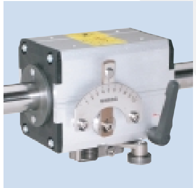
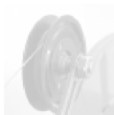
Uhing Lineartriebe®
Uhing Linear Drives®

Model RG & ARG
Technical Information

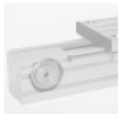


Zubehör
Accessories



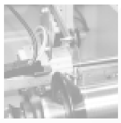
Wälzmutter
Linear Drive Nut

Zahnriemenantriebe
Timing Belt Drive

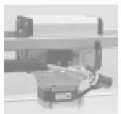


Klemm- und Spannelemente
Clamping Systems

Verlegesysteme
Winding Systems



Uhing MotionDrive®



Uhing Modular Winder

Technical basics

Selection

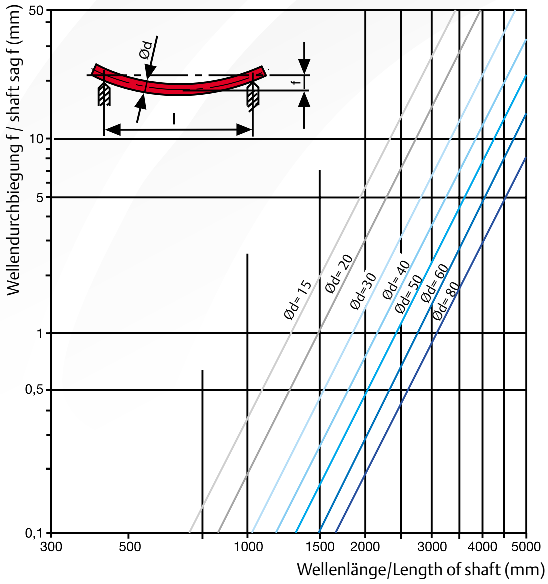
1. Formulae and related units

a(m/sec²)	= acceleration at the reversal point
d(mm)	= shaft diameter
F(N)	= side thrust required
F_{RG}(N)	= side thrust produced by Rolling Ring Drive Unit
F_R(N)	= friction ($F_N \cdot \mu$) only relevant when the the associated mass is mounted on its own independent carriage
F_N(N)	= normal force of total weight of associated mass and carriage
μ	= coefficent of friction
F_Z(N)	= additional force e.g. component of the cutting force of a separator
f(mm)	= shaft sag from Fig.1
g(m/sec²)	= acceleration due to gravity (9.81m/sec²)
h(mm)	= pitch of unit (travel per shaft revolution)
h_{max}(mm)	= maximum pitch see Fig.3
l(mm)	= length of shaft between centres of bearing brackets
m(kg)	= total mass to be moved, including the Rolling Ring Drive Unit, connections etc.
Md (Ncm)	= drive torque
Mo (Ncm)	= idling torque
n(r.p.m.)	= shaft speed
n_{crit}(r.p.m.)	= critical shaft speed
P(kW)	= drive power required
s(mm)	= length of reversal slowdown cam
t(sec)	= reversal time from Fig.2
v(m/sec)	= max. traverse speed required. Should always be calculated at maximum unit pitch (pitch setting 10 from Fig.2)
C(N)	= dynamic loading of Rolling Rings
P_R(N)	= radial loading of Rolling Rings

2. Preselection

A unit should be preselected by estimating the side thrust required and/or giving consideration to the permissible shaft sag f with reference to Fig. 1.

Fig. 1



2.1. Rolling Ring Drive Units with Instantaneous Reversal (Feature M)

Suitable for traversing speeds up to:

Kinemax, RG15, RG20:	0.30 m/sec
RG30, RG40:	0.40 m/sec
RG50, RG60, RG80:	0.25 m/sec

