</td>
<td>72</td>
<td>85</td>
<td>0.30</td>
</tr>
<tr>
<td>FZ 6208 P</td>
<td>420</td>
<td>3 000</td>
<td>8 950</td>
<td>7 990</td>
<td>22</td>
<td>80</td>
<td>94</td>
<td>0.50</td>
</tr>
</tbody>
</table>

The maximum transmissible torque is 2 times the specified nominal torque. See page 14 for determination of selection torque.

Keyway according to DIN 6885, page 1. *Tolerance of keyway width JS10.*

* The width of freewheel size FZ 6208 P is different to the corresponding ball bearing 6208.

---

**Table:**

- **Freewheel Size**
- **Nominal torque $M_N$ Nm**
- **Maximum speed $n_{min}$**
- **Load rating of bearing support**
- **Bore $d$ (mm)**
- **B (mm)**
- **D (mm)**
- **K (mm)**
- **Weight (kg)**

---

**Diagram:**

- Dimensions of the freewheel with keyway connection and press fit on the outer ring.
- Internal structure of the freewheel with sprags and bearing support.

---

**Indexing Freewheel**

- **Overrunning Clutch**
- **Backstop**
Internal Freewheels FZ … PP
for keyway connection on the outer ring
with sprags and bearing support

The maximum transmissible torque is 2 times the specified nominal torque. See page 14 for determination of selection torque.

Keyway according to DIN 6885, page 1 • Tolerance of keyway width JS10.
Keyway according to DIN 6885, page 3 • Tolerance of keyway width JS10.
* The width of freewheel size FZ 6208 PP is different to the corresponding ball bearing 6208.

Mounting
The torque is transmitted on the inner and on the outer ring by keyway connection. In order to transmit the torques specified in the table, the outer ring must be accommodated in a housing with an external diameter K. The housing is made of steel or grey cast iron in minimum quality GG-20. When using other housing materials or smaller external diameters, we urge you to contact us regarding the transmissible torque.
The tolerance of the housing bore D must be ISO H6 and the tolerance of the shaft must be ISO h6.
The permissible operating temperature of the freewheel is -40 °C to +80 °C. Please contact us if the temperature is different to the given values.

Lubrication
The freewheels are supplied grease-filled.

Example for ordering
Freewheel size FZ 6205 PP, standard type:
• FZ 6205 PP

<table>
<thead>
<tr>
<th>Freewheel Size</th>
<th>Nominal torque $M_{N}$ Nm</th>
<th>Maximum speed $n$ min⁻¹</th>
<th>Load rating of bearing support</th>
<th>Bore $d$ mm</th>
<th>B mm</th>
<th>D mm</th>
<th>K mm</th>
<th>N mm</th>
<th>P mm</th>
<th>Weight kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>FZ 6202 PP</td>
<td>21</td>
<td>8,400</td>
<td>5,160</td>
<td>2,410</td>
<td>15*</td>
<td>11</td>
<td>35</td>
<td>42</td>
<td>2</td>
<td>0,6</td>
</tr>
<tr>
<td>FZ 6203 PP</td>
<td>32</td>
<td>7,350</td>
<td>6,500</td>
<td>2,860</td>
<td>17*</td>
<td>12</td>
<td>40</td>
<td>51</td>
<td>2</td>
<td>1,0</td>
</tr>
<tr>
<td>FZ 6204 PP</td>
<td>88</td>
<td>6,000</td>
<td>6,890</td>
<td>4,190</td>
<td>20*</td>
<td>14</td>
<td>47</td>
<td>58</td>
<td>3</td>
<td>1,5</td>
</tr>
<tr>
<td>FZ 6205 PP</td>
<td>100</td>
<td>5,200</td>
<td>7,230</td>
<td>4,660</td>
<td>25*</td>
<td>15</td>
<td>52</td>
<td>63</td>
<td>6</td>
<td>2,0</td>
</tr>
<tr>
<td>FZ 6206 PP</td>
<td>230</td>
<td>4,200</td>
<td>7,730</td>
<td>5,660</td>
<td>30*</td>
<td>16</td>
<td>62</td>
<td>73</td>
<td>6</td>
<td>2,0</td>
</tr>
<tr>
<td>FZ 6207 PP</td>
<td>330</td>
<td>3,600</td>
<td>8,170</td>
<td>6,650</td>
<td>35*</td>
<td>17</td>
<td>72</td>
<td>85</td>
<td>8</td>
<td>2,5</td>
</tr>
<tr>
<td>FZ 6208 PP</td>
<td>420</td>
<td>3,000</td>
<td>8,950</td>
<td>7,990</td>
<td>40</td>
<td>22**</td>
<td>80</td>
<td>94</td>
<td>10</td>
<td>3,0</td>
</tr>
</tbody>
</table>

The maximum transmissible torque is 2 times the specified nominal torque. See page 14 for determination of selection torque.

Keyway according to DIN 6885, page 1 • Tolerance of keyway width JS10.

* Keyway according to DIN 6885, page 3 • Tolerance of keyway width JS10.
** The width of freewheel size FZ 6208 PP is different to the corresponding ball bearing 6208.
Application as
- Backstop
- Overrunning Clutch
- Indexing Freewheel

Features
Internal Freewheels FSN are roller freewheels without bearing support.
The freewheel is built into the customer housing. This makes compact, space-saving fitting solutions possible.
Nominal torques up to 3,000 Nm. The faces of both sides of the outer ring are provided with grooves for torque transmission.
Bores up to 80 mm.

Application example
Internal freewheel FSN 50 as backstop fitted to the end of the intermediate shaft of a spur gearbox in the drive of an elevator. In the case of a motor stop, the elevator must be held securely so that the conveyor goods do not pull backwards.
Internal Freewheels FSN

for keyway connection on the outer ring with rollers

### Internal Freewheels FSN

Internal Freewheels FSN are without bearing support. Concentric alignment of inner and outer ring must be provided by the customer.

The tolerance of the housing bore D must be ISO H7 or G7 and the tolerance of the shaft must be ISO h6 or j6.

