Freewheels
Backstops • Overrunning Clutches • Indexing Freewheels
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## Complete Freewheels

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### For bolting to the face

- **FB with sprags, available in five types**
  - 0 4 160,000 300 16
- **FKh with hydrodynamic sprag lift-off**
  - 0 4 22,000 120 18
- **BD ... X with sprag lift-off X**
  - 0 4 42,500 150 20
- **BD ... R with rollers**
  - 0 4 57,500 150 22

### With mounting flange

- **FBF with sprags, available in five types**
  - 0 4 160,000 300 24
- **FGR ... SF A1A2 with sprags**
  - 0 4 2150 50 26
- **FGR ... SF A2A7 with sprags**
  - 0 4 2150 50 26
- **FGR ... R A1A2 with rollers**
  - 0 4 68,000 150 28
- **FGR ... R A2A7 with rollers**
  - 0 4 68,000 150 28

### For keyway connection on the outer ring

- **BM ... X with sprag lift-off X**
  - 0 4 42,500 150 30
- **BM ... R with rollers**
  - 0 4 57,500 150 32
- **FGRN ... R A5A6 with rollers**
  - 0 4 68,000 80 34

### With lever arm

- **BA ... XG with sprag lift-off X and grease lubrication**
  - 4 4 42,500 150 36
- **BC ... XG with sprag lift-off X and grease lubrication**
  - 4 4 42,500 150 36
- **BA ... X with sprag lift-off X**
  - 4 4 42,500 150 38
- **BC ... X with sprag lift-off X**
  - 4 4 42,500 150 38
- **BA ... R with rollers**
  - 4 4 57,500 150 40
- **BC ... R with rollers**
  - 4 4 57,500 150 40
- **FGR ... R A3A4 with rollers**
  - 4 4 68,000 150 42
- **FGR ... R A2A3 with rollers**
  - 4 4 68,000 150 42
- **FA with sprags and grease lubrication**
  - 4 4 2500 85 44
- **FAV with rollers and grease lubrication**
  - 4 4 5000 80 46

### With shaft coupling

- **FBL for large shaft misalignments, with sprags**
  - 0 4 8000 140 48
- **FBE for small shaft misalignments, with sprags**
  - 0 4 160,000 300 50

## Housing Freewheels

<table>
<thead>
<tr>
<th>Backstop</th>
<th>Used as</th>
<th>With bearing support</th>
<th>Nominal torque up to Nm</th>
<th>Shaft up to mm</th>
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</table>

### For stationary arrangement

- **FKhG with hydrodynamic sprag lift-off**
  - 0 4 14,000 110 52
### Basic Freewheels

<table>
<thead>
<tr>
<th>Backstop</th>
<th>Used as</th>
<th>Indexing Freewheel</th>
<th>With bearing support</th>
<th>Nominal torque up to Nm</th>
<th>Bore up to mm</th>
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<td><strong>for assembly with customer connecting parts</strong></td>
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<tr>
<td><strong>FBO with sprags, available in five types</strong></td>
<td></td>
<td></td>
<td></td>
<td>160000</td>
<td>300</td>
<td>56</td>
</tr>
<tr>
<td><strong>FGR … SF with sprags</strong></td>
<td></td>
<td></td>
<td></td>
<td>2150</td>
<td>50</td>
<td>58</td>
</tr>
<tr>
<td><strong>FGR … R with rollers</strong></td>
<td></td>
<td></td>
<td></td>
<td>68000</td>
<td>150</td>
<td>60</td>
</tr>
</tbody>
</table>

### Integrated Freewheels

<table>
<thead>
<tr>
<th>Backstop</th>
<th>Used as</th>
<th>Indexing Freewheel</th>
<th>With bearing support</th>
<th>Nominal torque up to Nm</th>
<th>Bore up to mm</th>
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<td><strong>for bolting to the face</strong></td>
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<tr>
<td><strong>FXM with sprag lift-off X</strong></td>
<td></td>
<td></td>
<td></td>
<td>364000</td>
<td>320</td>
<td>62</td>
</tr>
<tr>
<td><strong>FON with sprags, available in three types</strong></td>
<td></td>
<td></td>
<td></td>
<td>25000</td>
<td>155</td>
<td>66</td>
</tr>
<tr>
<td><strong>for bolting to the face, with torque limiting</strong></td>
<td></td>
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<tr>
<td><strong>FXRV with sprag lift-off X</strong></td>
<td></td>
<td></td>
<td></td>
<td>53000</td>
<td>320</td>
<td>68</td>
</tr>
<tr>
<td><strong>FXRT with sprag lift-off X and with release function</strong></td>
<td></td>
<td></td>
<td></td>
<td>53000</td>
<td>320</td>
<td>68</td>
</tr>
</tbody>
</table>

### Internal Freewheels

<table>
<thead>
<tr>
<th>Backstop</th>
<th>Used as</th>
<th>Indexing Freewheel</th>
<th>With bearing support</th>
<th>Nominal torque up to Nm</th>
<th>Bore up to mm</th>
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<tr>
<td><strong>for press fit on the outer ring</strong></td>
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<tr>
<td><strong>FXN with sprag lift-off X</strong></td>
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<td></td>
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<td>20000</td>
<td>130</td>
<td>72</td>
</tr>
<tr>
<td><strong>FEN with sprags</strong></td>
<td></td>
<td></td>
<td></td>
<td>40000</td>
<td>100</td>
<td>76</td>
</tr>
<tr>
<td><strong>FGK with sprags and bearing support</strong></td>
<td></td>
<td></td>
<td></td>
<td>46000</td>
<td>50</td>
<td>78</td>
</tr>
<tr>
<td><strong>FCN … K/CF with sprags</strong></td>
<td></td>
<td></td>
<td></td>
<td>50000</td>
<td>60</td>
<td>80</td>
</tr>
<tr>
<td><strong>FCN … R with rollers</strong></td>
<td></td>
<td></td>
<td></td>
<td>84000</td>
<td>80</td>
<td>82</td>
</tr>
<tr>
<td><strong>FDN with sprags, available in three types</strong></td>
<td></td>
<td></td>
<td></td>
<td>24000</td>
<td>80</td>
<td>84</td>
</tr>
<tr>
<td><strong>FDE with sprags, available in three types</strong></td>
<td></td>
<td></td>
<td></td>
<td>24000</td>
<td>95</td>
<td>86</td>
</tr>
<tr>
<td><strong>FD with sprags, available in three types</strong></td>
<td></td>
<td></td>
<td></td>
<td>24000</td>
<td>95</td>
<td>88</td>
</tr>
<tr>
<td><strong>ZZ with sprags and bearing support</strong></td>
<td></td>
<td></td>
<td></td>
<td>32500</td>
<td>40</td>
<td>90</td>
</tr>
<tr>
<td><strong>ZZ … 2RS with sprags, bearing support and seals</strong></td>
<td></td>
<td></td>
<td></td>
<td>32500</td>
<td>40</td>
<td>92</td>
</tr>
<tr>
<td><strong>ZZ … P2RS with sprags, bearing support and seals</strong></td>
<td></td>
<td></td>
<td></td>
<td>13800</td>
<td>30</td>
<td>93</td>
</tr>
<tr>
<td><strong>ZZ … P with sprags and bearing support</strong></td>
<td></td>
<td></td>
<td></td>
<td>32500</td>
<td>40</td>
<td>94</td>
</tr>
<tr>
<td><strong>for keyway connection on the outer ring</strong></td>
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<tr>
<td><strong>ZZ … PP with sprags and bearing support</strong></td>
<td></td>
<td></td>
<td></td>
<td>32500</td>
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<td>95</td>
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<tr>
<td><strong>FSN with rollers</strong></td>
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<td>30000</td>
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<td>96</td>
</tr>
<tr>
<td><strong>FN with rollers</strong></td>
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<td></td>
<td></td>
<td>30000</td>
<td>60</td>
<td>98</td>
</tr>
<tr>
<td><strong>FNR with rollers and bearing support</strong></td>
<td></td>
<td></td>
<td></td>
<td>30000</td>
<td>60</td>
<td>100</td>
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### Freewheel technology details

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The maximum transmissible torques are 2 times the specified nominal torques.

Issue 07/2007 • Technical details subject to change without notice.
Freewheels are power transmission components 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 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.

In general, backstops are used where the inner ring freewheels and the stationary held outer ring prevents reverse rotation (figure 3).

The more complicated designed backstops where the outer ring freewheels and the stationary held inner ring prevents reverse rotation are rarely used today (figure 4).

Figure 5 shows an overrunning clutch where in driving operation the power flow is transferred from the inner ring to the outer ring and in freewheeling operation the outer ring overrun the inner ring at a higher speed.

Figure 6 shows an overrunning clutch where in driving operation the power flow is transferred from the outer ring to the inner ring and in freewheeling operation the inner ring overrun the outer ring at a higher speed.

Figure 7 shows an indexing freewheel where the outer ring makes the back and forth motion and the inner ring carries out the indexed feed.

Figure 8 shows an indexing freewheel where the inner ring makes the back and forth motion and the outer ring carries out the indexed feed.
**Areas of Application for Freewheels**

**Areas of application for Backstops**

- Gear units
- Electric motors
- Gear motors

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

**Areas of application for Overrunning Clutches**

- Textile machines
- Printing machines

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.

- Fans
- Ventilators

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

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

- Packaging machines
- Filling plants

The indexing freewheel is used in packaging machines and filling plants for an indexed feed.
In multimotor drives the overrunning clutch disengages the inactive or lower speed drive.

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

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

The index freewheel replaces a reduction gear in seed spreader.

The overrunning clutch ensures that the conveyed material can be pushed or pulled faster over the rollers than the speed of the drive.
Categories of Freewheels

Complete Freewheels

- With bearing support between inner and outer ring
- Completely enclosed
- With own lubrication
- Connection to the outer ring and the customer part by:
  - bolting to the face (figure 9),
  - mounting flange,
  - keyway connection on the outer ring,
  - lever arm (figure 10) or
  - shaft coupling.

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
- Exclusively used as an overrunning clutch
**Basic Freewheels**

- With bearing support between inner and outer ring
- For assembly with customer 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

**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 16, the outer ring can be turned freely clockwise (freewheeling operation), if the inner ring

- is at a standstill,
- is turned anticlockwise 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 sprags clamp without slipping between the tracks. In this direction of rotation high torque can be transmitted (driving operation).

The sprag arrangement in figure 16 also enables freewheeling operation while the inner ring is turned anticlockwise 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 17). 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 $\varepsilon_I$ or $\varepsilon_A$, whereby $\varepsilon_I > \varepsilon_A$. To achieve self-locking, the tangent of the clamping angle $\varepsilon_I$ must be less than the friction value $\mu$.

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

Because of the relationship

$$M = z \cdot R_I \cdot F_{TI} = z \cdot R_I \cdot F_{NI} \cdot \tan \varepsilon_I$$
$$= z \cdot R_A \cdot F_{TA} = z \cdot R_A \cdot F_{NA} \cdot \tan \varepsilon_A$$

with $z = \text{number of sprags}$

the normal forces and the clamping angles adapt automatically to the acting torque $M$. 

$$M = z \cdot R_I \cdot \frac{F_{TI}}{\tan \varepsilon_I} = z \cdot R_A \cdot \frac{F_{TA}}{\tan \varepsilon_A}$$
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 19, the outer ring can be turned freely clockwise (freewheeling operation), if the inner ring
- is at a standstill,
- is turned anticlockwise 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 19 also enables a freewheeling operation while the inner ring is turned anticlockwise 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 20). 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 $\epsilon$. 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:

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

Because of the relationship

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

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>Standards</th>
<th>Type with sprag lift-off X</th>
<th>Type with sprag lift-off Z</th>
<th>Type with RDUVIT®</th>
<th>Type with P-grinding</th>
<th>Type with hydrodynamic sprag lift-off</th>
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</thead>
<tbody>
<tr>
<td>Standard type</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 and indexing accuracy</td>
<td>For extended service life using sprag lift-off at high speed rotating outer ring</td>
</tr>
<tr>
<td>Use as Backstop</td>
<td>Up to medium speeds during freewheeling operation (inner or outer ring freewheels)</td>
<td>Up to very high speeds during freewheeling operation (inner ring freewheels)</td>
<td>Up to high speeds during freewheeling operation (outer ring freewheels)</td>
<td></td>
<td>Up to very high speeds during freewheeling operation (inner or outer ring freewheels)</td>
</tr>
<tr>
<td>Use as Overrunning Clutch</td>
<td>Up to medium speeds during freewheeling operation (inner or outer ring overruns)</td>
<td>Up to very high speeds during freewheeling operation (inner ring overruns)</td>
<td>Up to very high speeds during freewheeling operation (outer ring overruns)</td>
<td></td>
<td>Up to very high speeds during freewheeling operation (inner ring drives)</td>
</tr>
<tr>
<td>In addition the standard type, RINGSPANN has developed five other types for extended service life for freewheels with sprags. The table above lists the recommended application conditions for these types.</td>
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### Type with sprag lift-off X

The sprag lift-off X is applied for backstops and overrunning clutches, provided in freewheeling operation the inner 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 outer track. In this operating state, the freewheel works wear-free, i.e. with unrestricted service life.

Figure 21 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 centre of gravity \( S \) of the sprag turns the sprag anticlockwise 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 \( F_S \), the sprag again rests on the outer ring and the freewheel is ready to lock (figure 22). 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 23 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 centre of gravity \( S \) of the sprag turns the sprag anticlockwise 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 \( F_S \), the sprag again rests on the inner ring and the freewheel is ready to lock (figure 24). 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 point 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 backstops and overrunning clutches and considerably increase the service life.

Type with P-grinding
The P-grinding gives the RINGSPANN sprag freewheel its outstanding suitability as an indexing freewheel. P-grinding means that the outer track is not round, it is ground in a polygon shape. This means that the distance between the outer race and the inner race differs at different points on the circumference. As, during operation, the sprag slowly wanders in the circumferential direction, its angle position is constantly changing. The contact line on the sprag hence moves back and forth between the points a and b. This means the wear is distributed across the sprag over a greater area, which means the sprag profile that is so critical for its function is maintained. The sprags remain capable of functioning despite a considerable degree of use. P-grinding is used on indexing freewheels as this does not just give the freewheels an increased service life, but also an increase in indexing accuracy.

Type with hydrodynamic sprag lift-off
The hydrodynamic sprag 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 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 FRh and FRhG) 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 pumps the oil under pressure into the ring chamber and the oil then seeps out through the ring gap at a 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. Already before achieving synchronous running, the sprags are again 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.
Determination of Selection Torque

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:

$$M_A = 1.75 \cdot \eta \cdot M_L \ [Nm]$$

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

$$M_A = 1.75 \cdot \eta \cdot 9550 \cdot P_0/n_{SP} \ [Nm]$$

In these equations:
- $M_A = $ Selection torque of the backstop [Nm]
- $M_L = 9550 \cdot P_0/n_{SP} \ [Nm]$ = Static backdriving torque of the load referring to the backstop shaft [Nm]
- $P_L = $ Lifting capacity of the conveyor system at full load [kW]
- $P_0 = $ Nominal power of motor [kW]
- $n_{SP} = $ Speed of backstop shaft [min⁻¹]
- $\eta = $ Efficiency of installation (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 = $ 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 $\eta$:

<table>
<thead>
<tr>
<th>Type of installation</th>
<th>$\eta_1$</th>
<th>$\eta_2$</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>
</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 = $ 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 more 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 110 to 113 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,
   - 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.

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 P-grinding or
   - 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 101 as well as the technical points on pages 106 to 109.
Complete Freewheels FB
for bolting to the face
with sprags, available in five types

Application example
Two Complete Freewheels FB 82 SFT as over-running 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 lend the freewheels an extended service life.

Features
Complete Freewheels FB are sealed sprag freewheels with ball bearings. They are supplied oil-filled and ready for installation.
The freewheels FB are used as:
- Backstops
- Overrunning Clutches
- Indexing Freewheels

In addition to the standard type, four other types are available for extended service life and indexing accuracy.
Nominal torques up to 160 000 Nm.
Bores up to 300 mm. Many standard bores are available.