Calculation of side thrust required:

$$F = 2.5 \frac{m \cdot v}{t} + F_R + F_Z + 1.25 \cdot m \cdot g + (F_k)^*$$

*see section 6 - Winding Applications

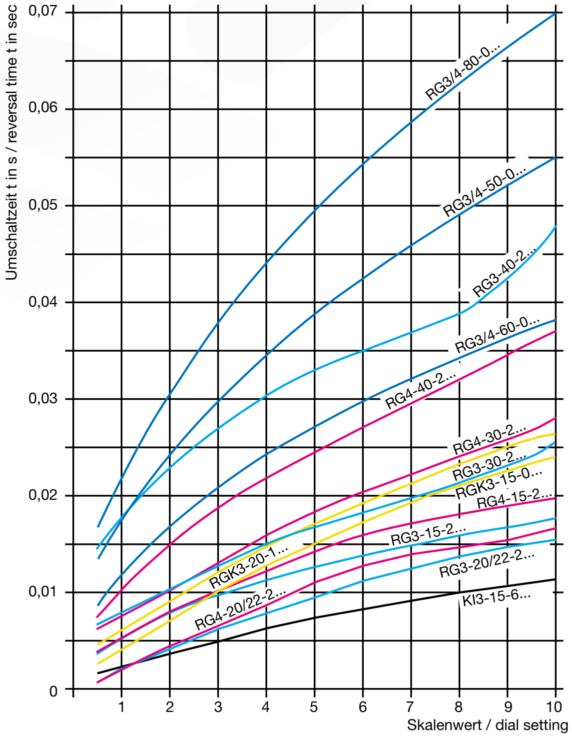
The reversal time t is dependent on the size of the Rolling Ring Unit and the pitch selected via the scale (pitch angle). The reversal action is of the triggered throwover type.
To find reversal time t:
Using the pitch selection scale value 10 in Fig. 2, find the curve for the appropriate unit size and read off the correspondending reversal time t.

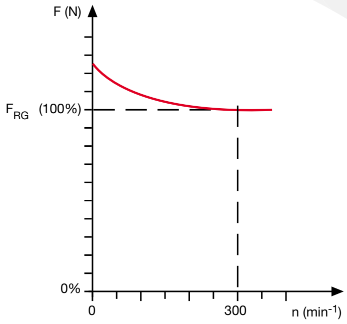
Note:
The value of side trust F calculated must be less than that of the Rolling Ring Drive Unit selected.

$F < F_{RG}$

If necessary, select a different size of unit and repeat the process. For winding applications please also refer to section 6.
Reduce shaft sag by doubled shaft bearing.

Fig. 2





Measuring of sidethrust in the middle of the Rolling Ring Drive.

Change in side thrust related to shaft speed

2.2 Rolling Ring Drive Units with reversal slowdown (Feature V)

Suitable for traverse speeds up to approx. 4.2 m/sec.
A reversal with slowdown reduces the forces imposed on the unit at the reversal point.

$$F = 1.25 \cdot m \cdot a + F_R + F_Z + 1.25 \cdot m \cdot g$$

If a maximum rate of acceleration a is specified, the required length s for the delay cam is calculated as follows:

$$s = \frac{v^2 \cdot 10^3}{a}$$

If the delay cam length s is specified, the acceleration a is calculated as follows:

$$a = \frac{v^2 \cdot 10^3}{s}$$

3. Side thrust

The value of side thrust F calculated must be less than that of the Rolling Ring Drive Unit selected.

$F < F_{RG}$

If the side thrust available from the unit chosen is too little, either a larger unit or a longer length of delay must be selected.

The thrust provided by the units is virtually constant for shaft speeds above 300 rpm. For slower speeds the thrust increases a little over the specified catalogue values as the speed reduces towards zero.
For increase of lifetime there should only be adjusted the side thrust which is needed as a result of calculation according to 2.1 and 2.2.

4. Shaft Speed

4.1. Calculation

$$n = \frac{v \cdot 6 \cdot 10^4}{h_{max}}$$

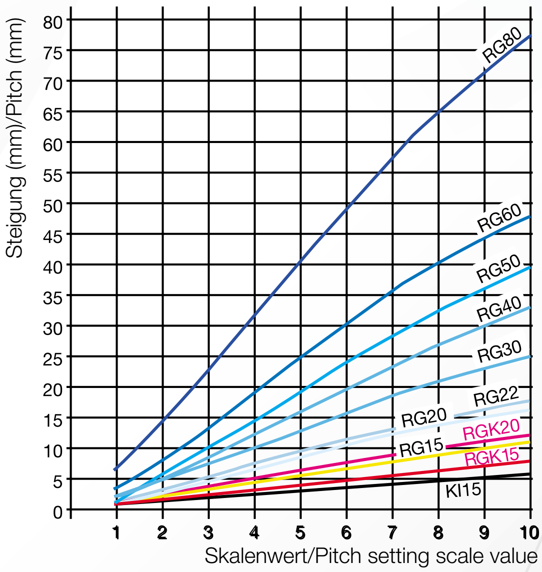
The speed so calculated must not be exceeded.