The outer ring has to be completely enclosed in a stable housing to transmit the listed torques.

### Lubrication

An oil lubrication of the specified quality must be provided.

### Example for ordering

Freewheel size FSN 12, standard type:
- FSN 12

### Mounting

The maximum transmissible torque is 2 times the specified nominal torque. See page 14 for determination of selection torque.

Keyway according to DIN 6885, page 1 • Tolerance of keyway width JS10.

* Keyway according to DIN 6885, page 3 • Tolerance of keyway width JS10.

---

**Table: Internal Freewheels FSN**

<table>
<thead>
<tr>
<th>Freewheel Size</th>
<th>Nominal Torque $N_m$ Nm</th>
<th>Inner ring freeswheels/overruns min⁻¹</th>
<th>Max. speed</th>
<th>Bore d</th>
<th>B</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>N</th>
<th>P</th>
<th>Weight kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>FSN 8</td>
<td>11</td>
<td>3050</td>
<td>4700</td>
<td>8</td>
<td>13</td>
<td>35</td>
<td>18.5</td>
<td>28</td>
<td>4</td>
<td>1.3</td>
<td>0.1</td>
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<tr>
<td>FSN 12</td>
<td>11</td>
<td>3050</td>
<td>4700</td>
<td>12</td>
<td>13</td>
<td>35</td>
<td>18.5</td>
<td>28</td>
<td>4</td>
<td>1.3</td>
<td>0.1</td>
</tr>
<tr>
<td>FSN 15</td>
<td>36</td>
<td>2350</td>
<td>3700</td>
<td>15*</td>
<td>18</td>
<td>42</td>
<td>21.0</td>
<td>36</td>
<td>5</td>
<td>1.7</td>
<td>0.1</td>
</tr>
<tr>
<td>FSN 17</td>
<td>56</td>
<td>2100</td>
<td>3300</td>
<td>17*</td>
<td>19</td>
<td>47</td>
<td>24.0</td>
<td>40</td>
<td>5</td>
<td>2.0</td>
<td>0.2</td>
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<tr>
<td>FSN 20</td>
<td>90</td>
<td>1750</td>
<td>3200</td>
<td>20*</td>
<td>21</td>
<td>52</td>
<td>29.0</td>
<td>45</td>
<td>6</td>
<td>1.5</td>
<td>0.2</td>
</tr>
<tr>
<td>FSN 25</td>
<td>125</td>
<td>1650</td>
<td>3100</td>
<td>25*</td>
<td>24</td>
<td>62</td>
<td>35.0</td>
<td>52</td>
<td>8</td>
<td>2.0</td>
<td>0.4</td>
</tr>
<tr>
<td>FSN 30</td>
<td>210</td>
<td>1400</td>
<td>2200</td>
<td>30*</td>
<td>27</td>
<td>72</td>
<td>40.0</td>
<td>60</td>
<td>10</td>
<td>2.5</td>
<td>0.6</td>
</tr>
<tr>
<td>FSN 35</td>
<td>306</td>
<td>1250</td>
<td>2150</td>
<td>35*</td>
<td>31</td>
<td>80</td>
<td>47.0</td>
<td>68</td>
<td>12</td>
<td>3.5</td>
<td>0.8</td>
</tr>
<tr>
<td>FSN 40</td>
<td>430</td>
<td>1100</td>
<td>2050</td>
<td>40*</td>
<td>33</td>
<td>90</td>
<td>55.0</td>
<td>78</td>
<td>12</td>
<td>3.5</td>
<td>0.9</td>
</tr>
<tr>
<td>FSN 45</td>
<td>680</td>
<td>1000</td>
<td>1900</td>
<td>45*</td>
<td>36</td>
<td>100</td>
<td>56.0</td>
<td>85</td>
<td>14</td>
<td>3.5</td>
<td>1.3</td>
</tr>
<tr>
<td>FSN 50</td>
<td>910</td>
<td>900</td>
<td>1750</td>
<td>50*</td>
<td>40</td>
<td>110</td>
<td>60.0</td>
<td>92</td>
<td>14</td>
<td>4.5</td>
<td>1.7</td>
</tr>
<tr>
<td>FSN 60</td>
<td>1200</td>
<td>750</td>
<td>1450</td>
<td>60*</td>
<td>46</td>
<td>130</td>
<td>75.0</td>
<td>110</td>
<td>18</td>
<td>5.5</td>
<td>2.8</td>
</tr>
<tr>
<td>FSN 70</td>
<td>2000</td>
<td>600</td>
<td>1000</td>
<td>70*</td>
<td>51</td>
<td>150</td>
<td>85.0</td>
<td>125</td>
<td>20</td>
<td>6.5</td>
<td>4.2</td>
</tr>
<tr>
<td>FSN 80</td>
<td>3000</td>
<td>500</td>
<td>900</td>
<td>80*</td>
<td>58</td>
<td>170</td>
<td>95.0</td>
<td>140</td>
<td>20</td>
<td>7.5</td>
<td>6.0</td>
</tr>
</tbody>
</table>

---

### Standard type

For universal use

### Dimensions

<table>
<thead>
<tr>
<th>Bore d</th>
<th>B</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>N</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>mm</td>
<td>mm</td>
<td>mm</td>
<td>mm</td>
<td>mm</td>
<td>mm</td>
</tr>
</tbody>
</table>

The maximum transmissible torque is 2 times the specified nominal torque. See page 14 for determination of selection torque.

Keyway according to DIN 6885, page 1 • Tolerance of keyway width JS10.

* Keyway according to DIN 6885, page 3 • Tolerance of keyway width JS10.
Internal Freewheels FN

for keyway connection on the outer ring with rollers

Application example
Internal freewheel FN 20 as a backstop, on the drive shaft of running gears on a chain conveyor. In normal operation, the drive shaft drives and the freewheel works in freewheeling operation. The freewheel as a backstop prevents the running gears from being able to run backwards uncontrolled in the event of a fault.