Mounting
The customer attachment part is centred 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 38 mm bore:
- FB 72 LZ, d = 38 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:
- anticlockwise free or
- clockwise free
Complete Freewheels FB
for bolting to the face with sprags, available in five types

<table>
<thead>
<tr>
<th>Freewheel Size</th>
<th>Type</th>
<th>Standard torque Nm</th>
<th>Max. torque Nm</th>
<th>Max. speed outer ring speed min⁻¹</th>
<th>Max. speed inner ring speed min⁻¹</th>
<th>Sprag lift-off at inner ring drives</th>
<th>Max. speed outer ring speed min⁻¹</th>
<th>Max. speed inner ring speed min⁻¹</th>
<th>Nominal torque Nm</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>FB 24</td>
<td>CF</td>
<td>45</td>
<td>4 800</td>
<td>5 500</td>
<td>1 220</td>
<td>220</td>
<td>1 750</td>
<td>1 400</td>
<td>4 800</td>
<td>CFP</td>
</tr>
<tr>
<td>FB 29</td>
<td>CF</td>
<td>80</td>
<td>3 500</td>
<td>4 000</td>
<td>1 220</td>
<td>220</td>
<td>1 750</td>
<td>1 400</td>
<td>3 500</td>
<td>CFP</td>
</tr>
<tr>
<td>FB 37</td>
<td>SF</td>
<td>200</td>
<td>2 500</td>
<td>2 600</td>
<td>1 220</td>
<td>220</td>
<td>1 750</td>
<td>1 400</td>
<td>2 500</td>
<td>SFP</td>
</tr>
<tr>
<td>FB 44</td>
<td>SF</td>
<td>320</td>
<td>1 900</td>
<td>2 200</td>
<td>1 220</td>
<td>220</td>
<td>1 750</td>
<td>1 400</td>
<td>1 900</td>
<td>SFP</td>
</tr>
<tr>
<td>FB 57</td>
<td>SF</td>
<td>630</td>
<td>1 400</td>
<td>1 750</td>
<td>1 220</td>
<td>220</td>
<td>1 750</td>
<td>1 400</td>
<td>1 400</td>
<td>SFP</td>
</tr>
<tr>
<td>FB 72</td>
<td>SF</td>
<td>1 250</td>
<td>1 120</td>
<td>1 600</td>
<td>1 220</td>
<td>220</td>
<td>1 750</td>
<td>1 400</td>
<td>1 120</td>
<td>SFP</td>
</tr>
<tr>
<td>FB 82</td>
<td>SF</td>
<td>1 800</td>
<td>1 025</td>
<td>1 450</td>
<td>1 220</td>
<td>220</td>
<td>1 750</td>
<td>1 400</td>
<td>1 025</td>
<td>SFP</td>
</tr>
<tr>
<td>FB 107</td>
<td>SF</td>
<td>2 500</td>
<td>880</td>
<td>1 250</td>
<td>1 220</td>
<td>220</td>
<td>1 750</td>
<td>1 400</td>
<td>880</td>
<td>SFP</td>
</tr>
<tr>
<td>FB 127</td>
<td>SF</td>
<td>5 000</td>
<td>800</td>
<td>1 150</td>
<td>1 220</td>
<td>220</td>
<td>1 750</td>
<td>1 400</td>
<td>800</td>
<td>SFP</td>
</tr>
<tr>
<td>FB 140</td>
<td>SF</td>
<td>10 000</td>
<td>750</td>
<td>1 100</td>
<td>1 220</td>
<td>220</td>
<td>1 750</td>
<td>1 400</td>
<td>750</td>
<td>SFP</td>
</tr>
<tr>
<td>FB 200</td>
<td>SF</td>
<td>20 000</td>
<td>630</td>
<td>900</td>
<td>1 220</td>
<td>220</td>
<td>1 750</td>
<td>1 400</td>
<td>630</td>
<td>SFP</td>
</tr>
<tr>
<td>FB 270</td>
<td>SF</td>
<td>40 000</td>
<td>510</td>
<td>750</td>
<td>1 220</td>
<td>220</td>
<td>1 750</td>
<td>1 400</td>
<td>510</td>
<td>SFP</td>
</tr>
<tr>
<td>FB 340</td>
<td>SF</td>
<td>80 000</td>
<td>460</td>
<td>630</td>
<td>1 220</td>
<td>220</td>
<td>1 750</td>
<td>1 400</td>
<td>460</td>
<td>SFP</td>
</tr>
<tr>
<td>FB 440</td>
<td>SF</td>
<td>160 000</td>
<td>400</td>
<td>550</td>
<td>1 220</td>
<td>220</td>
<td>1 750</td>
<td>1 400</td>
<td>400</td>
<td>SFP</td>
</tr>
</tbody>
</table>

The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal torque.

<table>
<thead>
<tr>
<th>Keyway according to DIN 6865, page 1</th>
<th>Tolerance of keyway width JS10.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Z</strong> = Number of tapped holes G on pitch circle T.</td>
<td></td>
</tr>
</tbody>
</table>

The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal torque.
Features

Complete Freewheels FKh with hydrodynamic sprag 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.

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

The freewheels FKh are used as:

- Overrunning Clutches

if the speeds in freewheeling operation and in driving operation are the same or similarly high.

Nominal torques up to 14 000 Nm.

Bores up to 95 mm.

Application example

Two Complete Freewheels FKh 28 ATR as overrunning 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.
Complete Freewheels FKh
for bolting to the face
with hydrodynamic sprag lift-off for multimotor drives

The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal torque.

---

### 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

Freewheel size FKh 28, type with hydrodynamic sprag lift-off and 50 mm bore:

- FKh 28 ATR, d = 50 mm

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

- anticlockwise free
- clockwise free

---

**Table:**

| Freewheel Size | Type | Nominal torque Nm | Max. speed Outer ring overruns min⁻¹ | Max. speed Inner ring drives min⁻¹ | Bore d Standard max mm | B mm | D mm | F mm | G** mm | H mm | K mm | L mm | R mm | T mm | Z** Number of tapped holes G on pitch circle T | Weight kg |
|----------------|------|--------------------|-------------------------------------|-----------------------------------|------------------------|------|------|------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------------------|-----------|
| FKh 24 ATR     | 1 100| 3 000              | 3 000                               | 35                                | 40*                   | 90   | 170  | 1,0  | M10    | 11    | 9     | 95    | 135   | 115   | 6                 | 9,6      |
| FKh 28 ATR     | 1 800| 2 000              | 2 000                               | 45                                | 50*                   | 103  | 186  | 1,0  | M10    | 11    | 11    | 105   | 135   | 115   | 12                | 14,0     |
| FKh 94 ATR     | 2 500| 1 800              | 1 800                               | 60                                | 60                    | 112  | 210  | 7,0  | M10    | 16    | 9     | 120   | 170   | 150   | 10                | 19,0     |
| FKh 106 ATR    | 4 200| 1 600              | 1 600                               | 70                                | 75*                   | 116  | 250  | 7,5  | M12    | 18    | 8     | 125   | 200   | 180   | 12                | 25,0     |
| FKh 148 ATR    | 7 000| 1 600              | 1 600                               | 90                                | 95*                   | 156  | 291  | 7,5  | M16    | 25    | 9     | 165   | 250   | 225   | 12                | 52,0     |
| FKh 2.53 ATR   | 14 000| 1 600             | 1 600                               | 90                                | 95*                   | 241  | 345  | 2,0  | M16    | 25    | 6     | 245   | 250   | 220   | 16                | 98,0     |

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

** Z = Number of tapped holes G on pitch circle T.
Complete Freewheels BD ... X
for bolting to the face
with sprag lift-off X

Features
Complete Freewheels BD ... X are sealed sprag freewheels with ball bearings and sprag lift-off X. They are supplied oil-filled.

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

The freewheels BD ... X are used as:
- Backstops
- Overrunning Clutches

for applications with high speed freewheeling operation and when used as an overrunning clutch with low speed driving operation.
Nominal torques up to 42 500 Nm.
Bores up to 150 mm.

Application example
Complete Freewheel BD 45 SX as an overrunning clutch on the shaft end of the high speed rotating main drive of a textile machine. The sprocket is linked to an auxiliary drive. In normal operation (freewheeling operation) the inner ring overruns and the outer ring is at a standstill with the bolted on sprocket. During set-up, the machine is driven by the slowly running auxiliary drive via the chain drive and the freewheel that is working in the driving operation. 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.
Complete Freewheels BD ... X
for bolting to the face
with sprag lift-off X

Mounting

The customer attachment part is centered on the diameter R and bolted on to the face. The pilot on the covers is particularly suitable for attaching smaller and narrower parts (sprockets, gear wheels etc.).

The customer must provide fastening screws of the necessary length in order to mount the attachment part.

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 BD 30, type with sprag lift-off X and 45 mm bore:

• BD 30 DX, d = 45 mm
Complete Freewheels BD ... R
for bolting to the face
with rollers

Features
Complete Freewheels BD ... R are sealed freewheels with rollers and ball bearings. They are supplied oil-filled.
The freewheels BD ... R are used as:
- Backstops
- Overrunning Clutches
- Indexing Freewheels
Nominal torques up to 57 500 Nm.
Bores up to 150 mm.

Application example
Complete freewheels BD 28 R as overrunning clutches in the roller conveyor of a continuous heating furnace system. The steel billets must run through the furnace at increasing speed. In order to achieve this, overrunning clutches with sprockets on both sides are arranged on the drive side of the transport rollers. The driven sprocket has in each case two teeth less than the driving sprocket. Therefore the speed increases from roller to roller. The length of the steel billet covers several rollers, all running at different speeds. The freewheels allow the slower rollers to adjust to the speed of the billet by overrunning their drive.
**Complete Freewheels BD ... R**

for bolting to the face with rollers

---

### Mounting

The customer attachment part is centered on the diameter R and then bolted on to the face. The pilot on the covers is particularly suitable for attaching smaller and narrower parts (sprockets, gear wheels etc.).

The customer must provide fastening screws of the necessary length in order to mount the attachment part.

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 BD 40, standard type with bore 60 mm:

- BD 40, d = 60 mm

---

**Table: Freewheel sizes**

| Freewheel Size | Type | Nominal torque Nm | Max. inner ring revolutions/min | Outer ring revolutions/min | B | D | F | G** | H | K | L | R | S | T | Z** | Weight kg |
|----------------|------|-------------------|--------------------------------|---------------------------|---|---|---|-----|---|---|---|---|---|---|---|-----|---------|
| BD 12 R        |      | 150               | 1.750 3.500                     |                           | 15 |    |   |     |    |   |   |   |   |   |    | 1.5 |
| BD 15 R        |      | 230               | 1.650 3.300                     |                           | 20 |    |   |     |    |   |   |   |   |   |    | 2.0 |
| BD 18 R        |      | 340               | 1.550 3.100                     |                           | 25 |    |   |     |    |   |   |   |   |   |    | 2.9 |
| BD 20 R        |      | 420               | 1.450 2.900                     |                           | 30 |    |   |     |    |   |   |   |   |   |    | 3.8 |
| BD 25 R        |      | 800               | 1.250 2.500                     |                           | 35 | 45  |   | 81.5 | 45 | 136| 1.75| M8 | 30 |   | 9.0| 115| 6.8 |
| BD 28 R        |      | 1200              | 1.100 2.200                     |                           | 35 | 40  | 45 | 81.5 | 45 | 136| 1.75| M8 | 30 | 9.0| 115| 11.7 |
| BD 30 R        |      | 1600              | 1.000 2.000                     |                           | 45 | 50  | 50 | 88.5 | 151| 0.75| M8 | 36 | 102| 1.00| 140| 103 |
| BD 35 R        |      | 1800              | 1.800 3.600                     |                           | 50 | 55  | 55 | 96.5 | 161| 0.75| M8 | 35 | 110| 1.10| 140| 12.5 |
| BD 40 R        |      | 3500              | 800 1.600                       |                           | 60 | 60  | 90 | 146.5| 246| 1.75| M14| 48 | 170| 1.60| 255| 18.5 |
| BD 45 R        |      | 7100              | 750 1.500                       |                           | 70 | 75  | 75 | 117.5| 206| 1.25| M12| 39 | 132| 1.40| 180| 24.2 |
| BD 50 R        |      | 7500              | 700 1.400                       |                           | 75 | 75  | 75 | 117.5| 206| 1.25| M12| 39 | 132| 1.40| 180| 24.2 |
| BD 52 R        |      | 9300              | 650 1.300                       |                           | 80 | 80  | 80 | 130.5| 216| 1.75| M14| 44 | 150| 1.50| 190| 31.1 |
| BD 55 R        |      | 12500             | 550 1.100                       |                           | 90 | 90  | 90 | 146.5| 246| 1.75| M14| 48 | 170| 1.60| 255| 18.5 |
| BD 60 R        |      | 14500             | 500 1.000                       |                           | 100| 100 | 100| 182.5| 291| 1.75| M14| 55 | 206| 1.90| 250| 78.2 |
| BD 70 R        |      | 22500             | 425 0.850                       |                           | 120| 120 | 120| 192.5| 321| 1.25| M16| 58 | 215| 2.10| 280| 93.4 |
| BD 80 R        |      | 25000             | 375 0.750                       |                           | 130| 130 | 130| 200.5| 351| 1.75| M16| 60 | 224| 2.20| 310| 116.8 |
| BD 90 R        |      | 35500             | 350 0.700                       |                           | 140| 140 | 140| 210.5| 371| 2.75| M16| 68 | 236| 2.40| 330| 136.7 |
| BD 95 R        |      | 35000             | 300 0.600                       |                           | 150| 150 | 150| 223.5| 391| 2.75| M16| 79 | 249| 2.50| 345| 159.3 |
| BD 100 R       |      | 57500             | 250 0.500                       |                           | 150| 150 | 150| 248.5| 411| 3.75| M20| 79 | 276| 2.70| 365| 190.4 |

---

**Keyway width dimensions:**

- BD 35, 40, 45: ±0.75
- BD 50, 52, 55: ±0.75
- BD 60: ±1.00

**M5**: Minimum 0.75, Maximum 1.75

**M8**: Minimum 0.75, Maximum 1.75

**M10**: Minimum 0.75, Maximum 1.75

**M12**: Minimum 0.75, Maximum 1.75

**M14**: Minimum 0.75, Maximum 1.75

**M16**: Minimum 0.75, Maximum 1.75

**M20**: Minimum 0.75, Maximum 1.75

---

**Notes:**

- The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal torque.
- **Z** = Number of tapped holes G on pitch circle T.
- Keyway according to DIN 6885, page 1 - Tolerance of keyway width JS10.

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**Diagram:**

- Complete Freewheels BD ... R for universal use
- Standard type
- Dimensions

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The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal torque.

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

**Z** = Number of tapped holes G on pitch circle T.
Complete Freewheels FBF
with mounting flange
with sprags, available in five types

Features
Complete Freewheels FBF with mounting flange are sealed sprag freewheels with ball bearings. They are supplied oil-filled and ready for installation.

The freewheels FBF are used as:
- Backstops
- Overrunning Clutches
- Indexing Freewheels

In addition to the standard type, four other types are available for extended service life and indexing accuracy.

Nominal torques up to 160 000 Nm.
Bores up to 300 mm. Many standard bores are available.

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 Z and 38 mm bore:
- FBF 72 LZ, d = 38 mm

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

with mounting flange
with sprags, available in five types

The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal torque.

Keyway according to DIN 6885, page 3 • 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 912) on pitch circle T.

** Z = Number of fastening holes for screws G (DIN 912) on pitch circle T.

The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal torque.

Keyway according to DIN 6885, page 3 • 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 912) on pitch circle T.

** Z = Number of fastening holes for screws G (DIN 912) on pitch circle T.

The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal torque.

Keyway according to DIN 6885, page 3 • 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 912) on pitch circle T.

** Z = Number of fastening holes for screws G (DIN 912) on pitch circle T.

The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal torque.

Keyway according to DIN 6885, page 3 • 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 912) on pitch circle T.

** Z = Number of fastening holes for screws G (DIN 912) on pitch circle T.
Complete Freewheels FGR ... SF A1A2 and FGR ... SF A2A7

Features

Complete Freewheel FGR ... SF A1A2 and FGR ... SF A2A7 with mounting flange are sealed sprag freewheels with ball bearings. They are supplied oil-filled and ready for installation.

