ROTAFRIX®
Friction Wheels,
Friction Rings
and Guide Pulleys

Vibration Control

** Continental**
CONTITECH

ROTAFRIX® Friction Wheels, Friction Rings and Guide Pulleys for rolling contact drives and drum drives
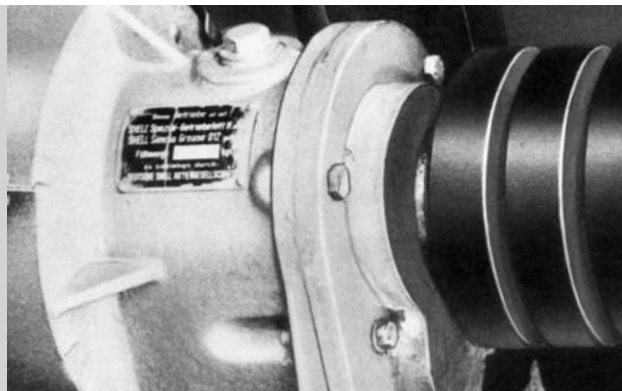
ContiTech

High-tech products and systems, combinations of rubber, plastics and other materials together with electronics: That's what ContiTech does. We are a development partner and original equipment manufacturer for all major industries, ranging from automotive engineering via the rail transport and aerospace industries to manufacturers of plants and machinery. We bring our expertise together under the overall ContiTech brand and demonstrate the width and depth of our capabilities in the Group. ContiTech's seven business units and their product market segments target the needs of their customers and markets. On one hand they act with the flexibility of a medium-sized enterprise and on the other hand with the financial resources and potential for synergies of a major corporation, Continental AG.

Vibration Control

The business unit Vibration Control is a development partner and partner for innovative components for vibration control applications in the automotive industry, for special vehicles, motorized drives, plant and machinery. Today's stationary machines make a variety of demands in terms of vibration and noise control. We work with state-of-the-art methods, addressing current concerns relating to environmental compatibility and the protection of resources. We see the entire vehicle as a system. For us chassis competence means matching the chassis and all other components to each other in an ideal fashion. Our holistic approach teamed with our broad systems, product and application know-how enables us to meet increased requirements, while protecting resources and the environment at the same time. We show a high regard for quality, costs and reliable logistics in the interests of our partners and customers.

ROTAFRIX® Friction Wheels, Friction Rings and Guide Pulleys

ROTAFRIX® products are the result of many years' experience in the field of drive technology. Using rubber, they offer optimal properties for rolling contact drives and drum drives. Ongoing R&D and leading-edge technologies guarantee extremely reliable products with a consistently high quality standard.
Our innovative performance makes ContiTech your ideal partner for tailored solutions to problems and case-specific consultancy from our application engineers.
This brochure offers a detailed guide to ROTAFRIX® friction rings, guide pulleys and friction wheels: their properties, the range, fitting, and application tips.

Service:

You can have the appropriate size calculated online at **www.schwingmetall.com** for the most common applications. For special cases please contact our ROTAFRIX® partner or our product R&D staff.