Application as
- Backstop
- Overrunning Clutch
- Indexing Freewheel

Features
Internal Freewheels FN are roller freewheels without bearing support. The freewheel is built into the customer housing. This makes compact, space-saving fitting solutions possible.
Nominal torques up to 3,000 Nm. The faces of both sides of the outer ring are provided with grooves for torque transmission. Bores up to 60 mm.
Internal Freewheels FN

for keyway connection on the outer ring with rollers

Mounting

Internal Freewheels FN are without bearing support. Concentric alignment of inner and outer ring must be provided by the customer.

The tolerance of the housing bore D must be ISO H7 or G7 and the tolerance of the shaft must be ISO h6 or j6.

The outer ring has to be completely enclosed in a stable housing to transmit the listed torques.

Lubrication

An oil lubrication of the specified quality must be provided.

Example for ordering

Freewheel size FN 45, standard type:

• FN 45
Internal Freewheels FNR

for keyway connection on the outer ring with rollers and bearing

Application as

- Backstop
- Overrunning Clutch
- Indexing Freewheel

Features

Internal Freewheels FNR are roller freewheels with bearing support. The freewheels of sizes 8 to 20 have a sleeve bearing. The sizes 25 to 60 have ball bearings, these enable higher speeds in freewheeling operation.

The freewheel is built into the customer housing. This makes compact, space-saving fitting solutions possible.

Nominal torques up to 3000 Nm. The faces of both sides of the outer ring are provided with grooves for torque transmission. Bores up to 60 mm.

Application example

Internal Freewheel FNR 40 as an indexing freewheel for an incremental drive in the feeding device of a wire processing machine. The indexing lever is driven by a crank operation. The back and forth movement is transferred by the indexing freewheel in a gradual rotating movement of the wire feeding device.
Internal Freewheels FNR
for keyway connection on the outer ring
with rollers and bearing

Mounting
The tolerance of the housing bore D must be
ISO H7 or G7 and the tolerance of the shaft must
be ISO h6 or j6.
The outer ring has to be completely enclosed in
a stable housing to transmit the listed torques.

Lubrication
An oil lubrication of the specified quality must
be provided.

Example for ordering
Freewheel size FNR 20, standard type:
• FNR 20

The maximum transmissible torque is 2 times the specified nominal torque. See page 14 for determination of selection torque.

Keyway according to DIN 6885, page 1 • Tolerance of keyway width 2510.
Cage Freewheels SF

for assembly with inner and outer ring with sprags, available in three types

Application as
- Backstop
- Overrunning Clutch
- Indexing Freewheel

Features
Cage Freewheels SF are sprag freewheels to be installed between customer-supplied inner and outer rings.
In addition to the standard type, two other types are available for extended service life. Nominal torques up to 93 000 Nm.

Mounting
The lateral guidance of the Cage Freewheels can be effected either by a shoulder on the outer ring or by guard rings or guard discs which are fixed in the outer ring.
Torque transmission capacity can be increased if several cages are arranged side by side. In this case please consult with RINGSPANN on transmissible torques.
Please note the technical points on page 102 regarding the sprag tracks.

Example for ordering
Freewheel size SF 44-14.5, standard type:
- SF 44-14.5 K
Cage Freewheels SF

for assembly with inner and outer ring with sprags, available in three types

The maximum transmissible torque is 2 times the specified nominal torque. See page 14 for determination of selection torque.

The theoretical nominal torque applies only for ideal concentricity between the inner and outer ring.

Cage Freewheels SF are available with short delivery times.

The maximum transmissible torque is 2 times the specified nominal torque. See page 14 for determination of selection torque.
**Cage Freewheels SF … P**

for assembly with inner and outer ring
for high run out (T.I.R.), with sprags

---

**Application as**
- Backstop
- Overrunning Clutch
- Indexing Freewheel

**Features**

Cage Freewheels SF … P are sprag freewheels to be installed between customer-supplied inner and outer rings. Nominal torques up to 5800 Nm.
Cage Freewheels SF … P

for assembly with inner and outer ring
for high run out (T.I.R.), with sprags

Mounting
The lateral guidance of the Cage Freewheels can be effected either by a shoulder on the outer ring or by guard rings or guard discs which are fixed in the outer ring.

Torque transmission capacity can be increased if several cages are arranged side by side. In this case please consult with RINGSPANN on transmissible torques.

Please note the technical points on page 102 regarding the sprag tracks.

Example for ordering
Frewheel size SF 44-14,5 type for high run out (T.I.R.):
• SF 44-14,5 P

---

### Cage Freewheels SF … P

<table>
<thead>
<tr>
<th>Freewheel Size</th>
<th>Type</th>
<th>Theoretical nominal torque [Nm]</th>
<th>Nominal torque at existing run out (T.I.R.) [Nm]</th>
<th>J [mm]</th>
<th>D [mm]</th>
<th>B [mm]</th>
<th>K [mm]</th>
<th>Sprags</th>
<th>Weight [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>SF 37-14,5</td>
<td>P</td>
<td>230</td>
<td>200</td>
<td>37.00</td>
<td>14.5</td>
<td>75</td>
<td>14</td>
<td>0.06</td>
<td></td>
</tr>
<tr>
<td>SF 44-14,5</td>
<td>P</td>
<td>420</td>
<td>360</td>
<td>44.00</td>
<td>14.5</td>
<td>90</td>
<td>20</td>
<td>0.08</td>
<td></td>
</tr>
<tr>
<td>SF 57-18,5</td>
<td>P</td>
<td>1200</td>
<td>750</td>
<td>57.00</td>
<td>18.5</td>
<td>100</td>
<td>24</td>
<td>0.13</td>
<td></td>
</tr>
<tr>
<td>SF 72-23,5</td>
<td>P</td>
<td>2700</td>
<td>1400</td>
<td>72.00</td>
<td>23.5</td>
<td>130</td>
<td>32</td>
<td>0.23</td>
<td></td>
</tr>
<tr>
<td>SF 82-25</td>
<td>P</td>
<td>2800</td>
<td>1900</td>
<td>82.00</td>
<td>25.0</td>
<td>135</td>
<td>36</td>
<td>0.26</td>
<td></td>
</tr>
<tr>
<td>SF 107-25</td>
<td>P</td>
<td>4100</td>
<td>2700</td>
<td>107.00</td>
<td>25.0</td>
<td>165</td>
<td>48</td>
<td>0.35</td>
<td></td>
</tr>
<tr>
<td>SF 127-25</td>
<td>P</td>
<td>5800</td>
<td>3900</td>
<td>127.00</td>
<td>25.0</td>
<td>200</td>
<td>56</td>
<td>0.40</td>
<td></td>
</tr>
</tbody>
</table>