The freewheels FGR ... SF A1A2 and FGR ... SF A2A7 are used as:
- Backstops
- Overrunning Clutches
- Indexing Freewheels

Nominal torques up to 2 150 Nm.
Bores up to 50 mm.

Application example

Complete Freewheel FGR 40 SF A1A2 as an indexing freewheel in the drive of the mixer shaft of a unit used to produce sugar. The mixer shaft must be driven step by step. This is carried out by two levers arranged opposite each other, which are moved back and forth via the hydraulic cylinders. The levers are welded onto a hub that is bolted on to the flange of the indexing freewheel. The feed drive of the mixer shaft is executed via one of the two levers and with the freewheel in driving operation. The other lever carries out the reverse turning of the outer ring while the freewheel is in freewheeling operation.
Complete Freewheels FGR ... SF A1A2 and FGR ... SF A2A7

with mounting flange

with sprags

Mounting

With Complete Freewheels FGR ... SF A1A2, the customer attachment part is centered on the external diameter D and then bolted on to the face via the flange A1.

With Complete Freewheels FGR ... SF A2A7, the customer attachment part is centered on the pilot diameter R and then bolted on to the face via flange A7. Hence, Complete Freewheels FGR ... SF 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 D or R of the attachment part must be ISO H7 or J7.

Example for ordering

Freewheel size FGR 30, standard type with flange A7 and cover A2:

- FGR 30 SF A2A7

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

- anticlockwise free or
- clockwise free
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 a simpler and more cost-effective manner.

Features

Complete Freewheel FGR … R A1A2 and FGR … R A2A7 with mounting flange are sealed roller freewheels with ball bearings. They are oil lubricated.

The freewheels FGR … R A1A2 and FGR … R A2A7 are used as:

- Backstops
- Overrunning Clutches
- Indexing Freewheels

Nominal torques up to 68 000 Nm.
Bores up to 150 mm.
Complete Freewheels FGR … R A1A2 and 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.

With Complete Freewheels FGR … R A1A2, the customer attachment part is centered on the external diameter D and bolted on to the face via flange A1.

With Complete Freewheels FGR … R A2A7, the customer attachment part is centered on the pilot diameter R and bolted on to the face via flange A7. Hence, Complete Freewheels FGR … SF 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 D or R of the attachment part must be ISO H7 or J7.

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 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:
- anticlockwise free
- clockwise free

| Freewheel Size | Type | Flange and cover combination | Nominal torque (Nm) | Max. speed (min⁻¹) | Bore d (mm) | A (mm) | D (mm) | F (mm) | G** K (mm) | L (mm) | L1 (mm) | N (mm) | N1 (mm) | R (mm) | T (mm) | Z** Weight |
|----------------|------|-------------------------------|---------------------|-------------------|-------------|-------|-------|-------|--------|-------|--------|-------|--------|-------|-------|-------|-------|
| FGR 12         | R    | A1A2 A2A7                     | 55 2 500 3 400      | 12 85 62         | 1 M5       | 3,0   | 42    | 44    | 10,0   | 10,0  | 42     | 72    | 3     | 1,2   |
| FGR 15         | R    | A1A2 A2A7                     | 130 2 200 4 800     | 15 92 68         | 1 M5       | 3,0   | 52    | 54    | 11,0   | 11,0  | 47     | 78    | 3     | 1,6   |
| FGR 20         | R    | A1A2 A2A7                     | 180 1 900 4 100     | 20 98 75         | 1 M5       | 3,0   | 57    | 59    | 10,5   | 10,5  | 55     | 85    | 4     | 1,9   |
| FGR 25         | R    | A1A2 A2A7                     | 290 1 550 3 350     | 25 118 90        | 1 M6       | 3,0   | 60    | 62    | 11,5   | 11,5  | 68     | 104   | 4     | 2,9   |
| FGR 30         | R    | A1A2 A2A7                     | 500 1 400 3 050     | 30 128 100       | 1 M6       | 3,0   | 68    | 70    | 11,5   | 11,5  | 75     | 114   | 6     | 3,9   |
| FGR 35         | R    | A1A2 A2A7                     | 730 1 300 2 850     | 35 140 110       | 1 M6       | 3,5   | 74    | 76    | 13,5   | 13,5  | 80     | 124   | 6     | 4,9   |
| FGR 40         | R    | A1A2 A2A7                     | 1 000 1 150 2 500   | 40 160 125       | 1 M8       | 3,5   | 86    | 88    | 15,5   | 15,5  | 90     | 142   | 6     | 7,5   |
| FGR 45         | R    | A1A2 A2A7                     | 1 150 1 100 2 400   | 45 165 130       | 1 M8       | 3,5   | 86    | 88    | 15,5   | 15,5  | 95     | 146   | 8     | 7,8   |
| FGR 50         | R    | A1A2 A2A7                     | 2 100 950 2 050     | 50 185 150       | 1 M8       | 4,0   | 94    | 96    | 14,0   | 14,0  | 110    | 166   | 8     | 10,8  |
| FGR 55         | R    | A1A2 A2A7                     | 2 600 900 1 900     | 55 204 160       | 1 M10      | 4,0   | 104   | 106   | 18,0   | 18,0  | 115    | 182   | 8     | 14,0  |
| FGR 60         | R    | A1A2 A2A7                     | 3 500 800 1 800     | 60 214 170       | 1 M10      | 4,0   | 114   | 116   | 17,0   | 17,0  | 125    | 192   | 10    | 16,8  |
| FGR 70         | R    | A1A2 A2A7                     | 6 000 700 1 600     | 70 234 190       | 1 M10      | 4,0   | 134   | 136   | 18,5   | 18,5  | 140    | 212   | 10    | 20,8  |
| FGR 80         | R    | A1A2 A2A7                     | 6 800 690 1 400     | 80 254 210       | 1 M10      | 4,0   | 144   | 146   | 21,0   | 21,0  | 160    | 232   | 10    | 27,0  |
| FGR 90         | R    | A1A2 A2A7                     | 11 000 500 1 300    | 90 278 230       | 1 M12      | 4,5   | 158   | 160   | 20,5   | 20,5  | 180    | 254   | 10    | 40,0  |
| FGR 100        | R    | A1A2 A2A7                     | 20 000 350 1 100    | 100 335 270      | 1 M16      | 5,0   | 182   | 184   | 30,0   | 30,0  | 210    | 305   | 10    | 67,0  |
| FGR 130        | R    | A1A2 A2A7                     | 31 000 250 900      | 130 380 310      | 1 M16      | 5,0   | 212   | 214   | 29,0   | 29,0  | 240    | 345   | 12    | 94,0  |
| FGR 150        | R    | A1A2 A2A7                     | 68 000 200 700      | 150 485 400      | 1 M20      | 5,0   | 246   | 248   | 32,0   | 32,0  | 310    | 445   | 12    | 187,0 |

The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal torque.

Keyway according to DIN 6885, page 1 • Tolerance of keyway width ±0,10.

** Z = Number of fastening holes for screws G (DIN 912) on pitch circle T.
Complete Freewheels BM … X
for keyway connection on the outer ring with sprag lift-off X

Features
Complete Freewheels BM… X are sealed sprag freewheels with ball bearings and sprag lift-off X. They are supplied oil-filled and ready for installation.

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

The freewheels BM … X are used as:
- Backstops
- Overrunning Clutches

for applications with high speed freewheeling operation and when used as overrunning clutch with low speed driving operation.

Nominal torques up to 42 500 Nm.

Bores up to 150 mm.

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 ... X
for keyway connection on the outer ring
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**

Freewheel size BM 55, type with sprag lift-off X and 90 mm bore:
- BM 55 SX, d = 90 mm

<table>
<thead>
<tr>
<th>Freewheel Size</th>
<th>Type</th>
<th>Nominal torque Nom.</th>
<th>Sprag lift-off at inner ring Freewheel/overruns</th>
<th>Max. speed Inner ring freewheels/overruns</th>
<th>Bore d mm</th>
<th>A mm</th>
<th>D mm</th>
<th>F mm</th>
<th>L mm</th>
<th>M mm</th>
<th>N mm</th>
<th>O mm</th>
<th>P mm</th>
<th>Weight kg</th>
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</thead>
<tbody>
<tr>
<td>BM 20 DX</td>
<td>420</td>
<td>750</td>
<td>1700</td>
<td>300</td>
<td>30</td>
<td>121</td>
<td>105</td>
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<td>77</td>
<td>20.25</td>
<td>8</td>
<td>33</td>
<td>4.0</td>
<td>2.5</td>
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<tr>
<td>BM 25 DX</td>
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<td>700</td>
<td>1600</td>
<td>290</td>
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<td>40</td>
<td>38</td>
<td>0.75</td>
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<td>22.25</td>
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<td>0.75</td>
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<td>150</td>
<td>150</td>
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<td>156</td>
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<td>11.5</td>
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</tbody>
</table>

The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal torque.

Keyway according to DIN 6885, page 1 • Tolerance of keyway width ±0.10.

**Dimensions**

For extended service life using sprags lift-off at high speed rotating inner ring

**Overrunning Clutch**

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.
Complete Freewheels BM … R
for keyway connection on the outer ring with rollers

Features
Complete Freewheels BM … R are sealed roller freewheels with ball bearings. They are supplied oil-filled and ready for installation. The freewheels BM … R are used as:
- Backstops
- Overrunning Clutches
- Indexing Freewheels
Nominal torques up to 57 500 Nm.
Bores up to 150 mm.

Application example
Complete Freewheel BM 40 R as an overrunning clutch on the shaft end of the main drive of a paper processing machine. The pulley is connected to an auxiliary drive. In normal operation (freewheeling operation) the inner ring overruns and the outer ring is at a standstill with the attached pulley. During set-up (driving operation) the machine is driven by an auxiliary drive via the pulley at a low speed.
### Complete Freewheels BM ... R

**for keyway connection on the outer ring with rollers**

#### Dimensions

<table>
<thead>
<tr>
<th>Freewheel Size</th>
<th>Type</th>
<th>Nominal torque Nm</th>
<th>Inner ring freewheels/overruns</th>
<th>Outer ring freewheels/overruns</th>
<th>Max. speed</th>
<th>Bore d</th>
<th>A</th>
<th>D</th>
<th>F</th>
<th>L</th>
<th>M</th>
<th>N</th>
<th>O</th>
<th>P</th>
<th>S</th>
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<td>160</td>
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<td>500</td>
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<td>520</td>
<td>440</td>
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<td>491</td>
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<td>732,0</td>
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</table>

The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal torque.

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

### 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

Freewheel size BM 20, standard type and 30 mm bore:
- BM 20 R, d = 30 mm
Complete Freewheels FGRN ... R A5A6
for keyway connection on the outer ring
with rollers

Features
Complete Freewheels FGRN... R A5A6 are sealed roller freewheels with ball bearings. They are oil lubricated.
The freewheels FGRN... R A5A6 are used as:
- Backstops
- Overrunning Clutches
- Indexing Freewheels
Nominal torques up to 6 800 Nm.
Bores up to 80 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

<table>
<thead>
<tr>
<th>Freewheel</th>
<th>Type</th>
<th>Cover combination</th>
<th>Nominal Torque Nm</th>
<th>Max. speed Inner ring freewheels/overruns min⁻¹</th>
<th>Outer ring freewheels/overruns min⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>FGRN 12</td>
<td>R A5</td>
<td>55</td>
<td>3 600</td>
<td>12 70 62</td>
<td>1 42 10,0 4 2,5 20 1,2</td>
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<tr>
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<td>R A5</td>
<td>130</td>
<td>4 800</td>
<td>15 76 68</td>
<td>1 52 11,0 5 3,0 28 1,6</td>
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<tr>
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<tr>
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<td>25 99 90</td>
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<td>2 500</td>
<td>40 135 125</td>
<td>1 86 15,5 12 5,0 53 7,5</td>
</tr>
<tr>
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<td>R A5</td>
<td>1150</td>
<td>2 400</td>
<td>45 140 130</td>
<td>1 86 15,5 14 5,5 53 7,8</td>
</tr>
<tr>
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<td>R A5</td>
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<td>2 050</td>
<td>50 160 150</td>
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<tr>
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<td>1 900</td>
<td>55 170 160</td>
<td>1 104 18,0 16 6,0 66 14,0</td>
</tr>
<tr>
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<td>1 800</td>
<td>60 182 170</td>
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</tr>
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<td>80 222 210</td>
<td>1 144 21,0 22 9,0 100 27,0</td>
</tr>
</tbody>
</table>

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:
- anticlockwise free or
- clockwise free

The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal torque.

Keyway according to DIN 6885, page 1 • Tolerance of keyway width JS10.
Application example
Complete Freewheel BA 52 SXG as a backstop on a radial fan. The backstop prevents a reverse rotation of the fan shaft from air flow or from an incorrectly polarized drive motor. By pulling out the holding pin, the shaft can be turned in both directions in order to carry out maintenance work. With the high shaft speed, the type with sprag lift-off X is used; the sprags work in freewheeling operation without contact and hence are wear-free.

Features
Complete Freewheels BA ... XG and BC ... XG with lever arm are sprag freewheels with grease-lubricated ball bearings and with sprag lift-off X.
The sprag lift-off X ensures wear-free freewheeling operation when the inner ring rotates at high speed.
The freewheels BA ... XG have an end cover and are fitted to shaft ends.
The freewheels BC ... XG are arranged on through shafts.
The freewheels BA ... XG and BC ... XG are used as:
- Backstops
for applications with high speed freewheeling operation.
Nominal torques up to 42 500 Nm.
Bores up to 150 mm.

Complete Freewheels BA ... XG and BC ... XG
with lever arm
with sprag lift-off X and grease lubrication
Complete Freewheels BA … XG and BC … XG

with lever arm

with sprag lift-off X and grease lubrication

### Type with sprag lift-off X

For extended service life using sprag lift-off at high speed rotating inner ring

<table>
<thead>
<tr>
<th>Freewheel Size</th>
<th>Type</th>
<th>Nominal Torque</th>
<th>Sprag lift-off at inner ring speed</th>
<th>Max speed Inner ring freewheels</th>
<th>Bore d</th>
<th>A</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>H</th>
<th>K</th>
<th>L</th>
<th>N</th>
<th>O</th>
<th>P</th>
<th>Q</th>
<th>R</th>
<th>S for Screw</th>
<th>Weight kg</th>
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<td>BC 20</td>
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<td>372</td>
<td>80.5</td>
<td>280</td>
<td>270</td>
</tr>
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</table>

The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal torque.

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

### 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 should have 0.5 to 2 mm play in the axial and radial directions.

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

The freewheels BC … XG are supplied ready for installation.

In the case of freewheels BA … XG, the inner ring must be secured axially with a retainer plate. Retainer plate with fastening screw can be supplied upon request.

### Example for ordering

Frewheel size BC 45 type with sprag lift-off X, grease lubrication and 65 mm bore:

- BC 45 SXG, d = 65 mm

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

- anticlockwise free
- clockwise free
Complete Freewheels BA … X and BC … X

with lever arm
with sprag lift-off X

Features

Complete Freewheels BA … X and BC … X with lever arm are sealed sprag freewheels with ball bearings and with sprag lift-off X. The sprag lift-off X ensures wear-free freewheeling operation when the inner ring rotates at high speed.

The freewheels BA … X 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.

The freewheels BC … X are supplied oil-filled and are arranged on through shafts.

The freewheels BA … X and BC … X are used as:

- Backstops

for applications with high speed freewheeling operation.

Nominal torques up to 42 500 Nm.

Bores up to 150 mm.

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 … X and BC … X

with lever arm
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 should have 0.5 to 2 mm play in the axial and radial directions.

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

The freewheels BC … X are supplied oil-filled and ready for installation.

In the case of freewheels BA … X, the inner ring must be secured axially with a retainer plate. Retainer plate with fastening screw and two seals can be supplied upon request. 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:
- anticlockwise free or
- clockwise free

The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal torque.

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

The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal torque.

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

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

Keyway according to DIN 6885, page 1 · Tolerance of keyway width JS10.
Complete Freewheels BA … R and BC … R

with lever arm
with rollers

Features

Complete Freewheels BA … R and BC … R with lever arm are sealed roller freewheels with ball bearings.