**Contents**

1 Product Description

ROTAFRIX® Friction Wheels, Friction Rings and Guide Pulleys

Application

Rubber rolling contact drives are economical and efficient, of simple construction, low-noise and maintenance-free. These properties have always encouraged designers to use rubber rolling contact drives to solve particular drive problems. They are widely used by machinery and tool manufacturers, in conveying technology and for drum drives. ROTAFRIX® friction rings and friction wheels are highly suitable for use in drum drives. This special type of rubber rolling contact drive is used in many mechanical engineering fields as an economical form of drive, for example for tube mills and ball mills.
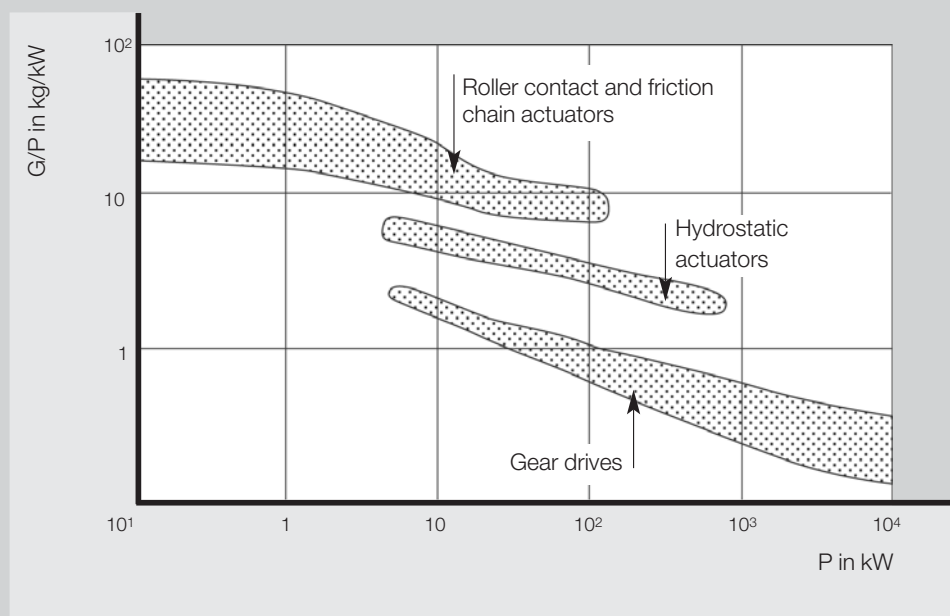
Classification of rolling contact drives by power/weight ratio and power range

Area of Application for Friction Wheels

The best-known examples of friction-locking power transmission are the vehicle tire/road and wheel/rail systems. The circumferential force required for propulsion is transmitted by the wheel to the rail by friction locking. The transmissible frictional force is a function of the wheel load and the coefficient of friction between the wheel and rail.

The operation of a rubber rolling contact drive is significantly affected by the correct installation of the rolling contact gears.

Application Field for Friction Rings and Guide Pulleys

ROTAFRIX® friction rings are the result of many years' experience in the field of drive technology. With their special elastomer materials they offer optimal properties for high-performance rolling-contact drives with high transmission capacities.

ROTAFRIX® guide pulleys made of solid rubber, optionally in combination with damping elements, are ideal for guiding hoisting cages and buckets. ContiTech has developed a special version which meets the durability requirements even at high conveying speeds of up to 20 m/s (72 km/h). The result is high-performance elements which are of simple construction, low-noise and maintenance-free. They are used for hoisting systems in mines.

Properties

ROTAFRIX® products have properties which, in combination, often permit particularly economical drive solutions and are therefore instrumental in ensuring the use of rubber rolling contact drives, drum drives and hoisting systems.

High Transmission Performance
The high-quality rubber compound ensures high power transmission thanks to its high coefficient of friction and, where appropriate, excellent bond to the metal.

High Efficiency
The rubber compound high coefficient of friction guarantees low slip / slippage and thus high (energy) efficiency.

Long Service Life
The wear-resistant rubber compound which can withstand high dynamic loads permits long service life.

Low-Noise Operation
The soft, damping elastomer lining prevents annoying operating noise.

Compact Space Requirement
The compact design of friction wheels, friction rings and guide pulleys permits drives with small volumes and low weights.

Trouble-Free Installation
The design and fitting of ROTAFRIX® products are straightforward and make no special demands.

Easy Fitting
The tapered base design of friction rings and guide pulleys enables straightforward, trouble-free fitting on site.

Maintenance-Free Operation
All ROTAFRIX® products are maintenance-free.

Low Bearing Load
The application of the proportional contact pressure principle results in lower shaft and bearing loads.

Product Range
A carefully graded standard range permits prompt ex-stock deliveries. Special sizes are available on request.

Friction Wheel Construction

ROTAFRIX® friction wheels consist of
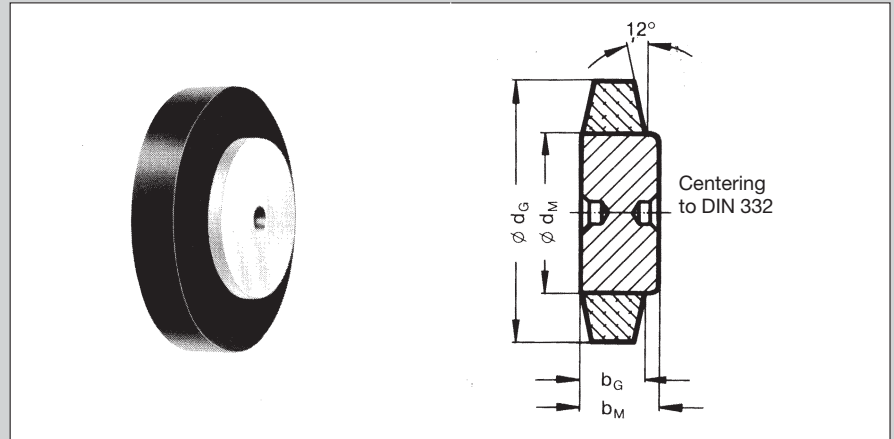- Rubber compound
- Metal hub