Recommended speed range:
n_{min} = 5 rpm
n_{max} = 3000 rpm

For speeds outside this range, please consult supplier.

The pitch h is obtained by taking the 10 setting value for the pitch selection scale and relating it to the graph for the appropriate unit size. (Fig. 3)
Minimum traverse stroke:
Feature M (see Page 11) ≈ 1 x d
Feature E+N > 0

Fig. 3



4.2. Critical shaft speed

$$n_{crit} = 1.225 \cdot 10^8 \frac{d}{l^2}$$

Note:
Depending upon its quality, the shaft can go out of balance at a speed of up to 25% lower than that specified above.
If it is necessary to go through a critical range in order to reach the operational speed, this can lead to short term shaft vibration. This has no effect on the operation of the drive.

If the operational speed is in the critical speed range, this can be rectified as follows:
1. with a double bearing support at one end: Increase factor approx. 1.5.
2. with double bearing supports at both ends: Increase factor approx. 2.2.

The distance between the bearing support brackets should be at least 2.5 x the diameter of the shaft.

5. Shaft Drive

5.1. Drive Torque

$$Md = \frac{F_{RG} \cdot h_{max}}{20 \cdot \pi} + Mo$$

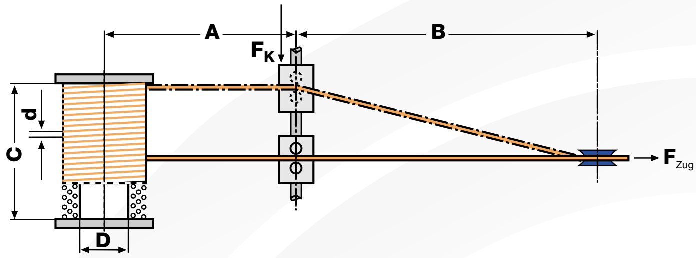
Value for Mo to be taken from the technical data section.

5.2. Drive Power Requirement

$$P = \frac{Md \cdot n}{9550 \cdot 10^2}$$

6. Winding applications

6.1. Formulae and related units



A(mm) = distance between traverse and spool
B(mm) = distance between previous pay-off
C(mm) = traverse width
D(mm) = barrel diameter of bobbin
d_{max}(mm) = maximum diameter of material to be wound or maximum pitch
F_{Zug}(N) = tension in the material to be wound
F_K(N) = component of force working against the direction of travel of the traverse
h_{max}(mm) = max. pitch of unit selected, taken from the technical data section
v_W(m/sec) = winding line speed

6.2. Tension

In winding operations, the force F_K acting on the traverse and related to the tension F_{Zug} in the material to be wound is a major factor in the selection of a Rolling Ring Traverse.

$$F_K = \frac{C \cdot F_{Zug}}{1{,}6 \cdot \sqrt{\frac{C^2}{4} + B^2}}$$

As, almost invariably, traverses with instantaneous reversal are used for winding applications, the value calculated for F_K must be added to the side thrust required figure taken from section 2.1.

6.3. Calculation of traverse speed

$$v = \frac{v_W \cdot d_{max}}{D \cdot \pi \cdot 0.95}$$

6.4. Optimum ratio between spool shaft and traverse shaft speeds

$$i_{opt} = \frac{0.95\, h_{max}}{d_{max}}$$

$i_{opt} > 1$ = traverse shaft slower
$i_{opt} < 1$ = traverse shaft faster

6.5. Please note

Pitch settings lower than "1" on the scale should be avoided if the requirement is for a high quality of wind. Compensate by changing the ratio between the spool shaft and traverse shaft speeds (reduce traverse shaft speed).