The freewheels BA … R have an end cover and are fitted to shaft ends. The oil filling is carried out after the freewheel has been installed to the end of the shaft.

The freewheels BC … R are supplied oil-filled and are arranged on through shafts.

The freewheels BA … R and BC … R are used as:

- Backstops

for applications with low to medium speed freewheeling operation.

Nominal torques up to 57 500 Nm.

Bores up to 150 mm.

Application example

Complete Freewheel BA 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 BA … R and BC … R

with lever arm
with rollers

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

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 should have 0.5 to 2 mm play in the axial and radial directions.

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

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 should have 0.5 to 2 mm play in the axial and radial directions.

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

Example for ordering

Frehweel size BD 40, standard type and 50 mm bore:

- BA 30 R, d = 50 mm

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

- anticlockwise free or
- clockwise free
**Complete Freewheels FGR … R A3A4 and FGR … R A2A3**

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

---

**Features**

Complete Freewheel FGR ... R A2A3 and 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 the shaft ends.

The freewheels FGR ... R A2A3 are arranged on through shafts.

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

The freewheels FGR ... R A2A3 and FGR ... R A3A4 are used as:

- Backstops

for applications with low to medium speed freewheeling operation.

Nominal torques up to 68 000 Nm.

Bores up to 150 mm.

---

**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.
Complete Freewheels FGR … R A3A4 and FGR … R A2A3

with lever arm
with rollers

### Standard type

**For universal use**

### Dimensions

| Freewheel Size | Type | Lever arm and cover combination | Nominal Torque Nm | Max. speed Inner ring freewheels min⁻¹ | Bore d | D | E | F | H | L | N | O | P | Q | S | Weight kg |
|----------------|------|---------------------------------|-------------------|---------------------------------------|--------|----|----|----|----|----|----|----|----|----|----|----|--------|
| FGR 12         | R A2A3 A3A4 | 55                              | 2 500             | 12 62 15 1 51 42 10 64 10 84 12 14 1,4 |
| FGR 15         | R A2A3 A3A4 | 130                             | 2 200             | 15 68 13 1 62 52 10 78 10 47 12 1,8 |
| FGR 20         | R A2A3 A3A4 | 180                             | 1 900             | 20 75 15 1 72 57 11 82 12 54 12 2,3 |
| FGR 25         | R A2A3 A3A4 | 290                             | 1 550             | 25 90 17 1 84 60 14 85 16 62 12 3,4 |
| FGR 30         | R A2A3 A3A4 | 500                             | 1 400             | 30 100 17 1 92 68 14 95 16 68 12 4,5 |
| FGR 35         | R A2A3 A3A4 | 730                             | 1 300             | 35 110 22 1 102 74 18 102 20 76 12 5,6 |
| FGR 40         | R A2A3 A3A4 | 1 000                           | 1 150             | 40 125 22 1 112 86 18 115 20 85 13 8,5 |
| FGR 45         | R A2A3 A3A4 | 1 150                           | 1 100             | 45 130 26 1 120 86 22 115 25 90 14 8,9 |
| FGR 50         | R A2A3 A3A4 | 2 100                           | 2 950             | 50 150 26 1 155 94 22 155 25 102 15 12,8 |
| FGR 55         | R A2A3 A3A4 | 2 600                           | 1 600             | 55 160 30 1 142 104 25 138 32 108 18 16,2 |
| FGR 60         | R A2A3 A3A4 | 3 500                           | 1 800             | 60 170 30 1 145 114 25 147 32 112 18 19,3 |
| FGR 70         | R A2A3 A3A4 | 6 000                           | 1 700             | 70 190 35 1 175 143 30 168 38 135 17 23,5 |
| FGR 80         | R A2A3 A3A4 | 6 800                           | 1 600             | 80 210 35 1 185 144 30 178 38 145 17 32,0 |
| FGR 90         | R A2A3 A3A4 | 1 100                           | 1 500             | 90 230 45 1 205 158 40 192 50 155 17 47,2 |
| FGR 100        | R A2A3 A3A4 | 2 000                           | 1 350             | 100 270 45 1 230 182 40 217 50 180 17 76,0 |
| FGR 130        | R A2A3 A3A4 | 3 100                           | 1 250             | 130 310 60 1 268 212 55 250 68 205 18 110,0 |
| FGR 150        | R A2A3 A3A4 | 6 800                           | 1 200             | 150 400 60 1 325 246 55 286 68 255 20 214,0 |

The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal torque.

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

### Mounting

**Basic Freewheel, lever arm, 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 FGR … R A2A3 already oil-filled can be supplied.

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 should have 0.5 to 2 mm play in the axial and radial directions.

### Example for ordering

**Freewheel size FGR 25, standard type with lever arm A3 and cover A4:**
- FGR 25 R A3A4

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

In the case of freewheels FGR … R A3A4, the inner ring must be secured axially with a retainer plate. The tolerance of the shaft must be ISO h6 or j6.

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

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:
- anticlockwise free or
- clockwise free
Application example

Complete Freewheel FA 82 SFP as an indexing freewheel for the material feed of a punch. The freewheel is driven by a bell crank. The type with P-grinding does not just give the freewheel an increased service life, but also an increased indexing accuracy.

Features

Complete Freewheels FA with lever arm are sprag freewheels with sleeve bearings. They are grease-lubricated and therefore maintenance-free.

The freewheels FA are used as:
- Backstops
- Indexing Freewheels

for applications with low speed freewheeling operation when used as a backstop or with a low to medium total number of actuations when used as an indexing freewheel.

In addition, the standard type, two other types are available for extended service life and indexing accuracy.

Nominal torques up to 2 500 Nm.
Bores up to 85 mm.
## Complete Freewheels FA

*with lever arm*
*with sprags and grease lubrication*

---

### Freewheel Size | Standard type | Type with RIDUVIT® | Type with P-grinding | Dimensions
| --- | --- | --- | --- |
| FA 37 SFT | 230 | 250 | 500 | Bore d mm
| FA 57 SFT | 630 | 170 | 340 | C mm
| FA 82 SFT | 1 600 | 130 | 260 | D mm
| FA 107 SFT | 2 500 | 90 | 1 830 | E mm

### Nominal Torque
- Standard type: mm
- Type with RIDUVIT®: mm
- Type with P-grinding: mm

### Max. speed
- Inner ring freewheels (min⁻¹)
- Nominal Torque (Nm)
- Max. speed (min⁻¹)

### Dimensions
- C
- D
- E
- H
- L
- N
- Weight kg

### Notes:
- The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal 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.

### 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 should 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
- Freewheel size FA 57, type with RIDUVIT® and 40 mm bore:
  - FA 57 SFT, d = 40 mm
Complete Freewheels FAV

with lever arm
with rollers and grease lubrication

Features
Complete Freewheels FAV with lever arm are roller freewheels with sleeve bearings. They are grease-lubricated and therefore maintenance-free.

The freewheels FAV are used as:
- Backstops
- Indexing Freewheels

for applications with low speed freewheeling operation when used as a backstop or with a low to high total number of actuations when used as an indexing freewheel.

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

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 should 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

The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal torque.

Keyway according to DIN 6885, page 1 - Tolerance of keyway width JS10.
Complete Freewheels FBL

with shaft coupling for large shaft misalignements
with sprags, available in three types

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.
The freewheels FBL are used as:

- Overrunning Clutches

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 shaft coupling can accept large radial and angular misalignments, without having a negative effect on the reactive forces of the neighbouring bearings. We can provide you with performance data upon request.

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.
### Complete Freewheels FBL

**with shaft coupling for large shaft misalignments with sprags, available in three types**

#### Freewheel Size

<table>
<thead>
<tr>
<th>Freewheel Size</th>
<th>Type</th>
<th>Nominal Torque Nm</th>
<th>Max. speed Inner ring overruns min(^{-1})</th>
<th>Max. speed Outer ring overruns min(^{-1})</th>
<th>Nominal Torque Nm</th>
<th>Max. speed Inner ring overruns min(^{-1})</th>
<th>Max. speed Outer ring overruns min(^{-1})</th>
<th>Nominal Torque Nm</th>
<th>Max. speed Inner ring overruns min(^{-1})</th>
<th>Max. speed Outer ring overruns min(^{-1})</th>
</tr>
</thead>
<tbody>
<tr>
<td>FBL 37</td>
<td>SF</td>
<td>85</td>
<td>2500</td>
<td>2600</td>
<td>SFT</td>
<td>85</td>
<td>2500</td>
<td>2600</td>
<td>CZ</td>
<td>85</td>
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<td>1900</td>
<td>2200</td>
<td>SFT</td>
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<td>2200</td>
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<tr>
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<td>1600</td>
<td>SFT</td>
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<td>1120</td>
<td>1600</td>
<td>LZ</td>
<td>430</td>
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<tr>
<td>FBL 82</td>
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<td>1025</td>
<td>1450</td>
<td>SFT</td>
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<td>1450</td>
<td>SFZ</td>
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<td>1250</td>
<td>SFT</td>
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<td>SFZ</td>
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</tr>
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<td>FBL 127</td>
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<td>1150</td>
<td>SFT</td>
<td>4000</td>
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<td>SFT</td>
<td>8000</td>
<td>750</td>
<td>1050</td>
<td>SFZ</td>
<td>8000</td>
</tr>
</tbody>
</table>

*The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal torque.*

#### 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

Freewheel size FBL 72, type with sprag lift-off Z and 38 mm bore in the freewheel and 40 mm bore in the shaft coupling:

- FBL 72 LZ, d1 = 38 mm, d2 = 40 mm
Complete Freewheels FBE
with shaft coupling for small shaft misalignments
with sprags, available in three types

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. The freewheels FBE are used as:

- Overrunning Clutches

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.

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.

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, d2 = 55 mm
### Complete Freewheels FBE

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

#### Freewheel Size

<table>
<thead>
<tr>
<th>Size</th>
<th>Type</th>
<th>Nominal Torque</th>
<th>Max. speed</th>
<th>Inner ring overruns</th>
<th>Outer ring overruns</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Nm</td>
<td>min⁻¹</td>
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<td>5,000</td>
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<td>320</td>
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<td>400</td>
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</tbody>
</table>

#### For universal use

For extended service life with coated sprags

#### Type with Sprag lift-off Z

For extended service life using sprags lift-off at high speed rotating outer ring

The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal torque.

---

**Freewheel Size**

<table>
<thead>
<tr>
<th>Standard</th>
<th>Bore d₁</th>
<th>Bore d₃</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>H</th>
<th>L</th>
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<tbody>
<tr>
<td>mm</td>
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</table>

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

* Keyway according to DIN 6885, page 3 • Tolerance of keyway width J510.
Housing Freewheels FKhG
for stationary arrangement
with hydrodynamic sprag lift-off for multimotor drives

Features

Housing Freewheels FKhG with hydrodynamic sprag 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.

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

The freewheels FKhG are used as:

- Overrunning Clutch

if the speeds in freewheeling operation and in driving operation are the same or similarly high. Nominal torques up to 14 000 Nm.

Shaft diameter up to 110 mm.

Hydrodynamic sprag lift-off

Housing Freewheels FkhG are equipped with hydrodynamic sprag lift-off. The hydrodynamic sprag 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 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 and FKhG) 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.
Housing Freewheels FKhG
for stationary arrangement
with hydrodynamic sprag lift-off for multimotor drives

Areas of application
Multimotor drives will be provided for two main reasons:
• Utmost security for a continuous plant operation in the event that one of the energy sources or a drive line fails.
• Energy saving in the case of partial load operation

Overrunning clutches as automatic clutches fulfil here an important function. They disengage the drive independently as soon as it no longer provides power to the working machine. The overrunning clutches do not require any external switching facilities.

Application example
Two Housing Freewheels FKhG 148 ATR in the multimotor drive of a coolant pump in a nuclear power plant. Under normal circumstances the pump is driven by the electric motor. In the event of a fault, the diesel engine is put into operation by a safety device, and continues to drive the pump without interrupting the coolant circulation. The Housing Freewheels automatically engage the respective working drive to the pump.

Application example
Three Housing Freewheels FKhG 2.53 ATR in the multimotor drive of a fresh air fan. The fan is driven by one or two electric motors. An additional auxiliary drive serves to slowly turn the fan for the purposes of inspection work or for an even cooling down after shut down. The Housing Freewheels automatically engage the respective working electric motor to the fan.
**Selection of Housing Freewheel**

We shall be pleased to advice you on the selection of a suitable Housing Freewheel. We can provide you with complete dimensions and technical data to aid in your design. If required, you will receive with the delivery quality certificates from our factory’s own quality assurance department or from a recognised classification office.

**Advantages**

- For the automatic engagement and disengagement of multimotor drives
- Designed for continuous operation
- Extremely long service life due to wear-free freewheeling operation by means of hydrodynamic sprag lift-off
- Technically sophisticated design
- Oil pumping by means of the integrated pitot tube
- Long oil-change intervals due to large oil volume
- Oil level can be checked or changed without shut down
- Low bearing forces due to use of large bearings results in long bearing life
- The spring characteristic curve is available for vibrational calculations
Housing Freewheels FKhG
for stationary arrangement
with hydrodynamic sprag lift-off for multimotor drives

![Diagram of Housing Freewheel](image)

### Mounting

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

### Accessories

During freewheeling operation, the stationary input shaft of the Housing Freewheel is effected by a drag torque from the freewheeling output shaft. The amount of drag torque depends on the size of the unit and the freewheeling speed; it could reach up to 20 Nm. If during freewheeling operation the torsional resistance of the adjacent drive is lower than the drag torque of the Housing Freewheel, it can be fitted with a brake to prevent the drive from being carried along during freewheeling operation. Therefore we offer:

- Built-in electromagnetic brake with indicator showing the operating conditions
- External brake

### Example for ordering

Prior to ordering, please complete the questionnaire on page 113 so that we can check the selection.

### Dimensions (mm)

<table>
<thead>
<tr>
<th>Freewheel Size</th>
<th>Type</th>
<th>Nominal torque</th>
<th>Max. speed</th>
<th>Input shaft drives</th>
<th>Shaft d1 and d2</th>
<th>Output shaft drives</th>
</tr>
</thead>
<tbody>
<tr>
<td>FKhG 24</td>
<td>ATR</td>
<td>1 100</td>
<td>2 400</td>
<td>2 400</td>
<td>45</td>
<td>300</td>
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<td>ATR</td>
<td>2 250</td>
<td>2 400</td>
<td>2 400</td>
<td>45</td>
<td>300</td>
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<tr>
<td>FKhG 94</td>
<td>ATR</td>
<td>3 400</td>
<td>1 800</td>
<td>1 800</td>
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<td>380</td>
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<td>FKhG 106</td>
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<td>1 800</td>
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<td>380</td>
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<tr>
<td>FKhG 148</td>
<td>ATR</td>
<td>7 000</td>
<td>1 500</td>
<td>1 500</td>
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<td>380</td>
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<tr>
<td>FKhG 2.53</td>
<td>ATR</td>
<td>14 000</td>
<td>1 500</td>
<td>1 500</td>
<td>110</td>
<td>380</td>
</tr>
</tbody>
</table>

The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal torque.

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

The freewheel sizes FKhG 24 and FKhG 28 are not equipped with a cooling fan.
**Basic Freewheels FBO**
for assembly with customer connecting parts with sprags, available in five types

---

**Application example**
Basic Freewheel FBO 127 SF as an overrunning clutch between the creep drive and the main drive of a cement mixer. In the case of creep operation, 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 and the creep drive is automatically disengaged. The freewheel is connected to the oil lubrication of the main gearbox and does not require any special maintenance. The arrangement of the seals between the freewheel and the main gearbox is advantageous. In normal operation (freewheeling operation), this is at a standstill and hence generates no additional friction-related temperature rise.

---

**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.

---

**Features**
Basic Freewheels FBO are sprag freewheels with ball bearings to be assembled with customer connecting parts. The freewheels are particularly suitable for installation in housings with oil lubrication and seals.
The freewheels FBO are used as:
- Backstops
- Overrunning Clutches
- Indexing Freewheels

In addition to the standard type, four other types are available for extended service life and indexing accuracy.
Nominal torques up to 160 000 Nm.
Bores up to 300 mm. Many standard bores are available.