Fig.1   *ROTAFRIX®friction wheel standard finish*

Rubber compound

The properties of the rubber compound are matched to the special properties of friction wheels. ROTAFRIX® friction wheels are available in the following version (delivery terms and purchase quantities for custom versions are available on request):

Polychloroprene rubber
Hardness 80 Shore A
Permissible friction lining temperature -30°C to +70°C
Wear-resistant and largely oil-resistant

Metal Hub

The metal hub is manufactured of commercially available 9 S 20 K free-machining steel. The hub has two center holes for subsequent machining. The metal hub is wider than the friction lining on one side to permit proper mounting of the rolling contact gear.

Designation

ROTAFRIX® friction wheels are designated by reference to the following data:
- Friction wheel external diameter d_G in mm
- Contact face width b_G in mm
- Metal hub diameter d_M in mm

Example
ROTAFRIX® 80/20 - 50 friction wheel
80 _____ Friction wheel external diameter d_G in mm
20 _____ Contact face width b_G in mm
50 _____ Metal hub diameter d_M in mm
Alternatively, the mold number as specified below can also be used.

Tolerances

The elastomer hardness tolerance is 80 ± 5 Shore A.

The rubber compound of ROTAFRIX® friction wheels is toleranced to ISO 3302 M3. The metal hub is toleranced to ISO 2767 - m.

Product Range

The standard range comprises the dimensions listed in Table 1 constructed in the finish outlined in the "Construction" section. They comply with Series 20 DIN 323 and are available ex stock.

Range (dimensions in mm)					*Table 1*

Mold No.	Designation	Friction Lining Dimensions		Metal Hub Dimensions	
		External Ø d_G	Width b_G	External Ø d_M	Width b_M
31674	40/10- 25	40	10	25	13
31675	45/11- 28	45	11	28	14
31555	50/12- 32	50	12	32	16
31676	56/14- 35	56	14	35	18
31605	63/16- 40	63	16	40	20
31677	71/18- 45	71	18	45	22
31606	80/20- 50	80	20	50	25
31678	90/22- 55	90	22	55	27
31642	100/25- 65	100	25	65	30
31643	112/28- 70	112	28	70	33
31644	125/32- 80	125	32	80	37
31645	140/36- 90	140	36	90	41
31679	160/40-100	160	40	100	45

Friction Ring and Guide Pulley Construction

ROTAFRIX® friction rings and guide pulleys consist of
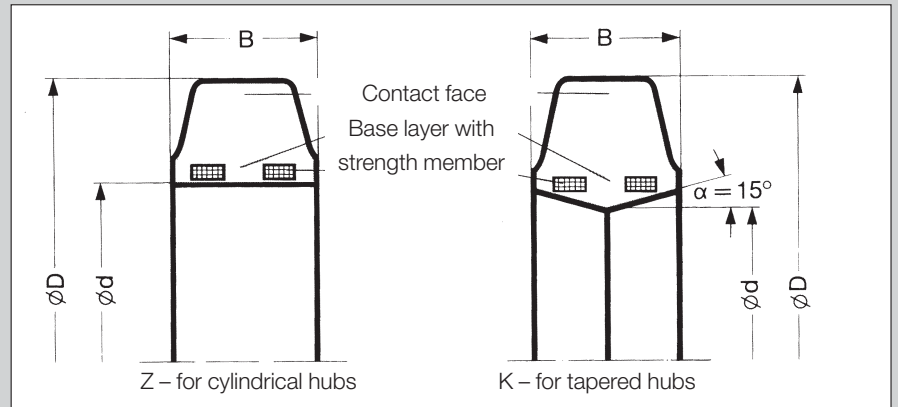- Contact face
- Base layer
- Strength member