7. Calculation of the operational life of Uhing Rolling Rings

1. C Determine a value for:

Type RG	C_1 (N)	C_2 (N)
15/KI/RGK	6050	2800
20/22/RGK	11200	5600
30	16800	9300
40	21600	13200
50	29600	18300
60	37700	24500
80	58800	39000

C_1 = Unit operating continuously on rotating shaft without a standstill
C_2 = Unit operating continuously and including a standstill on a rotating shaft

2. Calculate P_R
KI, RGK and all RG3-types: $P_R = 5 \cdot F_{RG}$*
all RG 4-types: $P_R = 2.5 \cdot F_{RG}$*
*F = calculated value of the side thrust according to 2.1 and 2.2 only if increasing of operational life time of the Rolling Rings is really necessary. In case of order it is an absolute must to mention.

3. Divide C by P_R

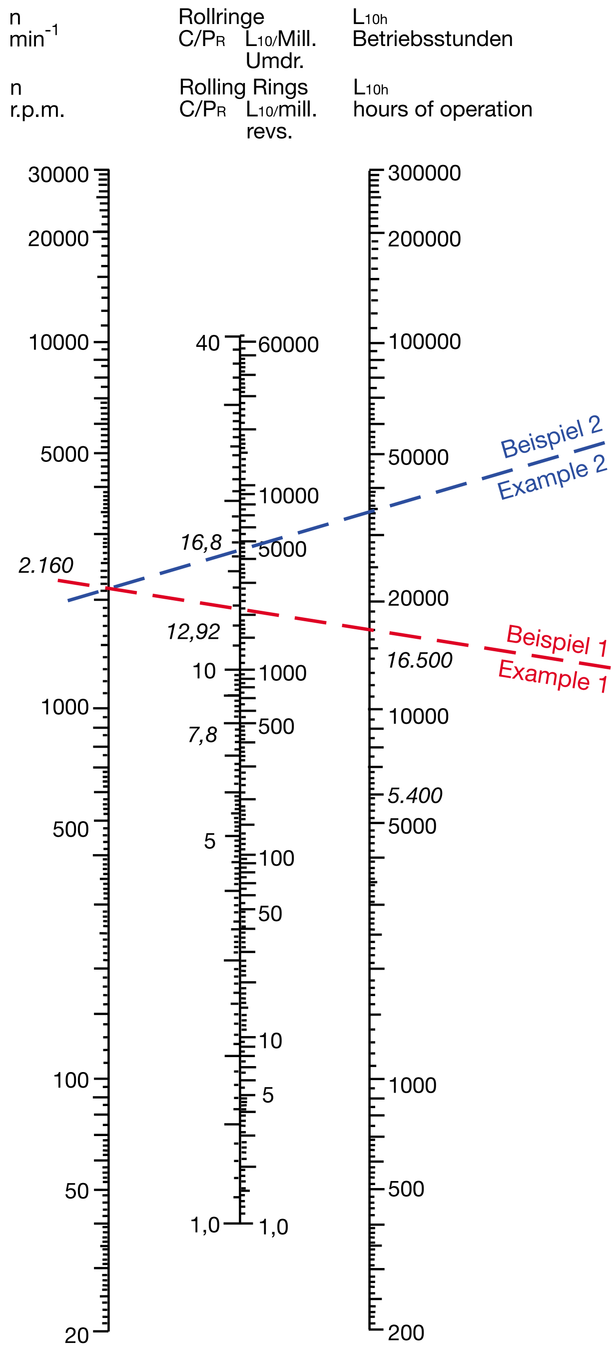
4. Calculate the required shaft speed as shown

$$n = \frac{v \cdot 6 \cdot 10^4}{h_{max}}$$

5. Determine the operational life in hours from the nomogram.

	Example 1	Example 2
	ARG 3-30-2 VCRF Speed 0.9 m/sec. Standard thrust F = 260 N	ARG 3-30-2 VCRF Speed 0.9 m/sec. **Reduced thrust F = 200 N**
1.	C_1 = 16,800	C_1 = 16,800
2.	$P_R = 5 \cdot 260$ N = 1,300 N	$P_R = 5 \cdot 200$ N = 1,000 N
3.	$\frac{C_1}{P_R} = \frac{16{,}800}{1{,}300} = 12.92$	$\frac{C_1}{P_R} = \frac{16{,}800}{1{,}000} = 16.8$
4.	$n = \frac{0.9 \cdot 6 \cdot 10^4}{25} = 2{,}160$ rpm	$n = \frac{0.9 \cdot 6 \cdot 10^4}{25} = 2{,}160$ rpm
5.	L_{10h} = 16,500 Hours of operation	L_{10h} = 35,000 Hours of operation

Nomogram



To make a selection for an application the data of application questionaire 03e are required.