---

**Example for ordering**
Freewheel size FBO 72, type with P-grinding and 38 mm bore:
- FBO 72 SFP, d = 38 mm
Basic Freewheels FBO

for assembly with customer connecting parts with sprags, available in five types

### Standard type
For universal use

### Type with RUDUVIT®
For extended service life with coated sprags

### Type with spray lift-off X
For extended service life using sprags lift-off at high-speed rotating inner ring

### Type with spray lift-off Z
For extended service life using sprags lift-off at high-speed rotating outer ring

### Type with P-grinding
For extended service life and indexing accuracy

---

<table>
<thead>
<tr>
<th>Freewheel Size</th>
<th>Type</th>
<th>Nominal torque Nm</th>
<th>Max. inner ring overruns Nm</th>
<th>Max. outer ring overruns Nm</th>
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<tbody>
<tr>
<td>FBO 37</td>
<td>SF</td>
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<td>1 200</td>
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<td>FBO 44</td>
<td>SF</td>
<td>150</td>
<td>1 200</td>
<td>2 200</td>
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<td>FBO 57</td>
<td>SF</td>
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<td>1 200</td>
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<td>FBO 72</td>
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<td>250</td>
<td>1 200</td>
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<td>2 200</td>
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<td>2 200</td>
</tr>
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<td>FBO 127</td>
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<td>400</td>
<td>1 200</td>
<td>2 200</td>
</tr>
<tr>
<td>FBO 140</td>
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<td>450</td>
<td>1 200</td>
<td>2 200</td>
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<td>2 200</td>
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<tr>
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<tr>
<td>FBO 340</td>
<td>SF</td>
<td>600</td>
<td>1 200</td>
<td>2 200</td>
</tr>
</tbody>
</table>

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**Keyways according to DIN 6885, page 3 - Tolerance of keyway width ±0.05.**

* Keyway according to DIN 6885, page 3 - Tolerance of keyway width ±0.05.

** Z = Number of fastening holes for screws (DIN 912) on pitch circle T.

*** C1 = Centering depth of connecting parts for standard type, type with RUDUVIT® and type with P-grinding.

C2 = Centering depth of connecting parts for type with spray lift-off X.

C3 = Centering depth of connecting parts for type with spray lift-off Z.

---

The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal 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.
Features

Basic Freewheels FGR...SF are sprag freewheels with ball bearings to be assembled with customer connecting parts. The freewheels are particularly suitable for installation in housings with oil lubrication and seals.

Freewheels of series FGR ...SF are used as:
- Backstops
- Overrunning Clutches
- Indexing Freewheels

Nominal torques up to 2 150 Nm.
Bores up to 50 mm.

Application example

Basic Freewheel FGR 45 SF as an indexing freewheel for the gradual drive of a conveyor train in a wood shaving silo. The indexing lever is driven by a crank. The back and forth movement is transferred by the indexing freewheel in a gradual rotating movement of the conveyor train. As the conveyor train does not require a continuous drive, the indexing freewheel replaces a more elaborate reduction gear.
Basic Freewheels FGR … SF
for assembly with customer connecting parts with sprags

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
Freewheel size FGR 35, standard type:
- FGR 35 SF

The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal 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.

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

** Z = Number of tapped holes G on pitch circle T.
Basic Freewheels FGR … R
for assembly with customer 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 calliper. The backdriving 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 calliper is opened manually.

Features
Basic Freewheels FGR … R are roller freewheels with ball bearings to be assembled with customer connecting parts. The freewheels are particularly suitable for installation in housings with oil lubrication and seals.
Freewheels of series FGR … R are used as:
- Backstops
- Overrunning Clutches
- Indexing Freewheels
Nominal torques up to 68 000 Nm.
Bores up to 150 mm.
Basic Freewheels FGR ... R
for assembly with customer 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
Freewheel size FGR 35, standard type:
• FGR 35 R

The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal torque.

Keyway according to DIN 6885, page 1 • Tolerance of keyway width \( \text{JS10} \).

** \( Z \) = Number of tapped holes \( G \) on pitch circle \( T \).

### Freewheel

| Freewheel Size | Type | Nominal torque \( \text{Nm} \) | Inner ring freewheels/overruns \( \text{mm}^1 \) | Outer ring freewheels/overruns \( \text{mm}^1 \) | Max. speed \( \text{Inner }: \text{Outer} \) | Bore \( d \) | B | C | D | E | F | G** | H | L | T | Z** | Weight | kg |
|---------------|------|-----------------|-----------------|-----------------|-----------------|-------|-----|----|----|----|----|-----|----|----|----|-----|-------|
| FGR 12 R      | R    | 55              | 2500            | 3400            | 12              | 20    | 3.5 | 62 | 20 | 42 | M5 | 42   | 51  | 3   | 0.5 |
| FGR 15 R      | R    | 130             | 2200            | 4800            | 15              | 28    | 2.0 | 68 | 25 | 47 | M5 | 52   | 56  | 3   | 0.8 |
| FGR 20 R      | R    | 180             | 1900            | 4100            | 20              | 34    | 2.4 | 75 | 30 | 55 | M5 | 57   | 64  | 4   | 1.0 |
| FGR 25 R      | R    | 290             | 1550            | 3350            | 25              | 35    | 2.4 | 90 | 40 | 68 | M6 | 60   | 78  | 4   | 1.5 |
| FGR 30 R      | R    | 500             | 1400            | 3050            | 30              | 43    | 2.4 | 100| 45 | 75 | M6 | 68   | 87  | 6   | 2.2 |
| FGR 35 R      | R    | 730             | 1300            | 2850            | 35              | 45    | 2.9 | 110| 50 | 80 | M6 | 74   | 96  | 6   | 3.0 |
| FGR 40 R      | R    | 1 000           | 1150            | 2500            | 40              | 53    | 2.9 | 125| 55 | 90 | M8 | 86   | 108 | 6   | 4.6 |
| FGR 45 R      | R    | 1 150           | 1180            | 2400            | 45              | 53    | 2.9 | 130| 60 | 95 | M8 | 86   | 112 | 8   | 4.7 |
| FGR 50 R      | R    | 2 100           | 950             | 2050            | 50              | 64    | 3.9 | 150| 70 | 110| M8 | 94   | 112 | 8   | 7.2 |
| FGR 55 R      | R    | 2 600           | 900             | 1900            | 55              | 66    | 2.9 | 160| 75 | 115| M10| 104  | 138 | 8   | 8.6 |
| FGR 60 R      | R    | 3 500           | 800             | 1800            | 60              | 78    | 5.4 | 170| 80 | 125| M10| 114  | 150 | 10  | 10.5|
| FGR 70 R      | R    | 6 000           | 700             | 1600            | 70              | 95    | 6.4 | 190| 90 | 140| M10| 134  | 165 | 10  | 13.4|
| FGR 80 R      | R    | 6 800           | 600             | 1400            | 80              | 100   | 3.9 | 210| 105| 160| M10| 144  | 185 | 10  | 18.2|
| FGR 90 R      | R    | 11 000          | 500             | 1300            | 90              | 115   | 4.9 | 230| 120| 180| M12| 158  | 206 | 10  | 28.0|
| FGR 100 R     | R    | 20 000          | 350             | 1000            | 100             | 120   | 5.4 | 270| 140| 210| M16| 182  | 240 | 10  | 43.0|
| FGR 130 R     | R    | 31 000          | 250             | 900             | 130             | 152   | 7.9 | 310| 160| 240| M16| 212  | 278 | 12  | 66.0|
| FGR 150 R     | R    | 68 000          | 200             | 700             | 150             | 180   | 6.9 | 400| 200| 310| M20| 246  | 360 | 12  | 136.0|

The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal torque.

** Keyway according to DIN 6885, page 1 • Tolerance of keyway width \( \text{JS10} \).

** \( Z \) = Number of tapped holes \( G \) on pitch circle \( T \).
Integrated Freewheels FXM

for bolting to the face
with sprag lift-off X

Features

Integrated Freewheels FXM are sprag free-wheels 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 freewheels FXM are used as:

- Backstops
- Overrunning Clutches

for applications with high speed freewheeling operation and when used as an overrunning clutch with low speed driving operation.

Nominal torques up to 364 000 Nm.

Bores up to 320 mm. Many standard bores are available.

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 120 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 anticlockwise 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 121). 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 SX 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 SX 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 DX 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.
The permissible run out (T.I.R.) must be outer ring must be provided by the customer.

Integrated Freewheels FXM are without bearing parts. Then the nominal torques specified in the table apply, whilst taking into consideration the existing run out (T.I.R.).

The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal 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 126). 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 128).
Integrated Freewheels FXM
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 140 mm bore and end cover:
- FXM 240 - 63 UX, d = 140 mm, with end cover
Integrated Freewheels FON
for bolting to the face
with sprags, available in three types

Features
Integrated Freewheels FON are sprag freewheels without bearing support. The freewheels FON are used as:
- Backstops
- Overrunning Clutches
- Indexing Freewheels

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. Many standard bores are available.

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

<table>
<thead>
<tr>
<th>Freewheel Size</th>
<th>Standard type</th>
<th>Type with RIDUVIT®</th>
<th>Type with sprag lift-off Z</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>For universal use</td>
<td>For extended service life with coated sprags</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</th>
<th>Type</th>
<th>Nominal torque Nm</th>
<th>Max. speed Inner ring freewheels/overruns min⁻¹</th>
<th>Type</th>
<th>Nominal torque Nm</th>
<th>Max. speed Inner ring freewheels/overruns min⁻¹</th>
<th>Type</th>
<th>Nominal torque Nm</th>
<th>Sprag lift-off at outer ring speed min⁻¹</th>
<th>Max. speed Outer ring freewheels/overruns min⁻¹</th>
<th>Type</th>
<th>Nominal torque Nm</th>
</tr>
</thead>
<tbody>
<tr>
<td>FON 37</td>
<td>SF</td>
<td>220</td>
<td>2 600</td>
<td>SF</td>
<td>2 500</td>
<td>2 600</td>
<td>SF</td>
<td>2 400</td>
<td>2 700</td>
<td>3 300</td>
<td>SF</td>
<td>2 900</td>
</tr>
<tr>
<td>FON 44</td>
<td>SF</td>
<td>315</td>
<td>2 200</td>
<td>SF</td>
<td>3 150</td>
<td>2 200</td>
<td>SF</td>
<td>2 250</td>
<td>2 300</td>
<td>3 200</td>
<td>SF</td>
<td>2 500</td>
</tr>
<tr>
<td>FON 57</td>
<td>SF</td>
<td>630</td>
<td>1 750</td>
<td>SF</td>
<td>1 600</td>
<td>1 750</td>
<td>SF</td>
<td>1 550</td>
<td>1 600</td>
<td>2 200</td>
<td>SF</td>
<td>2 000</td>
</tr>
<tr>
<td>FON 72</td>
<td>SF</td>
<td>1 250</td>
<td>600</td>
<td>SF</td>
<td>1 120</td>
<td>1 200</td>
<td>SF</td>
<td>1 100</td>
<td>1 200</td>
<td>1 850</td>
<td>SF</td>
<td>1 600</td>
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<tr>
<td>FON 82</td>
<td>SF</td>
<td>1 900</td>
<td>1 450</td>
<td>SF</td>
<td>1 900</td>
<td>1 450</td>
<td>SF</td>
<td>1 900</td>
<td>1 450</td>
<td>1 600</td>
<td>SF</td>
<td>1 600</td>
</tr>
<tr>
<td>FON 107</td>
<td>SF</td>
<td>2 800</td>
<td>1 250</td>
<td>SF</td>
<td>2 800</td>
<td>1 250</td>
<td>SF</td>
<td>2 800</td>
<td>1 250</td>
<td>2 000</td>
<td>SF</td>
<td>2 000</td>
</tr>
<tr>
<td>FON 127</td>
<td>SF</td>
<td>6 300</td>
<td>1 150</td>
<td>SF</td>
<td>6 300</td>
<td>1 150</td>
<td>SF</td>
<td>6 300</td>
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<td>2 000</td>
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<td>FON 140</td>
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<td>10 000</td>
<td>1 750</td>
<td>SF</td>
<td>10 000</td>
<td>1 750</td>
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<td>10 000</td>
<td>1 750</td>
<td>3 150</td>
<td>SF</td>
<td>3 150</td>
</tr>
<tr>
<td>FON 170</td>
<td>SF</td>
<td>16 000</td>
<td>1 000</td>
<td>SF</td>
<td>16 000</td>
<td>1 000</td>
<td>SF</td>
<td>16 000</td>
<td>1 000</td>
<td>3 800</td>
<td>SF</td>
<td>3 800</td>
</tr>
<tr>
<td>FON 200</td>
<td>SF</td>
<td>25 000</td>
<td>900</td>
<td>SF</td>
<td>25 000</td>
<td>900</td>
<td>SF</td>
<td>25 000</td>
<td>900</td>
<td>6 800</td>
<td>SF</td>
<td>6 800</td>
</tr>
</tbody>
</table>

The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal 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.

<table>
<thead>
<tr>
<th>Freewheel Size</th>
<th>Bored Standard</th>
<th>Max. A</th>
<th>B</th>
<th>D</th>
<th>F</th>
<th>G**</th>
<th>J</th>
<th>L</th>
<th>P</th>
<th>T</th>
<th>Z**</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>FON 37</td>
<td>25</td>
<td>25</td>
<td>85</td>
<td>55</td>
<td>M6</td>
<td>37</td>
<td>35</td>
<td>0.3</td>
<td>70</td>
<td>6</td>
<td>0.8</td>
<td></td>
</tr>
<tr>
<td>FON 44</td>
<td>25</td>
<td>25</td>
<td>95</td>
<td>62</td>
<td>M6</td>
<td>44</td>
<td>35</td>
<td>0.5</td>
<td>80</td>
<td>8</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>FON 57</td>
<td>30</td>
<td>30</td>
<td>110</td>
<td>75</td>
<td>M8</td>
<td>57</td>
<td>45</td>
<td>0.5</td>
<td>95</td>
<td>8</td>
<td>1.7</td>
<td></td>
</tr>
<tr>
<td>FON 72</td>
<td>45</td>
<td>38</td>
<td>133</td>
<td>90</td>
<td>M8</td>
<td>72</td>
<td>60</td>
<td>1.0</td>
<td>115</td>
<td>12</td>
<td>3.0</td>
<td></td>
</tr>
<tr>
<td>FON 82</td>
<td>55</td>
<td>40</td>
<td>145</td>
<td>100</td>
<td>M10</td>
<td>82</td>
<td>60</td>
<td>1.0</td>
<td>125</td>
<td>12</td>
<td>4.0</td>
<td></td>
</tr>
<tr>
<td>FON 107</td>
<td>70</td>
<td>45</td>
<td>170</td>
<td>125</td>
<td>M10</td>
<td>107</td>
<td>65</td>
<td>1.0</td>
<td>150</td>
<td>12</td>
<td>6.0</td>
<td></td>
</tr>
<tr>
<td>FON 127</td>
<td>90</td>
<td>68</td>
<td>200</td>
<td>145</td>
<td>M12</td>
<td>127</td>
<td>75</td>
<td>1.0</td>
<td>180</td>
<td>12</td>
<td>11.5</td>
<td></td>
</tr>
<tr>
<td>FON 140</td>
<td>115</td>
<td>68</td>
<td>250</td>
<td>180</td>
<td>M16</td>
<td>140</td>
<td>75</td>
<td>1.0</td>
<td>225</td>
<td>12</td>
<td>17.0</td>
<td></td>
</tr>
<tr>
<td>FON 170</td>
<td>120</td>
<td>70</td>
<td>290</td>
<td>210</td>
<td>M16</td>
<td>170</td>
<td>75</td>
<td>1.0</td>
<td>258</td>
<td>16</td>
<td>24.0</td>
<td></td>
</tr>
<tr>
<td>FON 200</td>
<td>140</td>
<td>85</td>
<td>320</td>
<td>240</td>
<td>M16</td>
<td>200</td>
<td>85</td>
<td>1.5</td>
<td>288</td>
<td>16</td>
<td>34.0</td>
<td></td>
</tr>
</tbody>
</table>

Keyway according to DIN 6885, page 3 • Tolerance of keyway width Z510.
* Keyway according to DIN 6885, page 1 • Tolerance of keyway width Z510.
** Z = Number of fastening holes for screws G on pitch circle T.