Cage Freewheels SF … P are available with short delivery times.
The maximum transmissible torque is 2 times the specified nominal torque. See page 14 for determination of selection torque.
The theoretical nominal torque applies only for ideal concentricity between the inner and outer ring. In practice, the concentricity is affected by the bearing play and centering errors of the neighboring parts. Then the nominal torques specified in the table apply, whilst taking into consideration the existing run out (T.I.R.).
Irreversible Locks IR
bidirectional acting backstop for assembly with connecting parts with rollers

Application as
Bidirectional Acting Backstop

Features
Irreversible Locks IR are bidirectional acting roller freewheels with bearing support. They are ready for installation.
Nominal torques up to 100 Nm.
Bores up to 35 mm.
Whereas a normal Freewheel transmits torques from the driving or driven side in only one direction of rotation, with the Irreversible Lock IR it is possible for the driving part to drive the shaft in both directions of rotation. There is, however, a locking action against any reverse torque coming from the driven part, irrespective of the direction of rotation in which it is exerted.

Operation
The centre body (1) is positively locked to the shaft (driven part) by a key. The housing (2) is bolted in place, e.g. on the frame of a machine in a fixed position. The driving customer-supplied part (lever, handwheel, etc.), which carries actuating pegs (3), is mounted on the shaft and has two bores to hold the drive studs (4). Thus, if force is applied to the driving part, depending upon the direction in which it is applied one or other of the actuating pegs presses one of the two locking rollers (5) out of engagement in opposition to the force exerted by the engaging spring (6). In this way, the driven part connected to the centre body can be rotated without difficulty. When this is done the roller which is still engaged operates as in a freewheel mechanism turning in the freewheeling direction. Due to the symmetrical layout of the irreversible lock, the process which has just been described can also take place in the same way in the opposite direction of rotation. If, however, forces coming from the machine attempt to rotate the centre body via the shaft, the centre body is locked to the fixed housing by the locking rollers. Each roller performs this function for one direction of rotation. Thus, the irreversible lock prevents unintended shifts and displacements from taking place. The irreversible locks are not suitable for use where the driven side tends to run ahead of the driving side during operation (e.g. for the operation of brakes during descending movements in lifts and hoists).

Application example
The valve, which in the example shown is a control or shut-off valve, is adjusted in the opening or closing direction by means of a handwheel. The Irreversible Lock prevents any uncontrolled shifts in the position of the valve due to the pressure exerted by the medium flowing in the pipe.
The use of Irreversible Locks is not restricted to manually operated valves and they can also be used with motorised adjusters. In this case there is the particular advantage that the torque motor need be designed to supply only the adjusting torque, which is generally low, since all standing and sudden reverse torques are absorbed by the Irreversible Lock.
Irreversible Locks IR
bidirectional acting backstop for assembly with connecting parts with rollers

The maximum transmissible torque is 2 times the specified nominal torque.

**Example for ordering**
Irreversible Lock IR 16 R, standard type with bore 16 mm:
- IR 16 R, d = 16 mm
Backstops FXM … LX in the drive of large pumps for power stations: In order to guarantee the required operating safety, in accordance with the redundancy principle several parallel working pumps are arranged in one circuit. This also offers the possibility of adapting the feed rate to the respective requirements with the best possible use of the pump capacity.

In pumps that are shut down, the backstops have the task of preventing reverse running under the back pressure of the conveyed medium and thus of preventing the pumps to act as turbines, while the other pumps of the pump group continue to operate. The reverse speeds and centrifugal forces that occur in such a case would destroy both the pump and the drive motor, incurring down time and considerable repair expense.

The backstop is located immediately above the sleeve bearing of the pump or, as shown in figure 98-1, above the sleeve bearing of the electric motor. Because of the function-related required sleeve bearing play and the unavoidable tolerances of neighbouring parts, the backstop needs a considerable misalignment capability. The backstop used with the sprag lift-off X at rotating inner ring permits T.I.R. of up to 0,8 mm.

In normal operation (freewheeling operation), because of the sprag lift-off the backstop works entirely without contact. Therefore, there is no wear on the sprags, and the service life is virtually unlimited. The existing oil mist protects the backstop from corrosion.
Backstop FXM 2.410 - 100 LX for the primary cooling water pump in a nuclear power station. Maximum torque 500’000 Nm. Speed 1485 min⁻¹. In service since 1996. Manufactured and tested with extensive documentation from RINGSPANN GmbH, Bad Homburg.

Iron ore conveyor plant in South Africa driven by three gear reducers with RINGSPANN backstops FXRW 170-63 MX.
Special Freewheel Designs

Special overrunning clutch for vertical installation, combined with a flexible pin-type coupling. The design is used in the dual drive of air pre-heaters in coal power plants.

The overrunning clutch is essential for both drives so that the respective stationary drive is not backdriven by the output side.

Overrunning clutch with sprag lift-off Z in special maintenance-free design. Lubrication of the sprags in the overrunning clutch is not required because of the high freewheeling speed of the outer ring. The sprags are lifted off of the stationary inner ring under the effect of the centrifugal force and thus operate without wear.

This overrunning clutch also uses life-time lubricated ball bearings and labyrinth seals; therefore, it is maintenance-free.
Special Freewheel Designs

Overrunning clutch FXM 2.240 - 96 LX in custom-made design in the auxiliary drive of a mill. In this special bearing arrangement, the ball bearings of the overrunning clutch only rotate when the mill is driven slowly via the auxiliary drive and the locked overrunning clutch. The inner ring with the mounted freewheel cage runs at high speed, but rotates without contact because of the sprag lift-off X. Hence overheating of the bearings as well as wear on the sprags is avoided.