Operational guide

Security advice: the movements of the traverse drive can crushes. It has to be protected against contact just like the rotating shaft.

1. Shaft material

1.1. Basic requirements

Uhing Linear Drives should only be used in conjunction with steel shafts manufactured from induction surface hardened, ground and finished bar of the following quality, minimum:

- surface hardness: 50 HRC
- tolerance on diameter: h6
- out of roundness: maximum one half of the diameter variation permitted by ISO tolerance h6
- true running tolerance (DIN ISO1101): ≤0.1 mm/m

1.2. Uhing precision shaft

Standard:
Material Cf 53, Mat.-No. 1.1213 induction surface hardened, 60-64 HRC
Rust resistant:
Material X 40 Cr 13, Mat.-No. 1.4034 induction surface hardened, 51-55 HRC
Rust and acid resistant:
Material X 90 CrMoV 18 Mat.-No. 1.4112 induction surface hardened, 52-56 HRC

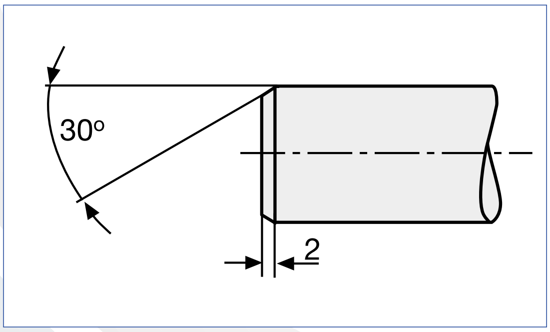
- all ground and superfinished
- surface roughness: mean value (DIN 4768 T.1) Ra: ≤ 0.35 µm
- tolerance on diameter: h6
- out of roundness: maximum one half of the diameter variation permitted by ISO tolerance h6
- true running tolerance (DIN ISO 1101): ≤ 0.1 mm/m

1.3. Uhing precision shafts with enhanced true running tolerance

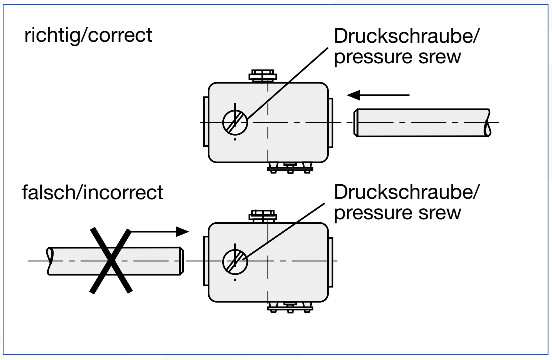
Available in the above styles, but - true running tolerance (DIN ISO 1101): ≤ 0.03 mm/m

1.4. Leading end chamfer

The leading end of the shaft should be chamfered to avoid damage to the Rolling Rings when screwing the unit onto the shaft.



The following method should be followed to facilitate the screwing of the shaft into the unit:
For units not having a pressure screw (KI and types RG 4-15/20/22/30-2) the entry side for the shaft is not specified.



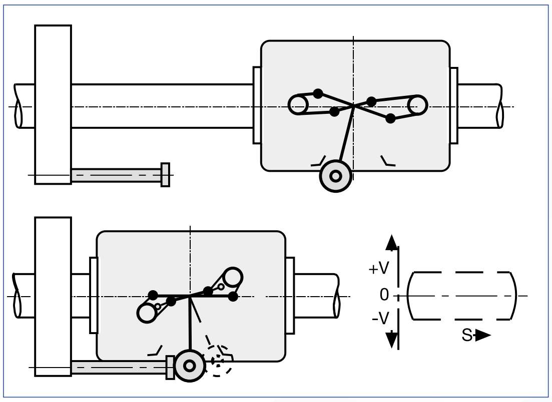
2. Shaft rotation

The mechanical reversal of the Rolling Ring Drive is related to the direction of shaft rotation. It will operate only when the rotation is as specified in the order (except for feature **D and RGK types)**.
When changing the direction of rotation, the pitch symmetry must be checked and adjusted if necessary (see Operating Instructions 05e).