Integrated Freewheels
Integrated Freewheels FXRV and FXRT

for bolting to the face

with sprag lift-off X and torque limiting

Features

Integrated Freewheels FXRV and FXRT are sprag freewheels without bearing support and with sprag lift-off X. They consist of the Integrated Freewheels FXM (refer to pages 62 to 65) with additional torque limiter.

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

The freewheels FXRV and FXRT are used as:

- Backstops

in the case of inclined conveyors with multiple drives, where several drives are equipped with their own backstops. In such installations, when stopping the load, the total backdriving torque initially (due to various backlashes and elasticities in the various drives) appears solely or predominately in only one backstop. This problem is solved as the torque limiter, which is built into the backstop, slips until additional backstops successively become engaged. Therefore it is achieved, that the total backdriving torque is distributed to the individual backstops. Furthermore dynamic peak torques of the locking procedure are reduced so that the reduction gear is protected from damaging peak torques. This makes the backstops FXRV and FXRT a valuable design element in increasing the operating security of inclined conveyors.

Advantages

- Protection of gearboxes from dynamic peak torques in the locking procedure
- Protection of gearboxes from overload by unequal load distribution in multiple drives
- Smaller gearboxes can be used without negatively effecting the safety
- Protection of the backstops, as dynamic peak torques are reduced by temporarily slipping
Integrated Freewheels FXRV and FXRT
for bolting to the face
with sprag lift-off X and torque limiting

Integrated Freewheels FXRV 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 70.

Integrated Freewheels FXRT with
torque limiting and with release
function
This series is designed in the same way as series FXRV; 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 71.
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.

Selection torque
If the backdriving torque $M_L$ is known, then the selection torque $M_A$ of the backstops should be determined as follows:

$$M_A = 1.2 \cdot M_L \; [Nm]$$

If, however, only the nominal power of the motor $P_0 \; [kW]$ is known, then this applies:

$$M_A = 1.2 \cdot 9550 \cdot \eta^2 \cdot \frac{P_0}{n_{SP}} \; [Nm]$$

In these equations:

$M_A = $ Selection torque of the backstop $[Nm]$

$M_L = 9550 \cdot \eta^2 \cdot \frac{P_0}{n_{SP}} \; [Nm]$ = Static backdriving torque of the load referring to the backstop shaft $[Nm]$

$P_L = $ Lifting capacity of the conveyor system at full load $[kW]$ = Lifting height $[m]$ multiplied by the load that is being conveyed per second $[kN/s]$

$P_0 = $ Nominal power of motor $[kW]$

$n_{SP} = $ Speed of backstop shaft $[min^{-1}]$

$\eta = $ Efficiency of installation

= Lifting capacity + Power loss

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

$$M_R \geq M_A$$

$M_R = $ Maximum slipping torque in accordance with the table values on pages 70 and 71 $[Nm]$

Approximate values for $\eta$:

<table>
<thead>
<tr>
<th>Type of installation</th>
<th>$\eta$</th>
<th>$\eta^2$</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 individual 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 110.
### Torques

The Integrated Freewheels FXRV are supplied with a set slipping torque $M_R$ of the torque limiter. The static backdriving torque $M_B$ 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 FXRV 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 of the attachment part must be ISO H7.

The tolerance of the shaft must be ISO h6 or h7.

### Example for ordering

Freewheel size FXRV 170 - 63 SX, type with sprag lift-off X, 90 mm bore and slipping torque 8 000 Nm:

- FXRV 170 - 63 SX, $d = 90$ mm, $M_R = 8 000$ Nm
Integrated Freewheels FXRV and FXRT
for bolting to the face
with sprag lift-off X, torque limiting and release function

### Torques

The Integrated Freewheels FXRT 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 FXRT 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 of the attachment part must be ISO H7.

The tolerance of the shaft must be ISO h6 or h7

### Release function

The finely controllable release function consists basically of three special screws (2) that are located in the spring pocket (1) and the locking plate (3). To release the backstop, first of all the special screws have to be unscrewed slightly, then the locking plate has to be turned clockwise by the angle \( W \). The special screws can then be tightened, whereupon, with the aid of the bellville spring set (4) the release procedure is finely initiated. When the release facility is actuated a small amount of oil may seep out for a brief period of time.

---

**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 912) 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

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.
The freewheels FXN are used as:
- Backstops
- Overrunning Clutches
for applications with high speed freewheeling operation and when used as an overrunning clutch with low speed driving operation.
Nominal torques up to 20 000 Nm. The torque is transmitted on the outer ring by press fit.
Bores up to 130 mm. Many standard bores are available.

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 138 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 anticlockwise 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 139). 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 DX 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 DX 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 set-up, 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 SX 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>Sprag lift-off at inner ring speed min⁻¹</th>
<th>Max. speed Inner ring freewheels/ overruns min⁻¹</th>
<th>Outer ring drives</th>
</tr>
</thead>
<tbody>
<tr>
<td>FXN 31 - 17/60</td>
<td>DX</td>
<td>100</td>
<td>890</td>
<td>5 000</td>
<td>356</td>
</tr>
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<td>FXN 31 - 17/62</td>
<td>DX</td>
<td>100</td>
<td>890</td>
<td>5 000</td>
<td>356</td>
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<tr>
<td>FXN 38 - 17/70</td>
<td>DX</td>
<td>150</td>
<td>860</td>
<td>5 000</td>
<td>224</td>
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<tr>
<td>FXN 46 - 25/80</td>
<td>DX</td>
<td>390</td>
<td>820</td>
<td>5 000</td>
<td>328</td>
</tr>
<tr>
<td>FXN 51 - 25/85</td>
<td>DX</td>
<td>480</td>
<td>750</td>
<td>5 000</td>
<td>300</td>
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<tr>
<td>FXN 56 - 25/90</td>
<td>DX</td>
<td>580</td>
<td>730</td>
<td>5 000</td>
<td>292</td>
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<td>DX</td>
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<td>750</td>
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<td>300</td>
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<tr>
<td>FXN 61 - 19/106</td>
<td>DX</td>
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<td>750</td>
<td>5 000</td>
<td>300</td>
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<td>FXN 66 - 25/100</td>
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<td>700</td>
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<tr>
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<td>800</td>
<td>700</td>
<td>5 000</td>
<td>280</td>
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<tr>
<td>FXN 76 - 25/115</td>
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<td>1 050</td>
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<td>5 000</td>
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<tr>
<td>FXN 76 - 25/120</td>
<td>DX</td>
<td>1 050</td>
<td>670</td>
<td>5 000</td>
<td>268</td>
</tr>
<tr>
<td>FXN 86 - 25/125</td>
<td>DX</td>
<td>1 350</td>
<td>630</td>
<td>5 000</td>
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</tr>
<tr>
<td>FXN 86 - 25/130</td>
<td>DX</td>
<td>1 350</td>
<td>630</td>
<td>5 000</td>
<td>252</td>
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<td>FXN 101 - 25/140</td>
<td>DX</td>
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<td>610</td>
<td>5 000</td>
<td>244</td>
</tr>
<tr>
<td>FXN 101 - 25/149</td>
<td>DX</td>
<td>1 700</td>
<td>610</td>
<td>5 000</td>
<td>244</td>
</tr>
<tr>
<td>FXN 101 - 25/150</td>
<td>DX</td>
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<td>610</td>
<td>5 000</td>
<td>244</td>
</tr>
<tr>
<td>FXN 85 - 40/140</td>
<td>SX</td>
<td>1 900</td>
<td>430</td>
<td>6 000</td>
<td>172</td>
</tr>
<tr>
<td>FXN 85 - 40/150</td>
<td>SX</td>
<td>1 900</td>
<td>430</td>
<td>6 000</td>
<td>172</td>
</tr>
<tr>
<td>FXN 100 - 40/160</td>
<td>SX</td>
<td>2 700</td>
<td>400</td>
<td>4 500</td>
<td>160</td>
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<td>FXN 105 - 50/165</td>
<td>SX</td>
<td>4 000</td>
<td>380</td>
<td>4 500</td>
<td>152</td>
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<tr>
<td>FXN 120 - 50/190</td>
<td>SX</td>
<td>6 500</td>
<td>320</td>
<td>4 000</td>
<td>128</td>
</tr>
<tr>
<td>FXN 140 - 50/215</td>
<td>SX</td>
<td>8 700</td>
<td>320</td>
<td>3 000</td>
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<tr>
<td>FXN 170 - 63/258</td>
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<td>20 000</td>
<td>250</td>
<td>2 700</td>
<td>100</td>
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</tbody>
</table>

The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal 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.
Internal Freewheels FXN

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

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.

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 DX, $d = 35$ mm
Internal Freewheels FEN
for press fit on the outer ring with sprags

Features
Internal Freewheels FEN are sprag freewheels without bearing support.
The outer ring is pressed into the customer housing. This makes compact, space-saving fitting solutions possible.
The freewheels FEN are used as:
- Backstops
- Overrunning Clutches
- Indexing Freewheels
In addition to the standard type, the type with RIDUVIT® can be supplied for extended service life.
Nominal torques up to 4,000 Nm. The torque is transmitted on the outer ring by press fit.
Bores up to 100 mm. Many standard bores are available.

Application example
Internal Freewheel FEN 82 SF as backstop fitted to the end of the intermediate shaft of a spur gearbox in the drive 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 backwards. The thin outer ring that is pressed into the housing enables a space-efficient fitting solution.
# Internal Freewheels FEN

for press fit on the outer ring with sprags

---

## Mounting

Internal Freewheels FEN 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 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.

---

## Lubrication

An oil lubrication of the specified quality must be provided.

---

## Example for ordering

Freewheel size FEN 72, type with RIDUVIT® and 50 mm bore:

- FEN 72 SFT, d = 50 mm

---

### Dimensions

<table>
<thead>
<tr>
<th>Freewheel Size</th>
<th>Type</th>
<th>Nominal Torque Nm</th>
<th>Max. Speed Inner ring/Outer ring rev/min</th>
<th>Bore d mm</th>
<th>B mm</th>
<th>D mm</th>
<th>F mm</th>
<th>J mm</th>
<th>K mm</th>
<th>L mm</th>
<th>Weight kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEN 37 SF</td>
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<td>2.500</td>
<td>2.600</td>
<td>220</td>
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<td>25</td>
<td>35</td>
<td>35</td>
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<tr>
<td>FEN 44 SF</td>
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<td>2.200</td>
<td>315</td>
<td>1.900</td>
<td>2.200</td>
<td>30</td>
<td>44</td>
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<td>0.5</td>
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<td>FEN 72 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>30</td>
<td>40</td>
<td>40</td>
<td>1.2</td>
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<tr>
<td>FEN 82 SF</td>
<td>1.250</td>
<td>1.120</td>
<td>1.600</td>
<td>1.250</td>
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<td>1.600</td>
<td>45</td>
<td>50</td>
<td>50</td>
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<tr>
<td>FEN 82 SF</td>
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<td>1.025</td>
<td>1.450</td>
<td>1.900</td>
<td>1.025</td>
<td>1.450</td>
<td>50</td>
<td>55</td>
<td>55</td>
<td>2.9</td>
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<tr>
<td>FEN 107 SF</td>
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<td>880</td>
<td>1.250</td>
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<td>880</td>
<td>1.250</td>
<td>70</td>
<td>85</td>
<td>85</td>
<td>3.2</td>
<td></td>
</tr>
<tr>
<td>FEN 107 SF</td>
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<td>880</td>
<td>1.250</td>
<td>2.880</td>
<td>880</td>
<td>1.250</td>
<td>70</td>
<td>85</td>
<td>85</td>
<td>4.2</td>
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<tr>
<td>FEN 127 SF</td>
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<td>800</td>
<td>1.150</td>
<td>4.000</td>
<td>800</td>
<td>1.150</td>
<td>90</td>
<td>100</td>
<td>100</td>
<td>6.5</td>
<td></td>
</tr>
</tbody>
</table>

The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal 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.

* Keyway according to DIN 6885, page 3 • Tolerance of keyway width J5.10.

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## Internal Freewheels
Internal Freewheels FGK

for press fit on the outer ring with sprags and bearing

Features

Internal Freewheels FGK are sprag freewheels with bearing support in the dimensions of the needle bearing series 59. The freewheels are supplied grease-filled for normal operating conditions and are maintenance-free. The outer ring is pressed into the customer housing. This makes compact, space-saving fitting solutions possible.

The freewheels FGK are used as
- Backstops
- Overrunning Clutches
- Indexing Freewheels

Nominal torques up to 460 Nm. The torque is transmitted on the outer ring by press fit. Bores up to 50 mm.

Application example

Internal Freewheel FGK 35 as an indexing freewheel in a circular knitting machine. Set-up in order to change material or after breakdown requires a sensitive, manual adjustment of the rotary table. Therefore the rotary table is moved via the freewheel which is working in driving operation. After set-up, the drive is carried out via the main motor and the freewheel outer ring overruns.
Internal Freewheels FGK
for press fit on the outer ring
with sprags and bearing

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 R6 and the tolerance of the shaft must be ISO p5. With these fits, normal bearing clearance is achieved in a built-in state.

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

Mounting

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 FGK 40, standard type:
• FGK 40

The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal torque.
Internal Freewheels FCN … K/CF
for press fit on the outer ring with sprags

Features

Internal Freewheels FCN … K/CF are sprag freewheels with series 62 ball bearing dimensions. The freewheels FCN … K (sizes 20 to 30) are also ball bearings and can accept radial and axial forces. They are supplied grease-filled for normal operating conditions and are maintenance-free. The freewheels FCN … CF (sizes 35 to 60) have no bearing support.

The freewheels FCN … K/CF are used as:
- Backstops
- Overrunning Clutches
- Indexing Freewheels

Nominal torques up to 500 Nm. The torque is transmitted on the outer ring by press fit. Bores up to 60 mm.

Application example

Two Internal Freewheels FCN 30 K in parallel arrangement as overrunning freewheels in the drive of the roof brush of an automatic car washing facility. The freewheels are arranged in the hub of a shaft coupling that connects the motor and the reduction gear. The freewheels prevent 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 freewheeling freewheel enables the drive to continue to turn in the lowering direction without causing any damage.
Internal Freewheels FCN … K/CF
for press fit on the outer ring
with sprags

Mounting
The freewheels FCN … CF (sizes 35 to 60) 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 H7 or J6 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
The freewheels FCN … K (sizes 20 to 30) 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.

In the case of the freewheels FCN … CF (sizes 35 to 60), an oil lubrication of the specified quality must be provided.

Example for ordering
Freewheel size FCN 40, standard type:
• FCN 40 CF
Internal Freewheels FCN ... R
for press fit on the outer ring
with rollers

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. The freewheels FCN ... R are used as:
- Backstops
- Overrunning Clutches
- Indexing Freewheels
Nominal torques up to 840 Nm. The torque is transmitted on the outer ring by press fit. Bores up to 80 mm.