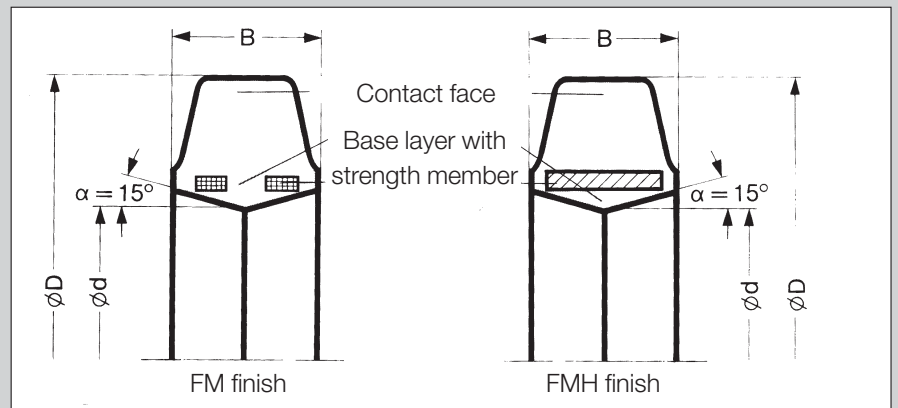*Fig. 2*   *ROTAFRIX® friction rings*

Fig. 3   *ROTAFRIX® guide pulleys*

Contact Face

The properties of the surface layer are matched to the special requirements imposed on it. A choice of two abrasion-resistant compounds of each is therefore available:

Friction rings	Guide pulleys
RM	**FM**
Natural rubber basis	Natural rubber basis
Hardness 73 Shore A	Hardness 67 Shore A
Permissible ambient temperature	Suitable for speeds up to 14 m/s (50 km/h)
-30 to +70°C, from 30°C with	**FMH**
reduced contact force	Natural rubber basis
RS	Hardness 67 Shore A
Polychloroprene rubber basis	Suitable for speeds up to 20 m/s (72 km/h)
Hardness 83 Shore A	This version has been tested by
Permissible ambient temperature	Versuchsgrubengesellschaft mbH,
-30 to +90°C, from 50°C with	Tremoniastr. 13, D-44137 Dortmund
reduced contact force	and rated as "recommended"
Largely resistant to many technical	(test report dated Sept. 9, 1976 La/sf).
oils and greases	

Base Layer

The base layer consists of a special hard elastomer material. It is firmly bonded to the contact face by means of vulcanization and contains the strength member.

The base layer is manufactured for both cylindrical and tapered hub finishes (code for cylindrical base design z, code for tapered base design k).

Strength Member

Friction rings	Guide pulleys
The strength member consists of steel reinforcing wires. These keep the friction ring under constant tension and ensure a particularly firm fit on the hub.	The strength member keeps the guide pulley under constant tension and ensures a particularly firm fit on the hub. In the FM finish the strength member consists of steel reinforcing wires, and in the FMH finish the strength member is a steel ring.

Designation

ROTAFRIX® friction rings and guide pulleys are designated by reference to the following data:
- External diameter D in mm
- Width B in mm
- Hub diameter d in mm
- Code for the base design
- Contact face finish

Friction rings are designated in accordance with DIN 7845.

Example

ROTAFRIX® 200/50-140 z, RM friction ring

200	200 mm friction ring external diameter
50	50 mm friction ring width
140	140 mm hub diameter
z	Base design for cylindrical hubs
RM	RM contact face finish

To differentiate them from elastic tires for industrial trucks ROTAFRIX® friction rings and guide pulleys are clearly labeled on their flanks to indicate their contact face finish by means of an embossed mark or a yellow vulcanized badge in order to prevent confusion with solid industrial tires and thus avoid complaints.

Tolerances

The elastomer hardness tolerance is ± 5 Shore A.

The dimensional tolerances for the friction ring and guide pulley external diameter D are ± 1.5% and for the friction ring and guide pulley width B ± 4%.

ROTAFRIX® friction rings and guide pulleys can be worn down to a residual cushion depth of 80% of the original figure.

The hub tolerances are specified in the "Hub" section on p.14.

Product Range

The range of ROTAFRIX® friction rings and guide pulleys manufactured is adapted to market requirements. The available sizes of friction rings are listed in Table 2, and the available sizes of guide pulleys in Table 3. Special finishes on request.