Integrated Freewheel FON 82 SFR in a special design as a load-operated brake in a non self-locking worm gear. A load is raised or lowered via the worm wheel. The load creates an axial force and this asserts back torque on the worm shaft. A freewheel is located on the worm shaft, the outer ring of the freewheel is connected via friction lining to the gearbox housing.

When the load is lifted, the inner ring freewheels and the freewheel runs in freewheeling operation. When the machine is brought to a standstill, the sprags of the freewheel lock and the back torque of the load is passed into the gearbox housing via the friction lining. If the motor lowers the load, the freewheel is also locked and the motor overcomes the friction torque of the brake.

In this case, the bearing support for the outer ring is secured by means of a special freewheel cage. Beside sprags, this design also includes cylindrical rollers. These rollers provide the centering of the outer ring to the inner ring.
Technical Points

Bearing support
In the case of freewheels without bearing support, the design must ensure that the inner and outer ring are located concentric to one another with as little as possible play. The sprags do not have a centering effect of the outer ring to the inner ring. If the radial runout exceeds the prescribed limits, the transmissible torques will be reduced which could result in failures.
In the case of freewheels with built-in ball bearings, the customer must check these with regard to the application related loads in accordance with the calculations from the bearing manufacturer. We will gladly supply you with documents regarding the built-in bearing types and bearing distances.
The series FDN and FD in type CFR have a bearing support to absorb radial forces. A second bearing support must be provided to absorb axial and tilting forces.
Axial forces between the inner and outer rings must not be directed via the sprags or the rollers, as this could interfere with the torque transmission. Therefore, the bearing support between the inner and outer ring must be free from axial play. The best design solution are axially pre-loaded roller bearings.

Central application of force
The forces applied to the freewheel – push rod force, drive belt etc. – should act between the bearings of the freewheel. If the effective line of the lateral force acts outside of the bearing, a rigid bearing or a pre-loaded bearing must be provided. Otherwise, the service life of the freewheel could be reduced. In the case of indexing freewheels, a central application of force is required in order to achieve utmost indexing accuracy and highest service life.

Fastening screws for connecting parts
In many freewheels in this catalogue, the customer’s connecting parts are bolted to the outer ring of the freewheel. This screw connection is not comparable to a standard screw connection, e.g. like that of a VDI 2230. The torque in the freewheel is only pulsating, i.e. the circumferential force on the screw works in just one direction. The connection between the outer ring and the connected part is not purely by friction, because the elastic expansion of the outer ring during torque transmission causes movement between the connected parts, until the screws locate circumferentially. Therefore, the screw connections in freewheels must be calculated for shearing. It has proven that for these fastening screws, the material quality 8.8 is sufficient. Because of the higher brittleness, screws of quality 12.9 should not be used. Tightening torques for the freewheel fastening screws should be selected as per the values listed in VDI 2230, in each case taking into account the existing friction values.

Sprag track
The inner sprag track of freewheels without an inner ring (FD series) and the inner and outer spray track of cage freewheels manufactured by the customer. It must be hardened and machined (grinding or hard-turned). The sprag track must then have the following characteristics:

- Conicity: ≤ 5 µm per 10 mm track width
- Average peak-to-valley height Rz as per DIN 4768, page 1; 1,6 µm ≤ Rz ≤ 6,3 µm
- Hardness: 62 ± 2 HRC
With case hardening:
Case hardening depth Eht as per DIN 50190, page 1: 1,5 ... 2 mm, hardness limit HG = 550 HV1, core strength ≥ 1 100 N/mm²

If other hardness processes are to be applied or if you need to deviate from the specified directives, we will gladly offer assistance in working out a solution.
To facilitate mounting when sliding on the freewheel, a lead-in chamfer of, for example, 2 x 30°, should be provided on the sprag track.
Transmissible torque

The calculation of the transmissible torque of a freewheel assumes that you know the geometrical associations between the clamping elements and the freewheel rings.

In the case of a sprag freewheel with cylindrical inner and outer ring races, the formula for the inner clamping angle (refer to figure 103-1) is:

\[
\tan \varepsilon_i = \frac{R_a - R_i}{c - (R_i + r_i - R_a + r_a)^2 (R_i + r_i) (R_a - r_a)}
\]

When calculating the transmissible torque you must also take into consideration the elastic deformations of the freewheel rings. These deformations are created by the large radial forces which the sprags exert on the rings during the locking process. For this purpose, differential equations must be solved that describe the interaction between stresses and deformations in the rings. The Hertzian surface pressure distribution on the contact points between the sprags and the tracks is represented by Fourier's series and inserted as boundary conditions in differential equations. In an iterative process, with continuously increasing forces, geometrical values, deformations and stresses are calculated and compared with the permissible limit values. The following limits must be observed:

- Hertzian pressure on the contact points
- Limit of clamping angle
- Tangential stresses in the rings
- Limit of sprag positional angle

In this calculation the influence of eccentric tracks is also taken into consideration. In addition, the calculation provides the torsion spring characteristic curve of the freewheel (refer to figure 103-3), which is particularly required for dynamic calculations of an entire installation.

Torsion spring characteristic curve

For many applications, in addition to the torque transmission, the elastic behaviour of the freewheel in a locked state (driving operation) plays a decisive role. As figure 103-2 shows, the outer ring and the inner ring twist (wind-up) against each other during torque transmission. The higher the transmitted torque M the more they twist. The numerical relation between the torque M and the elastic torsional angle is represented in the torsion spring characteristic curve of the freewheel. The calculation of the torsion spring characteristic curve is also carried out using the geometrical values and the deformation equations. Figure 103-3 shows how important the torsion spring characteristic curve is, for example, in the application as indexing freewheel. Here, the torsion spring characteristic curves are shown for a "soft" freewheel (flat characteristic curve) and a "stiff" freewheel (steep characteristic curve). If the driving torque M fluctuates, for example, around the value ΔM, the effect on the torsion angle α of the freewheel with a flat characteristic curve is much greater than that of a freewheel with a steep characteristic curve. In indexed feed drives therefore, you always select freewheels with the steepest possible characteristic curve.