Application example
Internal Freewheel FCN 45 R as a backstop fitted to the end of the intermediate shaft of a spur gearbox in the drive of a chain conveyor. In the case of a motor stop, the conveyor must be held securely so that the conveyor goods do not pull backwards. The thin outer ring that is pressed into the housing enables a space-efficient fitting solution.
Internal Freewheels FCN … R
for press fit on the outer ring
with rollers

### Standard type
For universal use

### Dimensions

<table>
<thead>
<tr>
<th>Freewheel Size</th>
<th>Type</th>
<th>Nominal torque Nm</th>
<th>Inner ring freewheels/ overruns mm²</th>
<th>Outer ring freewheels/ overruns mm²</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>4 300</td>
<td>6 700</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>5 300</td>
<td>8 300</td>
<td>10</td>
<td>9</td>
<td>30</td>
<td>35</td>
<td>0,03</td>
</tr>
<tr>
<td>FCN 12</td>
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<td>11,0</td>
<td>5 000</td>
<td>12</td>
<td>10</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>4 400</td>
<td>15*</td>
<td>11</td>
<td>11</td>
<td>35</td>
<td>40</td>
<td>0,08</td>
</tr>
<tr>
<td>FCN 20</td>
<td>R</td>
<td>20</td>
<td>3 300</td>
<td>20*</td>
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<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>2 900</td>
<td>25*</td>
<td>15</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>2 400</td>
<td>30*</td>
<td>16</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>2 100</td>
<td>35*</td>
<td>17</td>
<td>17</td>
<td>72</td>
<td>80</td>
<td>0,32</td>
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<tr>
<td>FCN 40</td>
<td>R</td>
<td>170,0</td>
<td>1 900</td>
<td>40*</td>
<td>18</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>1 750</td>
<td>45*</td>
<td>19</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>1 650</td>
<td>50*</td>
<td>20</td>
<td>20</td>
<td>90</td>
<td>100</td>
<td>0,50</td>
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<td>FCN 60</td>
<td>R</td>
<td>420,0</td>
<td>1 350</td>
<td>60*</td>
<td>22</td>
<td>22</td>
<td>110</td>
<td>122</td>
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<tr>
<td>FCN 80</td>
<td>R</td>
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<td>1 070</td>
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<td>26</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. Therefore, peak torques must not exceed 2 times the nominal 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.

### 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
**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 overrun 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.

**Features**

Internal Freewheels FDN are sprag freewheels with anti-friction bearing dimensions. The freewheels FDN are used as:
- Backstops
- Overrunning Clutches
- Indexing Freewheels

The standard type and the type with P-grinding for increased service life and indexing accuracy do 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. Many standard bores are available.

**Internal Freewheels FDN**

for press fit on the outer ring with sprags, available in three types

---

Nominal torques up to 2 400 Nm. The torque is transmitted on the outer ring by press fit. Bores up to 80 mm. Many standard bores are available.
# Internal Freewheels FDN

for press fit on the outer ring with sprags, available in three types

---

<table>
<thead>
<tr>
<th>Freewheel Size</th>
<th>Type</th>
<th>Nominal torque Nm</th>
<th>Type</th>
<th>Nominal torque Nm</th>
<th>Load rating of bearing support dynamic C N</th>
<th>static C0 N</th>
<th>Type</th>
<th>Nominal torque Nm</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>FDN 15</td>
<td>CFH</td>
<td>16</td>
<td>CFR</td>
<td>8</td>
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<td>0,1</td>
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<td>CFH</td>
<td>20</td>
<td>CFR</td>
<td>14</td>
<td>8 300</td>
<td>4 200</td>
<td>CFP</td>
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<td>12</td>
<td>20</td>
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<td>CFR</td>
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<td>12 000</td>
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<td>CFP</td>
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<td>20*</td>
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<td>8 000</td>
<td>CFP</td>
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<td>28*</td>
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<td>80</td>
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<td>50</td>
<td>CFR</td>
<td>35</td>
<td>18 400</td>
<td>11 300</td>
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<td>86</td>
<td>92</td>
<td>0,7</td>
</tr>
<tr>
<td>FDN 100</td>
<td>CFH</td>
<td>100</td>
<td>CFR</td>
<td>50</td>
<td>26 600</td>
<td>17 000</td>
<td>CFP</td>
<td>50</td>
<td>20*</td>
<td>62</td>
<td>86</td>
<td>95</td>
<td>0,7</td>
</tr>
</tbody>
</table>

The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal torque.

Keyway according to DIN 6885, page 1 • Tolerance of keyway width ±0.10.

Mounting

Internal freewheels FDN in standard type and type with P-grinding 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, type with P-grinding with 20 mm bore:
- FDN 30 CFP, d = 20 mm
**Application example**

Two Internal Freewheels FDE 65 CFP, type with P-grinding, as indexing freewheels in the spring drive of a high-voltage switch. The contacts of high-voltage switches must be separated from each other within a few milliseconds upon shut down. The abrupt opening is achieved by a pretensioned spring. When this is triggered the contacts are pulled apart from each other. After the switch is switched back on, the release spring is retensioned. This is executed by a camshaft that drives two indexing freewheels. This turns the shaft of the release spring at a specified angle in small steps. The solution with indexing freewheels replaces a more expensive reduction gear. The P-grinding type ensures an increased service life and considerable indexing precision.

---

**Features**

Internal Freewheels FDE are sprag freewheels with anti-friction bearing dimensions. The freewheels FDE are used as:

- Backstops
- Overrunning Clutches
- Indexing Freewheels

The standard type and the type with P-grinding for increased service life and indexing accuracy do 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 inner and outer ring by press fit.

Bores up to 95 mm.
**Internal Freewheels FDE**

for press fit on the outer ring

with sprags, available in three types

---

**Mounting**

Internal freewheels FDE in standard type and type with P-grinding 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 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 P6 and the tolerance of the shaft must be ISO P6.

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 FDE 50, standard type with bearing support:

- FDE 50 CFR
Internal Freewheels FD
for press fit on the outer ring
with sprags, available in three types

Features
Internal Freewheels FD are sprag freewheels without an inner ring. The customer’s hardened and ground shaft is used as the inner track.
The freewheels FD are used as:
- Backstops
- Overrunning Clutches
- Indexing Freewheels

The standard type and type with P-grinding for increased service life and indexing accuracy do 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, available in three types

<table>
<thead>
<tr>
<th>Freewheel Size</th>
<th>Type</th>
<th>Nominal torque Nm</th>
<th>Type</th>
<th>Nominal torque Nm</th>
<th>Load rating of bearing support dynamic C N</th>
<th>static C0 N</th>
<th>Type</th>
<th>Nominal torque Nm</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>CFR</td>
<td>6</td>
<td>7 600</td>
<td>4 200</td>
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<td>12</td>
<td>16</td>
<td>34</td>
<td>45</td>
<td>0,1</td>
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<tr>
<td>FD 15</td>
<td>CFH</td>
<td>16</td>
<td>CFR</td>
<td>8</td>
<td>7 800</td>
<td>4 200</td>
<td>CFP</td>
<td>7</td>
<td>15</td>
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<td>0,1</td>
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<td>4 200</td>
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<tr>
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<td>7 000</td>
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<td>CFP</td>
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<td>62</td>
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<td>FD 50</td>
<td>CFH</td>
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<td>120</td>
<td>18 400</td>
<td>11 300</td>
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</tr>
<tr>
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<td>CFR</td>
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<td>21 400</td>
<td>14 100</td>
<td>CFP</td>
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<td>65</td>
<td>25</td>
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<tr>
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<td>CFR</td>
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<td>23 800</td>
<td>17 800</td>
<td>CFP</td>
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<td>110</td>
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<td>CFR</td>
<td>1 100</td>
<td>48 600</td>
<td>45 000</td>
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<td>35</td>
<td>130</td>
<td>165</td>
<td>0,7</td>
</tr>
</tbody>
</table>

The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal torque.

Mounting
Internal freewheels FD in type standard and type with P-grinding 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.

Please note the instructions on page 106 regarding the sprag track (shaft).

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 FD 12, standard type:
• FD 12 CFH
Application example

Two Internal Freewheels ZZ 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 ZZ
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 ZZ 6202, standard type:
• ZZ 6202
Internal Freewheels ZZ ... 2RS
for press fit on the outer ring
with sprags, bearing support and sealing

<table>
<thead>
<tr>
<th>Freewheel Size</th>
<th>Nominal torque (Nm)</th>
<th>Maximum speed (min⁻¹)</th>
<th>Load Rating of Bearing Support (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Dynamic C</td>
</tr>
<tr>
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<td>9.3</td>
<td>10 000</td>
<td>6 100</td>
</tr>
<tr>
<td>ZZ 15 2RS</td>
<td>17.0</td>
<td>8 400</td>
<td>7 400</td>
</tr>
<tr>
<td>ZZ 17 2RS</td>
<td>31.0</td>
<td>7 350</td>
<td>7 900</td>
</tr>
<tr>
<td>ZZ 20 2RS</td>
<td>50.0</td>
<td>6 000</td>
<td>9 400</td>
</tr>
<tr>
<td>ZZ 25 2RS</td>
<td>85.0</td>
<td>5 200</td>
<td>10 700</td>
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<tr>
<td>ZZ 30 2RS</td>
<td>138.0</td>
<td>4 200</td>
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<tr>
<td>ZZ 35 2RS</td>
<td>175.0</td>
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</tr>
<tr>
<td>ZZ 40 2RS</td>
<td>325.0</td>
<td>3 000</td>
<td>15 500</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>B (mm)</th>
<th>D (mm)</th>
<th>K (mm)</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZZ 12 2RS</td>
<td>14</td>
<td>32</td>
<td>39</td>
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</tr>
<tr>
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</tr>
<tr>
<td>ZZ 20 2RS</td>
<td>19</td>
<td>47</td>
<td>58</td>
<td>0.15</td>
</tr>
<tr>
<td>ZZ 25 2RS</td>
<td>20</td>
<td>52</td>
<td>63</td>
<td>0.18</td>
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<tr>
<td>ZZ 30 2RS</td>
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<td>62</td>
<td>73</td>
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<td>ZZ 35 2RS</td>
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<td>72</td>
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</tr>
<tr>
<td>ZZ 40 2RS</td>
<td>23</td>
<td>80</td>
<td>94</td>
<td>0.60</td>
</tr>
</tbody>
</table>

The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal torque.

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 100°C, briefly up to 120°C.

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

Example for ordering
Freewheel size ZZ 17 2RS, standard type:
• ZZ 17 2RS
**Internal Freewheels ZZ … 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 -40°C to 100°C, briefly up to 120°C.

---

### Lubrication

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

---

### Example for ordering

Freewheel size ZZ 25 P2RS, standard type:

- ZZ 25 P2RS

---

<table>
<thead>
<tr>
<th>Freewheel Size</th>
<th>Nominal torque Nm</th>
<th>Maximum speed mm¹</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>ZZ 20 P2RS</td>
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<td>6000</td>
<td>9400 4500</td>
<td>20</td>
<td>19</td>
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<tr>
<td>ZZ 25 P2RS</td>
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<td>10700 5500</td>
<td>25</td>
<td>20</td>
<td>52</td>
<td>63</td>
<td>0,18</td>
</tr>
<tr>
<td>ZZ 30 P2RS</td>
<td>138</td>
<td>4200</td>
<td>11700 6500</td>
<td>30</td>
<td>30</td>
<td>62</td>
<td>73</td>
<td>0,30</td>
</tr>
</tbody>
</table>

The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal torque.

Keyway according to DIN 6885, page 1 - Tolerance of keyway width ±10.

---

### Diagram

[Diagram of an internal freewheel showing dimensions and keyway connection.]
Internal Freewheels ZZ ... P
for press fit on the outer ring
with sprags and bearing support

The freewheels are supplied grease-filled.

### 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 100°C, briefly up to 120°C.

### Lubrication

The freewheels are supplied grease-filled.

### Example for ordering

Freewheel size ZZ 6203 P, standard type:

- ZZ 6203 P

---

<table>
<thead>
<tr>
<th>Freewheel Size</th>
<th>Nominal torque Nm</th>
<th>Maximum speed ( \text{min}^{-1} )</th>
<th>Load rating of bearing support</th>
<th>Bore d ( \text{mm} )</th>
<th>B ( \text{mm} )</th>
<th>D ( \text{mm} )</th>
<th>K ( \text{mm} )</th>
<th>Weight ( \text{kg} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZZ 6202 P</td>
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<td>7400</td>
<td>3400</td>
<td>15*</td>
<td>11</td>
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</tr>
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<td>3800</td>
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<td>40</td>
<td>51</td>
<td>0.07</td>
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<tr>
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<td>0.14</td>
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<td>ZZ 6206 P</td>
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<td>6500</td>
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<tr>
<td>ZZ 6207 P</td>
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<td>12600</td>
<td>7300</td>
<td>35*</td>
<td>17</td>
<td>72</td>
<td>85</td>
<td>0.30</td>
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<tr>
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<td>12300</td>
<td>40</td>
<td>22</td>
<td>80</td>
<td>94</td>
<td>0.50</td>
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</tbody>
</table>

The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal 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.

* The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal torque.
Internal Freewheels ZZ … PP
for keyway connection on the outer ring
with sprags and bearing support

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 hous-
ing is made of steel or grey cast iron in mini-
mum 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 100 °C, briefly up to 120°C.

Lubrication

The freewheels are supplied grease-filled.

Example for ordering

Freewheel size ZZ 6205 PP, standard type:

• ZZ 6205 PP

The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal 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.

<table>
<thead>
<tr>
<th>Freewheel Size</th>
<th>Nominal torque Nm</th>
<th>Maximum speed ( \text{m}^1 \text{s}^{-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>
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<tbody>
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<td>7.400</td>
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<td>0.6</td>
</tr>
<tr>
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<td>ZZ 6206 PP</td>
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<td>6.500</td>
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<td>35*</td>
<td>17</td>
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<tr>
<td>ZZ 40 PP</td>
<td>325</td>
<td>3.000</td>
<td>15.500</td>
<td>12.300</td>
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<td>22</td>
<td>80</td>
<td>94</td>
<td>10</td>
<td>3.0</td>
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</tbody>
</table>

Example for ordering

Freewheel size ZZ 6205 PP, standard type:

• ZZ 6205 PP

The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal 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 FSN**

*for keyway connection on the outer ring with rollers*

**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. The freewheels FSN are used as:

- Backstops
- Overrunning Clutches
- Indexing Freewheels

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

<table>
<thead>
<tr>
<th>Freewheel Size</th>
<th>Nominal torque/min</th>
<th>Max. speed</th>
<th>Bore d (mm)</th>
<th>B (mm)</th>
<th>D (mm)</th>
<th>E (mm)</th>
<th>F (mm)</th>
<th>N (mm)</th>
<th>P (mm)</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>
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<td>1.3</td>
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<td>2350</td>
<td>3700</td>
<td>15*</td>
<td>18</td>
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<td>5</td>
<td>1.7</td>
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<tr>
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<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>
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<td>52</td>
<td>29.0</td>
<td>45</td>
<td>6</td>
<td>1.5</td>
</tr>
<tr>
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<td>1650</td>
<td>3100</td>
<td>25*</td>
<td>24</td>
<td>62</td>
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<td>52</td>
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<td>2.0</td>
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<td>2200</td>
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<tr>
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<td>2150</td>
<td>35*</td>
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</tr>
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<td>80*</td>
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<td>140</td>
<td>20</td>
<td>7.5</td>
</tr>
</tbody>
</table>

The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal 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.

Mounting
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.

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

Example for ordering
Freewheel size FSN 12, standard type:
- FSN 12
**Internal Freewheels FN**

for keyway connection on the outer ring with rollers

**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. The freewheels FN are used as:

- Backstops
- Overrunning Clutches
- Indexing Freewheels

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.

**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.
## Internal Freewheels FN

for keyway connection on the outer ring with rollers

### Standard type

For universal use

### Dimensions

<table>
<thead>
<tr>
<th>Freewheel Size</th>
<th>Nominal torque (Nm)</th>
<th>Inner ring freewheels/overruns (mm²)</th>
<th>Max. speed inner ring (m/s)</th>
<th>Outer ring freewheels/overruns (mm²)</th>
<th>Bore d (mm)</th>
<th>B (mm)</th>
<th>D (mm)</th>
<th>E (mm)</th>
<th>F (mm)</th>
<th>N (mm)</th>
<th>P (mm)</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
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<td>2800</td>
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<td>37</td>
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<td>3,0</td>
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</tr>
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<td>0,6</td>
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</tr>
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<td>25</td>
<td>80</td>
<td>40</td>
<td>68</td>
<td>9</td>
<td>4,0</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>FN 30</td>
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<td>1400</td>
<td>30</td>
<td>90</td>
<td>45</td>
<td>75</td>
<td>12</td>
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<td>1,6</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>FN 35</td>
<td>500</td>
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<td>100</td>
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<td>80</td>
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<td>FN 40</td>
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<td>1100</td>
<td>45</td>
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<td>16</td>
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<td>150</td>
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<td>18</td>
<td>9,0</td>
<td>8,4</td>
<td></td>
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</tr>
</tbody>
</table>

The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal torque.

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.