The table lists the friction ring designations and the corresponding hub dimensions for cylindrical and tapered hubs. – The hubs are not supplied by ContiTech.
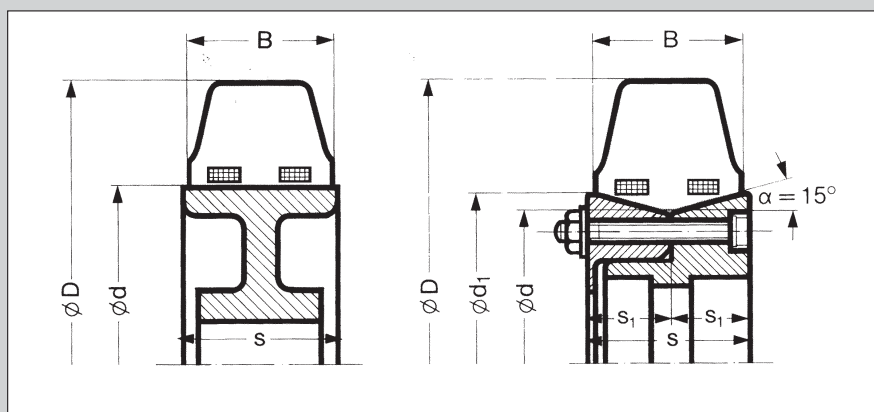
They are available from trade outlets.

Fig. 4   *ROTAFRIX®friction rings with hubs*

| Friction Ring Product Range and Hub Dimensions (dimensions in mm) | | | | | | | | | | | | *Table 2* |

Designation D/B-d	Stock Goods		Hub Dimensions for Cylindrical Hubs					Hub Dimensions for Tapered Hubs				
			with Number of Friction Rings									
Hub	Finish			1	2	3	4					
	RM	RS	d	S_{min}	S_{min}	S_{min}	S_{min}	d	d_1[1]	S_{min}	a	S_1[1]
60/50-30 z		●	30	52								
71/60-34 z		●	34	63								
86/50-40 z		●	40	52								
85/60-40 z		●	40	63								
95/50-50 z		●	50	52								
95/60-50 z		●	50	63								
100/45-60 z		●	60	47								
125/50-75 z	●	●	75	52	110							
160/50-100 z	●	●	100	52	110							
160/50-100 k								100	113.9	52	15°	26.0
180/50-120 z	●		120	52	110							
200/50-140 z	●	●	140	52	110							
200/50-140 k								140	153.9	52	15°	26.0
200/75-100 z	●	●	100	78	160							
200/75-100 k								100	120.9	78	15°	39.0
230/50-170 z	●	●	170	52	110							
230/50-170 k								170	183.9	52	15°	26.0
230/75-120 z	●	●	120	78	160							
230/75-120 k								120	140.9	78	15°	39.0
250/60-170 z	●		170	63	130	190						
250/60-170 k								170	186.9	63	15°	31.5
250/75-140 z	●	●	140	78	160	235						
250/75-140 k								140	160.9	78	15°	39.0
280/60-190 z	●		190	63	130	190						
310/60-220 z	●	●	220	63	130	190						
310/60-220 k								220	236.9	63	15°	31.5
360/60-270 z	●		270	63	130	190						
360/75-270 z	●		270	78	160	235						
360/75-270 k								270	290.9	78	15°	39.0
400/60-305 z	●		305	63	130	190						
415/75-305 z	●		305	78	160	235						
415/75-305 k								305	325.9	78	15°	39.0
500/65-410 z			410	68	140	205						
500/85-370 z	●		370	89	180	265	354					
500/85-370 k								370	393.8	89	15°	44.5
560/100-410 z			410	104	210	312	416					
750/75-640 z		●		640	78	160	235	312				
1000/100-850 z				850	104	210	312	416				

[1] Diameter d_1 is calculated from angle a and hub width S_1 .
Width S_1 is a minimum value. If S_1 is exceeded, d_1 must be recalculated using angle a.