3. Reversal

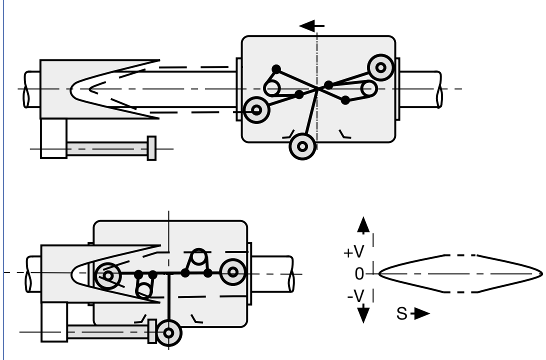
3.1. Instantaneous reversal (Feature M)

Mode of operation: on making contact with a traverse stroke limiting endstop, the torsion springs in the reversal mechanism charge, trigger and fire the reversal once the throwover position has been reached.
For the reversal mechanism to operate, a minimum distance of travel approximately equivalent to the diameter of the shaft (dependent of the pitch setting) is required.The reversal time is also pitch related (see Fig. 2, page 20). Consequently, as the pitch is increased, there is a slight increase in the traverse stroke length (and a decrease if the pitch is reduced).
Differences in the stroke length also result when the speed of a unit, the pitch of which remains unaltered, is varied by significantly changing the shaft speed.
Drive speed increases = increase in length of stroke,
Drive speed decreases = decrease in length of stroke.



3.2. **Reversal slowdown** (Feature V)

Mode of operation: just prior to the reversal point an additional lever, which terminates in a contact bearing, makes contact with a V-shaped slowdown cam which causes it to swivel. This swivel action serves to reduce the unit's pitch as it approaches the reversal point such that the instantaneous reversal which follows is at a greatly reduced traverse speed.
This reversal slow-down makes higher traverse speed and/or greater forces possible.
The reversal slowdown is predominantly related to distance, changes in pitch do not effect the length of traverse stroke.



4. Pitch setting

The pitch is the distance travelled per revolution of the shaft. With a Uhing Rolling Ring Drive, this is variable between "1" and maximum "10". The pitch can be set either when the unit is in motion or stationary.
The following pitch setting possibilities are available:
Kinemax and RGK: self retaining knob for infinite variability.
Feature C: 100/50 pitch selection scale covering the full pitch range.
Feature S: Set screws for the infinitely variable setting of the pitch in each direction.
Feature Z: Worm gear drive for infinitely variable pitch setting. Remote control from one of the end bracket positions possible.
Note: With the exception of **S** type units, the pitch is generally set to be the same for both directions of travel. The difference in pitch in the two directions (symmetry) is factory set not to exceed 2.5%, for RGK types not to exceed 5%.

5. Separately carried additional loads

If Rolling Ring Drives are used to move separately carried masses, allowance should be made in the coupling to compensate for any misalignment between the drive shaft and the carriage.
It should be additionally ensured that the distance between the point of connection and the unit is as short as possible, as twisting moments affect the thrust produced.

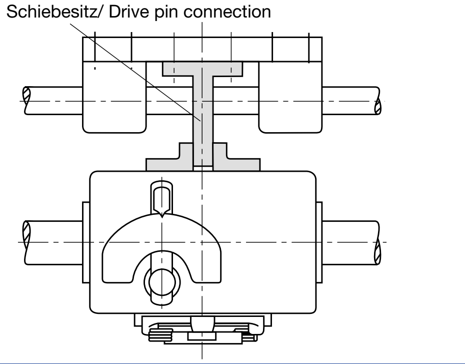
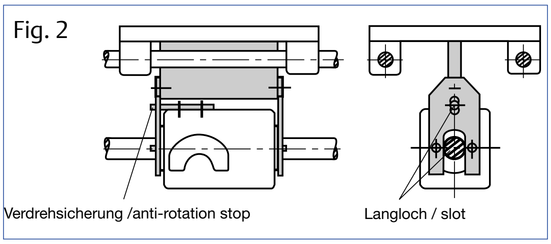
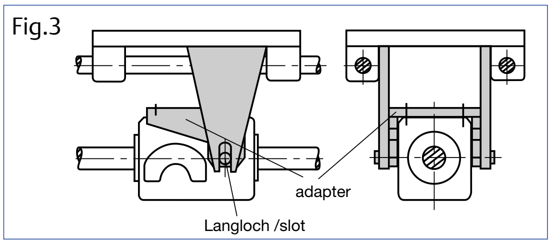


Fig. 1

Optimum couplings are twist-free as shown in Fig. 2 and 3.