Actuation frequencies and actuation service life of indexing freewheels

In the case of indexing freewheels, the maximum actuation frequency and the actuation service life depending on the actuation frequency are important selection characteristic values.

Maximum actuation frequency:

You cannot give a definite maximum permissible actuation frequency for any given freewheel, as many different influences of the entire machine construction can effect the freewheel. Of particular importance are: Type of machine, size and time course of the actuation torque and the index angle, required indexing accuracy, type of indexing freewheel, type of lubrication, drive of freewheel via inner or outer ring. This partial list shows that you cannot make a general statement regarding the maximum actuation frequency of a given catalogue freewheel. From successful applications with catalogue freewheels maximum actuation frequencies of up to 800 actuations per minute have been realized.

Actuation service life:

In the case of the actuation service life, it behaves similarly to that of the maximum actuation frequency as the influences on the freewheel are actually the same. It is not possible to calculate an exact number of actuations for any catalogue freewheel. Extensive research of the FVA (German Power Transmission Research Association) have come up with some associations. Of course, the test bench conditions are much idealised and cannot be freely transferred to the practical application conditions of indexing freewheels. In accordance with the research results, the total number of actuations of indexing freewheels is particularly dependent upon the torque and the resulting Hertzian pressure on the clamping points.

Figure 103-4 shows that we can differentiate between three areas: Overload, fatigue and rolling contact wear. Indexing freewheels must therefore be designed in such a way that they work in the area of rolling contact wear. This way, the total number of actuations can be in excess of 1x10⁶. With an actuation frequency of 100 actuations/minute, this corresponds to a service life of approximately 16 666 hours.
Maximum speeds and service life of backstops and overrunning clutches

The maximum permissible speed of freewheels that are used as backstops or overrunning clutches is primarily dependent upon the

- required service life in freewheeling operation,
- lubrication and heat dissipation as well as the category of the freewheel.

Dependency of the maximum speed on the required freewheel duration of use

In the case of freewheels with sprags or rollers, wear will occur in the same way as it does with any other sliding machine parts. This wear increases as the relative speed of the sliding parts increases. RINGSPANN has developed different types which can reduce or even reverse these effects. The qualitative course of the service life in freewheeling operation of backstops and overrunning clutches in the various types is shown in figure 104-1. Refer to pages 12 and 13 for more detailed explanations on the types.

The maximum speeds given in the tables here (apart from the types with sprag lift-off X and Z as well as with hydrodynamic sprag lift-off) must always be considered in connection with the minimum required service life in freewheeling operation!

Information regarding the service life in freewheeling operation can be obtained upon request. Simply let us know the operating conditions.

The maximum speeds specified in the tables here apply for an ambient temperature of 20 °C. Other maximum speeds will apply for other ambient temperatures or special freewheel designs.

It is generally possible, by means of constructive measures that deviate from the standard design, to achieve even higher speeds. Please contact us if this is the case, preferably using the questionnaire on page 106 or 107.

Dependency of the maximum speed on the lubrication and heat dissipation

With regard to the lubrication and heat dissipation you must consider two key speed limits:

- Limit of maximum permissible operating temperature as well as the
- limit of lubricant life.

Maximum permissible operating temperature:
The maximum permissible speed of a freewheel in freewheeling operation is, among others, reached if the maximum permissible operating temperature of the freewheel has been reached. Freewheels are lubricated with either oil or grease, in order to minimise the friction between the sliding parts in freewheeling operation. The lubrication also has the function of removing any occurring frictional heat and abrasive wear from the contact points. In principle, it is best to provide oil lubrication as this best facilitates the tasks described above.

In the case of Complete Freewheels and Internal Freewheels of series FZ..., which form a unit made up of clamping elements, bearing support, seals and lubrication, there are predominantly four sources of heat that have a restrictive effect on the maximum permissible speed of the freewheel:

- Frictional heat of the seals
- Frictional heat of the lubricant
- Frictional heat of the clamping elements
- Frictional heat of the bearings

The major part of the frictional heat is dissipated into the environment. The ambient conditions (ambient temperature, air speed etc.) therefore also have an influence on the operating temperature. Hence, the ambient conditions also have a speed-restricting effect on Complete Freewheels and Internal Freewheels of series FZ ....

Lubricant life:
The lubricant ages because of the mechanical demands made upon it and after a certain period of use it is no longer sufficiently capable of ensuring the function of reducing friction and protecting against wear. The speed of aging depends, among others, on the speed in freewheeling operation. In the event that the lubricant cannot be replaced, the lubricant life must be taken into consideration when establishing the maximum speed. Contact us for information in this regard.
### Lubrication

For each series the standard lubrication (oil or grease lubrication) is specified on the respective catalogue pages. If a different design is required, please contact us.

The lubricants recommended in the table below for the various ambient temperature ranges have been predominantly chosen for the functioning capabilities of the sprags or the rollers when starting the machine or installation. If, after starting, the freewheel is in operation for a considerable period of time, then an operating temperature will arise in the freewheel that is generally higher than the ambient temperature. For this operating temperature you must check, if the lubrication capabilities of the oil or the basic oil contained in the grease is sufficient for any roller bearings that are built into the freewheel. In critical cases, it has proven useful to use the highly aging-resistant synthetic oil MOBIL SHC 626.

### Oil lubrication

The lubrication should be carried out with a non-resinous oil with a kinematic viscosity in accordance with the lubricant table below. For Complete Freewheels and Housing Freewheels with standard oil lubrication, the oil quantity can be established from the installation and operating instruction manuals. Integrated Freewheels FXM as well as Internal Freewheels FXN can run with immersion lubrication, circulating lubrication or – in the case of operation above the sprag lift-off speed – without oil lubrication. With these series it is also permissible to use oils and greases with friction-value-reducing additives (molybdenum disulphide). If operating without oil lubrication, the sprags and the outer track must be greased prior to installation with a suitable viscous grease in accordance with the installation and operating instruction manual.