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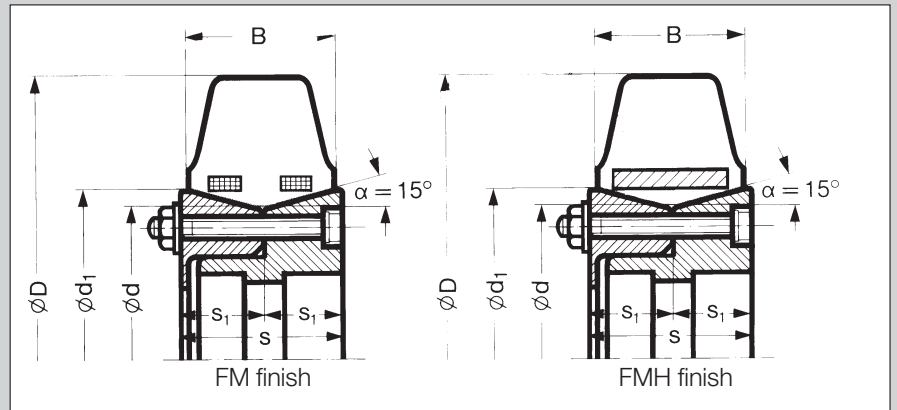
Fig. 5   *ROTAFRIX® guide rollers with hubs*

Table 3		Guide Roller Product Range and Hub Dimensions (dimensions in mm)				
Designation D/B-d	**Finish**	**Hub Dimensions**				
		d	d_1[1]	S_{min}	a	S_1[1]
300/75-220 k	FM	220	240.9	78	15°	39.0
300/75-220 k	FMH	220	240.9	78	15°	39.0
300/85-170 k[2]	FM	170	193.8	89	15°	44.5
415/75-305 k[2]	FM	220	240.9	78	15°	39.0

[1] Diameter d_1 is calculated from angle a and hub width S_1. Width S_1 is a minimum value.
   If S_1 is exceeded, d_1 must be recalculated using angle a.

[2] Manufactured to order

2 Fitting, Machining

Fitting and Machining

ROTAFRIX® products have a proven track record of durability and operational reliability. Assuming the drive or the pulley guide system is correctly designed and properly fitted and machined, ROTAFRIX® is maintenance-free.

The following tips will help to fully exploit all the benefits of ROTAFRIX® in practice.

General Tips

The axes of the drive and driven shafts must be aligned such that they are parallel. Radial runout of the hubs must be avoided. If multiple friction rings, wheels or guide pulleys are mounted adjacent to each other, the shaft must be sufficiently stiff. Worn friction rings and guide pulleys must be replaced in sets.

Friction rings must be ground after fitting in applications which require operation to be as oscillation-free as possible and a high degree of rotational accuracy and in the case of friction rings fitted in sets. This balances out any production-related depth tolerances, while ensuring even loading on friction rings which are fitted in sets.

The depth of ROTAFRIX® friction rings can be be turned or ground down to 80% of the friction ring depth, and the friction lining depth of standard finishes of ROTAFRIX® friction wheels to a minimum of $0.5 * b_G$. This enables speed ratios to be accurately tuned to special applications.

ROTAFRIX® guide pulleys do not generally need to be ground. It is permitted, however, in the case of particularly smooth pulley systems.

Please see the "Machining" section for details.

Hubs

The prerequisite for ROTAFRIX® friction rings and guide pulleys being securely seated is that dimensionally accurate hubs finished to the correct specification are used.

The hub dimensions (p.7, Table 1 and p.11, Table 2) must match those specified for the relevant ROTAFRIX® friction rings and guide pulleys. Tolerances h 11 apply to the diameters of cylindrical hubs and js 12 for tapered hubs (Table 4).

Table 4	Hub Diameter Tolerance (dimensions in mm)	
Hub Diameter d	**Tolerance** h 11	js 12
< 80	− 0.190	± 0.150
80 - 120	− 0.220	± 0.175
> 120 - 180	− 0.250	± 0.200
> 180 - 250	− 0.290	± 0.230
> 250 - 315	− 0.320	± 0.260
> 315 - 400	− 0.360	± 0.285
> 400 - 500	− 0.400	± 0.315
> 500 - 630	− 0.430	−
> 630	− 0.470	−

The hub surface should finely machined (machining codett ▼▼, peak-to-valley height R_z = 16-32 μm corresponding to R_a = 3.2-6.3 μm).

Excessive surface roughness prevents the required uniform sliding during pressfitting. The hub edges should have a 1x 45° chamfer. Excessive chamfering, especially with narrow hubs, can have an adverse effect on the hub fit.

The hubs must be at least 4% wider than the nominal width of the friction rings. If the hub is too narrow, its edges cut into the base of the friction ring and destroy it. If two friction rings are to be pressed onto one hub, the hub width must be sized as if for two individual friction rings.