**Mounting**

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

**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

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 outer ring is build into the customer housing. This makes compact, space-saving fitting solutions possible.
The freewheels FNR are used as:
- Backstops
- Overrunning Clutches
- Indexing Freewheels
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.

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

<table>
<thead>
<tr>
<th>Freewheel Size</th>
<th>Nominal Torque</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</th>
</tr>
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<tbody>
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<td>1200</td>
<td>1200</td>
<td>8</td>
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<td>3,0</td>
</tr>
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<td>1200</td>
<td>12</td>
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<td>37</td>
<td>19</td>
<td>30</td>
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</tr>
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<td>950</td>
<td>15</td>
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</tr>
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</tr>
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<td>130</td>
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<td>80</td>
<td>125</td>
<td>18</td>
<td>9,5</td>
</tr>
</tbody>
</table>

The maximum transmissible torque is 2 times the specified nominal torque. Therefore, peak torques must not exceed 2 times the nominal torque.

Keyway according to DIN 6885, page 1 • Tolerance of keyway width ±10.

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.

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

Example for ordering
Freewheel size FNR 20, standard type:
• FNR 20
Backstops FXM ... UX 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 189, 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.
Application Examples

Backstop FXM 2.410 - 100 UX for the primary cooling water pump in a nuclear power station. Required torque 500 000 Nm. Speed 1 485 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 FXRT 170 SX.
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 240 - 63 UX 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, FDE 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.

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 (as shown in figure 192) 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
In the case of freewheels without an inner ring (FD series), the inner sprag track is manufactured by the customer. It must be hardened and machined (grinding or hard-turned). The sprag track must then have the following characteristics:

- Conicity: \( \leq 3 \mu m \text{ per } 10 \text{ mm track width} \)
- Average peak-to-valley height \( R_z \) as per DIN 4768, page 1: \( 1.6 \mu m \leq R_z \leq 6.3 \mu m \)
- Hardness: 62 \( \pm 2 \) 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 \( \geq 1 100 \text{ N/mm}^2 \)

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.

Grease-lubricated ball bearings for Complete Freewheels BA … XG and BC … XG
Complete Freewheels BA … XG and BC … XG have grease-lubricated ball bearings. It should be noted that these ball bearings have a \( L_{10} \) grease service life. Diagram 196 shows the dependency of the grease service life \( L_{10} \) on the speed in the freewheeling operation. After reaching the grease service life \( L_{10} \), the bearing must be replaced or cleaned and regreased. The specifications in the diagram are valid for stationary installations, horizontal shafts and a maximum operating temperature of 70 °C. A grease service life \( L_{10} \) of more than 30000 hours is not recommended. The diagram shows an excerpt from the theoretically possible range of grease service life \( L_{10} \) (which would be practical for the majority of applications) as a function of the speed in freewheeling operation.
Technical Points

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 197) is:

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

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 interplay 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 199), 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 locked state (driving operation) plays a decisive role. As figure 198 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 199 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 \( \Delta M \), the effect on the torsion angle \( \alpha \) 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 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 200 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 \( 1 \times 10^9 \). With an actuation frequency of 100 actuations/minute, this corresponds to a service life of approximately 16 666 hours.
Technical Points

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 201. 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 spray lift-off X and Z) 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 110 or 111.

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 FCN … K, FGK and ZZ …, 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 FCN … K, FGK and ZZ …

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.

Dependency of the maximum speed on the category of the freewheel

All the components of a freewheel are stressed during rotation because of the centrifugal forces. The maximum permissible component stress must be taken into consideration when establishing the permissible speeds. Furthermore, the service life of the bearings must be considered. The bearing manufacturer’s directives must be adhered to. For economic reasons, the standard freewheel is designed for a maximum speed that generally suits most applications. Higher speeds can be achieved by means of special construction measures.

The maximum speeds specified in this catalogue for Basic Freewheels FBO and FGR … SF, for Integrated Freewheels FON as well as for Internal Freewheels FEN apply for installation conditions as given with Complete Freewheels. Knowing the actual installation conditions higher speeds can be permitted under some circumstances. Please contact us if this is the case, preferably using the questionnaire on page 110 or 111.
### Technical Points

#### 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.

### Lubrication table

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Oil lubrication</th>
<th>Grease lubrication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agip</td>
<td>For ambient temperatures from 0° C to +50° C Kinematic viscosity at 40° C, ISO-VG 46/68 [mm²/s]</td>
<td>For ambient temperatures from –15° C to +50° C Kinematic viscosity at 40° C, ISO-VG 32 [mm²/s]</td>
</tr>
<tr>
<td>Agip</td>
<td>For ambient temperatures from 0° C to +50° C Kinematic viscosity at 40° C, ISO-VG 46/68 [mm²/s]</td>
<td>For ambient temperatures from –15° C to +50° C Kinematic viscosity at 40° C, ISO-VG 10 [mm²/s]</td>
</tr>
<tr>
<td>ARAL</td>
<td>VITAM GF 46/68</td>
<td>VITAM GF 10</td>
</tr>
<tr>
<td>BP</td>
<td>ENERGOL HLP-HM 46/68</td>
<td>ENERGOL HLP-HM 10</td>
</tr>
<tr>
<td>CASTROL</td>
<td>VARIO HDX</td>
<td>ALPHASYN T 15</td>
</tr>
<tr>
<td>CHEVRON</td>
<td>HYDRAULIC OIL AW 46/68</td>
<td>RANOID HD 10</td>
</tr>
<tr>
<td>ELF</td>
<td>ELFOLNA 46</td>
<td>ELF AVIATION HYDRAULIC OIL 20</td>
</tr>
<tr>
<td>ESSO</td>
<td>NUTO H 46/68</td>
<td>UNIVIS J 13</td>
</tr>
<tr>
<td>KLÜBER</td>
<td>CRUCOLAN 46/68</td>
<td>ISOFLEX LDS 18 Spezial A POLYLUUB WH 2</td>
</tr>
<tr>
<td>MOBIL</td>
<td>D.T.E. 25/26</td>
<td>AERO HF A</td>
</tr>
<tr>
<td>SHELL</td>
<td>TELLUS 46/68</td>
<td>TELLUS T 15</td>
</tr>
<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>
</tr>
</tbody>
</table>

Please contact us in the case of temperatures in excess of 50° C and below -40° C.

### 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, FXRV, FXRT 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 BA ... XG, BC ... XG, FA, FAV, FCN ... K and ZZ ... 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 our authorisation. Exception: Integrated Freewheels FXM, FXRV, FXRT as well as Internal Freewheels FXN.
Questionnaire for selecting RINGSPANN Backstops

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

| Company: ____________________________ | Date: ____________________________ |
| Address: ____________________________ | Enquiry Ref.: ______________________ |
| Name: ______________________________ | Phone: ____________________________ |
| Department: _________________________ | Fax: ______________________________ |
| E-mail: _____________________________ | ____________________________ |

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
   - 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)  \( n_{\text{op}} = \) ________ 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 take the peak torque that occurs if the drive motor is started in the locking direction of the backstop (incorrectly poled drive motor)?
   - If yes, the backstop must be substantially oversized.
     - Yes  No

2.4 Maximum backdriving torque  \( M_{\text{max}} = \) ________ Nm

2.5 Lifting capacity of the conveyor system  \( P_L = \) ________ kW

2.6 Efficiency of the machine between backstop and drive  \( \eta = \) ________

2.7 Number of stops per day: ________________

2.8 Daily operating time: ________ hours

3. Installation conditions

3.1  Open, outside  Yes  No
   - 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:
     - ________ mm\(^2\)/s ________ °C

3.2 Should the backstop be releasable?
   - Yes  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
# Questionnaire for selecting RINGSPANN Overrunning Clutches

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

<table>
<thead>
<tr>
<th>Company:</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address:</td>
<td>Enquiry Ref.:</td>
</tr>
<tr>
<td>Name:</td>
<td>Phone:</td>
</tr>
<tr>
<td>Department:</td>
<td>Fax:</td>
</tr>
<tr>
<td>E-mail:</td>
<td></td>
</tr>
</tbody>
</table>

### 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:

<table>
<thead>
<tr>
<th>Type of machine</th>
<th>Machine group</th>
<th>Installation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Arrangement</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

### 2. Operating data

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

- Asynchronous motor
- direct start-up
- A-∆ start-up
- Other electric motor
  - Type: |
  - Combustion engine
    - Type: |
    - Number of cylinders: |
  - Turbine
  - Other (please explain in more detail): |

<table>
<thead>
<tr>
<th>Drive</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.2 To be transmitted in driving operation:

- Power: kW or Torque: Nm
- Maximum torque Nm
- 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

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

- with an elastic coupling
- with a torsionally stiff coupling

2.4 Speed

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

- Moment of inertia: J = kgm²
- Speed of mass: n = min⁻¹

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

- Minimum torque Mₘₐₓ = Nm
- Maximum torque Mₘₘₐₓ = Nm
- Min-/Max.-torque is not known

2.7 Daily operating time: hours (h)

### 3. Installation conditions

3.1 Open, outside

3.2 Ambient temperature on the freewheel:

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Other</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.4 Connection to the central lubrication system is possible

<table>
<thead>
<tr>
<th>Name of lubricant</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.5 Kinematic viscosity mm²/s °C

<table>
<thead>
<tr>
<th>Viscosity</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 4. Estimated requirements

<table>
<thead>
<tr>
<th>Pieces</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 5. Enclosures

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

**Please photocopy or use the PDF-File from our Homepage!**

<table>
<thead>
<tr>
<th>Company:</th>
<th>Date:</th>
<th>Address:</th>
<th>Enquiry Ref.:</th>
<th>Name:</th>
<th>Phone:</th>
<th>Fax:</th>
<th>E-mail:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Department:</th>
<th></th>
</tr>
</thead>
</table>

## 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

   - 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

<table>
<thead>
<tr>
<th>Pieces (one-off)</th>
<th>Pieces/month</th>
<th>Pieces/year</th>
</tr>
</thead>
</table>

## 5. Enclosures

- Specifications
- Data sheet
- Sketch/drawing

---

**RINGSPANN GmbH**  
Schaberweg 30–34  
D-61348 Bad Homburg  
Telefon +49 6172 275-0  
Telefax +49 6172 275-275  
www.ringspann.com  
mailbox@ringspann.com
### Questionnaire for selecting RINGSPANN Housing Freewheels

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

<table>
<thead>
<tr>
<th>Company:</th>
<th>Date:</th>
<th>Enquiry Ref.:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address:</td>
<td></td>
<td>Phone:</td>
</tr>
<tr>
<td>Name:</td>
<td></td>
<td>Fax:</td>
</tr>
<tr>
<td>Department:</td>
<td></td>
<td>E-mail:</td>
</tr>
</tbody>
</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
      - \( \Delta \)-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
      - from _____ min\(^{-1}\) to _____ min\(^{-1}\)
      - from _____ min\(^{-1}\) to _____ min\(^{-1}\)
      - 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
      - Anticlockwise
      - Clockwise

   2.4 To be transmitted in driving operation
      - Power: _____ kW
      - Torque: _____ 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 Should the Housing Freewheel be equipped with a parking brake?
      - With built-in electromagnetic brake
      - With externally fitted brake

   2.8 Selected Housing Freewheel
      - Size: ____________________________

   2.9 Daily operating time
      - ________ hours (h)
      - thereof ________ (h) driving operation
      - thereof ________ (h) freewheeling operation

3. Installation conditions

   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):

4. Estimated requirements

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

5. Enclosures
   - Specifications
   - Data sheet
   - Sketch/drawing
<table>
<thead>
<tr>
<th><strong>Freewheels</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Backstops</strong>  &lt;br&gt;Automatic protection against reverse running of conveyor belts, elevators, pumps, and fans.</td>
</tr>
<tr>
<td><strong>Overrunning Clutches</strong> &lt;br&gt;Automatic engaging and disengaging of drives.</td>
</tr>
<tr>
<td><strong>Indexing Freewheels</strong> &lt;br&gt;For gradual feed of materials.</td>
</tr>
<tr>
<td><strong>Housing Freewheels</strong> &lt;br&gt;Automatic engaging and disengaging of multi-motor drives for installations with continuous operation.</td>
</tr>
<tr>
<td><strong>Freewheel Elements</strong> &lt;br&gt;Cage Freewheels, Sprag Sets and Freewheel Chains.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Brakes</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Industrial Disc Brakes</strong>  &lt;br&gt;Manually actuated – manually released.</td>
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<tr>
<td><strong>Torque Limiters with Rollers</strong>  &lt;br&gt;With double or single rollers. Through ratcheting or disengaging, also for 360° synchronous running.</td>
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<tr>
<td><strong>Force Limiters</strong>  &lt;br&gt;Reliable axial overload protection in piston rods.</td>
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<th><strong>Torque and Force Limiters</strong></th>
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<td><strong>Torque Limiters with Rollers</strong>  &lt;br&gt;Reliable overload protection with maximum response accuracy. Also backlash free.</td>
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<tr>
<td><strong>Torque Limiters with Friction Linings</strong>  &lt;br&gt;RIMOSTAT Torque Limiter for constant torque. Belleville Spring Torque Limiter for simple release.</td>
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<td><strong>Force Limiters</strong>  &lt;br&gt;Reliable axial overload protection in piston rods.</td>
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<th><strong>Couplings and Clamping Clutches</strong></th>
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<tr>
<td><strong>Flexible Couplings</strong>  &lt;br&gt;Large, allowed radial and angular misalignments. Minimum resiliency.</td>
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<tr>
<td><strong>Flange-Couplings</strong>  &lt;br&gt;Rigid, easily removable shaft coupling with no clearance cone clamping elements.</td>
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<tr>
<td><strong>Clamping Clutches</strong>  &lt;br&gt;For the automatic coupling of rolls. Fast, safe and free from slipping connection.</td>
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<tr>
<td><strong>Safety Clamping Units</strong>  &lt;br&gt;Spring actuated – pneumatically released. For secure and precise positioning of piston rods.</td>
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<th><strong>Shaft-Hub-Connections</strong></th>
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<td><strong>Two-part Shrink Discs</strong>  &lt;br&gt;External clamping connection. Advantages: Simple, secure mounting even without torque wrench.</td>
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<tr>
<td><strong>Three-part Shrink Discs</strong>  &lt;br&gt;External clamping connection for the fastening of hollow shafts on solid shafts.</td>
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<tr>
<td><strong>Cone Clamping Elements</strong>  &lt;br&gt;For shaft-hub connections. High torques with small dimensions.</td>
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<tr>
<td><strong>Star and Clamping Discs</strong>  &lt;br&gt;Ideal for shaft-hub connection for frequent release.</td>
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<tr>
<td><strong>Star Spring Washers</strong>  &lt;br&gt;Axial spring element for preloading of ball bearings.</td>
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<th><strong>Precision Clamping Technology</strong></th>
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<td><strong>Standard Parts for Clamping Fixtures</strong>  &lt;br&gt;The RINGSPANN System for the manufacture of your own precision clamping fixtures.</td>
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<td><strong>Standard Clamping Fixtures</strong>  &lt;br&gt;Standard program in high precision, ready manufactured chucks and mandrels.</td>
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<td><strong>Special Clamping Fixtures</strong>  &lt;br&gt;Custom made solutions for specific clamping problems.</td>
</tr>
<tr>
<td><strong>Collet Mandrels</strong>  &lt;br&gt;Universal, cost effective standard series. Fast collet change to other clamping diameters.</td>
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<tr>
<td><strong>Hydraulic Expanding Clamping Tools</strong>  &lt;br&gt;Mandrels and chucks with high concentricity. Clamping several workpieces in one process possible.</td>
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### Workholding Technology

**Hydraulic Expanding Clamping Tools**

Mandrels and chucks with high concentricity. Clamping several workpieces in one process possible.

**Standard Parts for Clamping Fixtures**

The RINGSPANN System for the manufacture of your own precision clamping fixtures.

**Standard Clamping Fixtures**

Standard program in high precision, ready manufactured chucks and mandrels.

**Special Clamping Fixtures**

Custom made solutions for specific clamping problems.

**Collet Mandrels**

Universal, cost effective standard series. Fast collet change to other clamping diameters.

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Mandrels and chucks with high concentricity. Clamping several workpieces in one process possible.