In the case of designs with Basic Freewheels, Integrated Freewheels FON and Internal Freewheels with oil lubrication, ensure that the inner track is immersed in the oil.

If an immersion lubrication is not possible, an oil circulating lubrication must be provided, which will then ensures a constant oil film on the inner track.

### Grease lubrication

The freewheels FA, FAV and FZ … have a grease lubrication that is designed to last for the service life. It is maintenance-free and generally requires no subsequent lubrication. In order to increase the service life of freewheels with grease lubrication, after an operating time of about two years the freewheels should be disassembled, cleaned, checked and regreased. Refer to the lubrication table for recommended greases.

### Attention

Oils and greases that contain friction-reducing additives like molybdenum disulphide or the like, may only be used with authorisation of RINGSPANN. Exception: Integrated Freewheels FXM as well as Internal Freewheels FXN.

### Lubrication table

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Oil</th>
<th>Grease</th>
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<tbody>
<tr>
<td><strong>For ambient temperatures from 0 °C to +50 °C</strong></td>
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<tr>
<td>Agip</td>
<td>OSO 46/68</td>
<td>OSO 32</td>
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<td>ARAL</td>
<td>VITAM GF 46/68</td>
<td>VITAM GF 32</td>
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<td>BP</td>
<td>ENERGOL HLP-HM 46/68</td>
<td>ENERGOL HLP-HM 32</td>
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<td>CASTROL</td>
<td>VARIO HDX</td>
<td>ALPHASYNT 10</td>
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<td>CHEVRON</td>
<td>HYDRAULIC OIL AW 46/68</td>
<td>RANO HD 10</td>
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<td>KLÜBER</td>
<td>LAMORA HLP 46/68</td>
<td>Klüberoil 4 UH1-15</td>
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<td>MOBIL</td>
<td>DTE 25/26</td>
<td>DTE 10 Excel 15</td>
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<td>SHELL</td>
<td>TELLUS 46/68</td>
<td>TELLUS T 15</td>
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<tr>
<td>TOTAL</td>
<td>AZOLLA ZS 46/68</td>
<td>EQUIVIS XLT 15</td>
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<tr>
<td>other manufacturers</td>
<td>Gearbox or hydraulic oils without solid lubricants ISO-VG 46/68</td>
<td>Gearbox or hydraulic oils without solid lubricants ISO-VG 32; Automatic transmission fluids [ATF]</td>
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</tbody>
</table>

Please contact us in the case of temperatures in excess of 50 °C and below -40 °C.
## Questionnaire for selecting RINGSPANN Backstops

Please photocopy or use the PDF-File from our website!

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<tr>
<th>Company:</th>
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### 1. Where will the Backstop be used?

#### 1.1 Type of machine:

In the case of conveyor belts:
- Angle of the steepest segment ____ °
- Multiple-drive? □ Yes □ No
- If yes, number of drives ______

#### 1.2 Backstop location:

- □ on the gearbox
- □ on the motor
- □ elsewhere: ________________

#### 1.3 Arrangement:

- □ on the shaft end
  - Diameter: __________ mm
  - Length: __________ mm
- □ on a through shaft
  - Diameter: __________ mm
- □ on a pulley
- □ on a sprocket
- □ elsewhere: ________________

#### 1.4 If possible, please include specification, data sheet, sketch or drawing with connection dimensions.

### 2. Operating data

#### 2.1 Speed at the backstop location (backstop shaft) n_{sp} = ________ min⁻¹

- Would it be possible to arrange the backstop on a high speed shaft? (higher speed = lower torque = smaller backstop)
- If necessary please give further details on the drawing.

#### 2.2 Nominal power of motor 
P_0 = ________ kW

#### 2.3 Must the backstop also absorb the peak torque that occurs if the drive motor is started in the locking direction of the backstop (incorrectly poled drive motor)?

- □ Yes □ No

#### 2.4 Maximum backdriving torque

\[ M_{max} = ________ \text{Nm} \]

#### 2.5 Lifting capacity of the conveyor system 
P_L = ________ kW

#### 2.6 Efficiency of the machine between backstop and drive 
\[ \eta = \quad \]

#### 2.7 Number of daily locking processes: ______

#### 2.8 Daily operating time: ________ hours

### 3. Installation conditions

#### 3.1 □ Open, outside

- □ Open, in a closed room
- □ In the machine housing
  - □ Lubrication by means of oil bath or oil mist in the machine housing
  - □ Connection to the central lubrication system is possible

#### 3.2 Should the backstop be releasable?

- □ No □ Yes, in an emergency
- □ Yes, frequently

#### 3.3 Ambient temperature on the backstop:

- from ________ ° C to ________ ° C

#### 3.4 Other (e.g. accessibility, dust susceptibility and other environmental influences that could be of significance):

#### 3.5 Are there any elastic elements/components located between the backstop and the installation that is to be backstopped (elastic couplings generate considerable peak torques at the moment of stopping)?

- □ Yes □ No

### 4. Estimated requirements

- ______________ Pieces (one-off) ______________ Pieces/month ______________ Pieces/year

### 5. Enclosures

- □ Specifications
- □ Data sheet
- □ Sketch/drawing

---

RINGSPANN GmbH

Schaberweg 30 - 38  
61348 Bad Homburg, Germany

Phone +49 6172 275-0  
Fax +49 6172 275-275

www.ringspann.com  
info@ringspann.com
### Questionnaire for selecting RINGSPANN Overrunning Clutches

Please photocopy or use the PDF-File from our website!

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#### 1. Where will the Overrunning Clutch be used?