Fig. 2


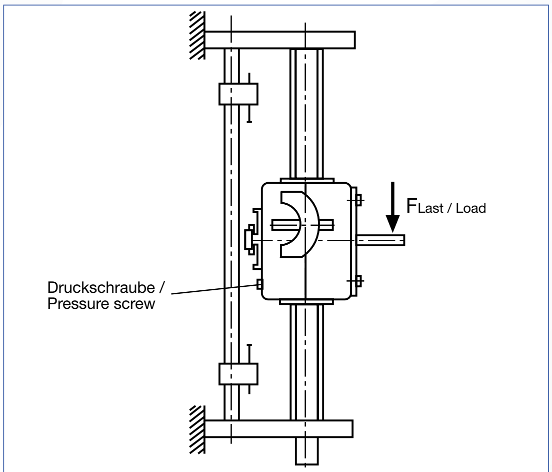
Coupling connection at end of unit

Fig.3


Coupling connection at side of unit

6. Vertical applications

Attention should be given to the direction of the applied load and the position of the pressure setting screw so as to avoid a drop in thrust efficiency (except with KI 3-15-6, RGK-types, RG 4-15/20/22/30-2).
In the arrangement illustrated, there is an increase in thrust when unit is moving up the shaft.



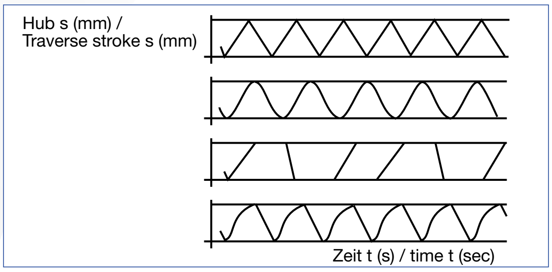
In applications using units with a free-movement-lever, care must be taken before operating it to ensure that the load can not drop in an uncontrolled way - injury could result.

7. Stopping on a rotating shaft

Rolling Ring Drives fitted with slowdown cams (type **V**) or a control lever (**H** or **K**) can, with appropriate control, be brought to a standstill (pitch setting "0") without the need to stop the shaft. This could be necessary if the drive is being used as a feed mechanism and is required to wait for a start signal at one or both ends of its traverse stroke.
Intermediate stop positions between the end stop positions are also possible. If positional accuracy in excess of ±0.5 mm is acceptable, slowdown cams are adequate for the purpose. Otherwise, if accuracy better than ±0.5 mm is sought, a control lever should be used.
To protect the condition of the shaft, we recommend that the drive to the shaft be switched out if the standstill period exceeds 5 sec. at full rated thrust. The standstill time can be extended if the shaft speed is low or the thrust is reduced. Please direct related enquiries to the supplier.

8. Traversing characteristics

By using a lever, the end of which is in the form of a roller which makes contact with cams arranged along the length of the traverse stroke, the pitch - and with it the speed - can be matched to the most varied requirements, the distances travelled being exactly repeatable.



9. Synchronization of processes

Drives fitted with set screws (type S) offer the possibil-ity of exactly relating the speed to that of already ex-isting processes, e.g. synchronization of a travelling cutting head in cutting operations involving continuously fed materials. If the Uhing shaft and the material feed have a common drive, synchronization is maintained even if the overall material speed varies.

10. Operating temperature

Suitable for a temperature range of -10° to +80° C (RGK to + 50°C). Special styles available for other temperatures on request.

11. Maintenance

Shaft: MoS2 free ballbearing greases can be used, e.g. SKF Alfalub LGMT, Esso Beacon EP1...3.

Procedure:
Clean the shaft and spread the grease with a rag as thin as possible.
Lubricate the reversal mechanism, particularly the springs, with high viscosity machine oil (SAE 90).
RGK is maintanance free.

Frequency:
Monthly, shorter intervals are recommended e.g. where a unit is required to be stationary on a rotating shaft, it is working in shifts, where it operates under extremly dusty conditions, at temperatures over 80° C.
Technical alterations are reserved.

Worldwide

The addresses of our agencies are available in the internet:
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