Hubs which are to be reused must be cleaned, and any dents and burrs on the hub edges must be eliminated before fitting the ring.

Tips for Fitting Friction Rings

Friction Rings with Cylindrical Base

Friction rings with a cylindrical base are press-fitted to the cylindrical hub with pretension using a hydraulic plate press. Despite the steel reinforcement, the friction ring is still sufficiently elastic that fitting can be carried out without difficulty if the following instructions are observed.

Supplementary Tools

Special supplementary tools are needed for the press-fitting process since the friction ring is not fitted directly but via a tapered expansion ring. To avoid deformation during fitting, a cylindrical press-fit ring is used which distributes the pressure evenly over the entire periphery of the ring and also prevents tilting.
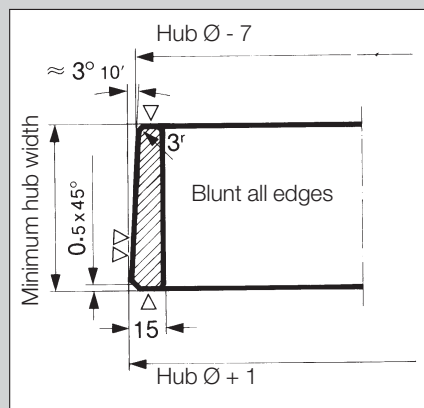
Fig. 6   *Expansion ring*
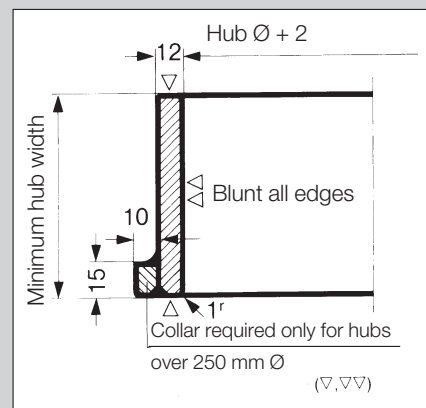
Fig. 7   *Press-fit ring*

The expansion ring should be manufactured as shown in Fig. 7. An expansion ring is unnecessary for small and narrow friction rings if the hub has highly chamfered edges.

The press-fit ring is shown in Fig. 8. The press-fit ring ideally has a collar for hubs of greater than 250 mm Ø. Press blocks must not be used instead of a press-fit ring.

The expansion ring and press-fit ring must only be used for the friction ring size they are built for. Any other use would damage the tools.

Fitting agent

When press-fitting friction rings, the fitting agent TIP TOP SE lubricant, art. no. 5930388, should be used, diluted with water in a ratio 1:5 in accordance with manufacturer specifications. Oils, greases or normal fitting paste for pneumatic tires may not be used.

Press-Fit Procedure (Fig. 8)
- Check hub (B) for correct size, degrease it and place it on press plate (A).
- Center the expansion ring (C) on the hub. If high quantities are to be fitted, it is recommended to center the expansion ring on the hub.
- Apply lubricant solution evenly to sliding surfaces of hubs, expansion ring and friction ring (D).
- Place friction ring on expansion ring.
- Place press-fit ring (E) centrally on friction ring. Check that press guides are plane-parallel.
- Lower press until friction ring is seated centrally on hub. The press must move in plane-parallel mode at a speed of < 35 mm/s and must move continuously, without interruption.

When press-fitting 2 or more friction rings onto a hub, proceed as follows:
- With 2 friction rings: press-fit from both sides
- With 3 or 4 friction rings: enlarge press-fit ring to multiple friction ring width and press-fit from both sides.