1.1 Type of machine, machine group or installation, in which the overrunning clutch will be used:

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1.2 Arrangement of the overrunning clutch (if possible, please include specification, data sheet, sketch or drawing with connection dimensions):

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#### 2. Operating data

2.1 In driving operation the drive of the overrunning clutch will be carried out by:

- [ ] Asynchronous motor
- [ ] direct start-up
- [ ] Α-Δ-start-up
- [ ] Other electric motor
  - Type: 
- [ ] Combustion engine
  - Type: 
  - Number of cylinders: 
- [ ] Turbine
- [ ] Other (please explain in more detail):
  - 

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2.2 To be transmitted in driving operation:

- Power: _______kW or
- Torque: _______Nm

2.3 Maximum torque _______Nm
  (Important for drives that develop their maximum torque below their nominal speed.)

2.4 Speed

1. in driving operation:
   - from _______ min⁻¹ to _______ min⁻¹
2. in freewheeling operation:
   - (when overrunning clutch is disengaged)
   - Primary part (driver):
     - from _______ min⁻¹ to _______ min⁻¹
   - Secondary part (driven machine):
     - from _______ min⁻¹ to _______ min⁻¹

2.5 Should the overrunning clutch be combined with a shaft coupling?

- [ ] with an elastic coupling
- [ ] with a torsionally stiff coupling

2.6 If, upon start up, larger masses are to be accelerated:

- [ ] Moment of inertia: \( J = \) _______ kgm²
- [ ] Speed of mass: \( n = \) _______ min⁻¹

2.7 Torque fluctuations/torsional vibrations during driving operation generate the following torque limits

- [ ] Minimum torque \( M_{\text{min}} = \) _______ Nm
- [ ] Maximum torque \( M_{\text{max}} = \) _______ Nm
- [ ] Minimum or Maximum torque is not known

2.8 Daily operating time: _______ hours (h)
   - thereof _______ (h) driving operation
   - thereof _______ (h) freewheeling operation

#### 3. Installation conditions

3.1

- [ ] Open, outside
- [ ] Open, in a closed room
- [ ] in the machine housing
  - [ ] Lubrication by means of oil bath or oil mist in the machine housing
  - [ ] Connection to the central lubrication system is possible
- [ ] Name of lubricant:

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3.2 Ambient temperature on the freewheel:

- from _______ °C to _______ °C

3.3 Other (e.g. accessibility, dust susceptibility and other environmental influences that could be of significance):

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#### 4. Estimated requirements

- [ ] Pieces (one-off)
- [ ] Pieces/month
- [ ] Pieces/year

#### 5. Enclosures

- [ ] Specifications
- [ ] Data sheet
- [ ] Sketch/drawing
## Questionnaire for selecting RINGSPANN Indexing Freewheels

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### 1. Where will the Indexing Freewheel be used?

1.1 Type of machine, machine group or installation, in which the indexing freewheel will be used:

#### 1.2 Arrangement of the indexing freewheel (if possible, please include specification, data sheet, sketch or drawing with connection dimensions).

### 2. Operating data

2.1 Index angle of the indexing freewheel:

- from _____° to _____°

2.2 Number of actuations (indexes) per minute:

- from _____/min to _____/min

2.3 The back and forth movement is made by:

- freewheel outer ring
- freewheel inner ring
- ________________

2.4 The back and forth movement is generated by:

- bell crank
- hydraulic cylinder
- pneumatic cylinder
- cam disk or plate
- other (please explain in more detail):

#### 2.5 Proposed shaft dimensions:

- Diameter ________ mm
- Length ________ mm

2.6 Normal torque:

- \( M = \) ________ Nm
- Maximum torque:
  - \( M_{\text{max}} = \) ________ Nm (including peaks)

2.7 Daily operating time:

- ________ hours

### 3. Installation conditions

3.1 Open, outside

- Open, in a closed room

- In the machine housing

  - Lubrication by means of oil bath or oil mist in the machine housing
  - Connection to the central lubrication system is possible

- Name of lubricant:

- Kinematic viscosity:

  - ________ mm²/s ________ °C

3.2 Ambient temperature on freewheel:

- from ________ °C to ________ °C

3.3 Other (e.g. accessibility, dust susceptibility and other environmental influences that could be of significance):

- ________________

### 4. Estimated requirement

- ________ Pieces (one-off)
- ________ Pieces/month
- ________ Pieces/year

### 5. Enclosures

- Specifications
- Data sheet
- Sketch/drawing
**Questionnaire for selecting RINGSPANN Housing Freewheels FH**

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</table>

1. Where will the Housing Freewheels be used?
   1.1 Type of installation: ______
   1.2 Type of working machine: ______

2. Operating data
   2.1 In driving operation the drive will be carried out by
   - [ ] Asynchronous motor
   - [ ] Direct start up
   - [ ] \( \lambda \Delta \)-start up
   - [ ] Other electric motor
     - Type: ______
   - [ ] Combustion engine
     - Type: ______ No. of cylinders: ______
   - [ ] Turbine
   - [ ] Other (please explain in more detail): ______

   2.2 Speeds in driving operation
   - Speeds in freewheeling operation
     - from ______ min\(^{-1}\) to ______ min\(^{-1}\)
     - from ______ min\(^{-1}\) to ______ min\(^{-1}\)

   2.3 Direction of rotation in driving operation when viewed in direction X
   - [ ] Counterclockwise
   - [ ] Clockwise

   2.4 To be transmitted in driving operation
   - Power: ______ kW
   - Torque: ______ Nm
   - ______ Nm

   2.5 Maximum torque determined by rotational vibration calculation
   - ______ Nm

   2.6 Should the Housing Freewheel be combined with shaft coupling?
   - [ ] With elastic coupling
   - [ ] With torsionally stiff coupling

   2.7 Selected Housing Freewheel
   - Size: ______

   2.8 Daily operating time
   - ______ hours (h)
   - thereof ______ (h) driving operation
   - thereof ______ (h) freewheeling operation

3. Installation conditions
   3.1 Ambient temperature on the freewheel:
   - from ______ °C to ______ °C

   3.2 Other (e.g. accessibility, dust susceptibility and other environmental influences that could be of significance):

   3.3 Enveloping conditions:

4. Estimated requirements
   - ______ Pieces (one-off)
   - ______ Pieces/month
   - ______ Pieces/year

5. Enclosures
   - [ ] Specifications
   - [ ] Data sheet
   - [ ] Sketch/drawing

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