The force required for press-fitting depends on the diameter and width of the friction ring. Press-fitted friction rings should be left for a few hours before being machined or installed.
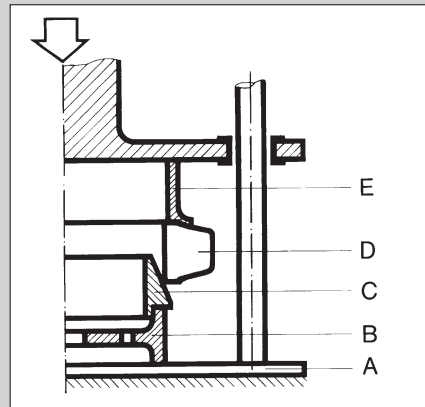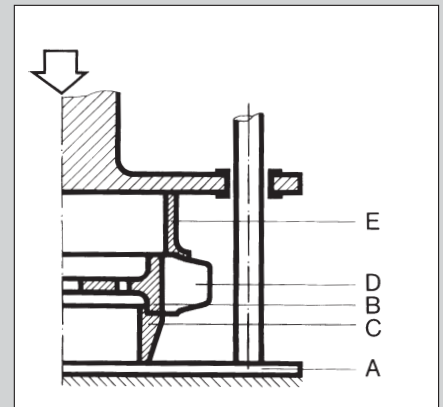
Fig. 8   Press-fitting   Fig. 9   Removal

Removal Procedure (Fig. 9)
- Place expansion ring (C) on press platen (A).
- Center hub (B) with firmly seated friction ring (D) on expansion ring.
- Center press-fit ring (E) on friction ring.
- Lower press.

When removing 2 or more friction rings from a hub, the friction ring width must be appropriately increased, as in the press-fit procedure. The force required to remove rings is about 2-3 x the press-fit force.

Once removed, friction rings must not be reused.

Friction Rings and Guide Pulleys with Tapered Base
Friction rings and guide pulleys with a tapered base are fitted using two hub halves. A firm fit of the friction ring is achieved by tightening the two hub halves against the conical seat of the friction ring or guide pulley (p.12, Fig. 5).

When fitting, it is important to ensure that the hub has a smooth finish and that the hub halves are directly contiguous after fitting.

Fitted friction rings or guide pulleys should be left for a few hours before being machined or installed.

Machining Friction Rings,
Friction Wheels and Guide Pulleys

Material properties make it necessary to take certain special features into consideration when machining elastomer products. The following tips have proven helpful in actual practice.

Grinding

Grinding wheel:	Poralun grindstone, designation "60 H mmg" (for particularly fine surfaces "80 H mmg"), ceramically bonded
Circumferential speed:	Grindstone 28 - 32 m/s
	Friction ring 0.5 m/s
	Rotational direction: counterrotating
Feed:	Rough grinding 0.2 m/min
	Finish grinding 0.06 m/min
Advance:	Rough grinding 2.0 mm max
	Finish grinding 0.6 mm max
Cooling:	Air cooling or cooling with "Adroit S" at a ratio of 1 : 60
Grinding belt:	Grain "80 H"
Speed:	As indicated by manufacturer
Advance:	0.3 mm

Turning

Tool:	Thin, surface-ground spoon chisel
Circumferential speed:	= 4 m/s

The parts have to be ground after turning.

Important Tips

- Pay attention to temperature thresholds
  When machining the metal parts of the hubs, it is important that the metal temperature does not exceed 100°C.
  In grinding and turning operations the sustained temperature of the contact face should not exceed 70°C, with brief peaks of 80°C permitted.
- Use orbital reciprocal grinding
  An orbital reciprocal grinding motion yields smooth surfaces.
  Avoid end grinding.
- Grind with gentle pressure
  With gentle pressure there is no danger of excessive heat buildup. The contact face tends to smear if excessive pressure is applied. Discontinue grinding if a smear forms. Allow the elastomer lining to cool well before sprinkling talcum powder on the surface. Then continue grinding, applying gentle pressure.
- Clean grinding wheel with compressed air
  Cleaning the grinding wheel frequently ensures a uniform surface quality.

Storage, Cleaning

DIN 7716 contains general guidelines on the storage, cleaning and maintenance of rubber products.
Soiled ROTAFRIX® products can be cleaned using a glycerine-alcohol mixture (1 : 10). Solvents such as naphtha or benzene must not be used. The use of sharp objects is also not permitted.

Driving Wheel

ROTAFRIX® friction wheels are generally used as driving wheels since a rubber driving wheel achieves greater usable coefficients of friction than a steel driving wheel. Transmission ratios of up to i = 1/7 are feasible in practice. The transmissible power can be multiplied by configuring several rubber rolling contact gears on a common hub.

Counter wheel

The counter wheel must always be a little wider than the friction ring to avoid damaging the contact face and edge compression. The durability of the drive is improved if the surface roughness of the countergear is as low as possible.

Thermal Stress

The temperature of the elastomer lining should not exceed 70°C. Once the drive has been run in, brief peaks of up to 80°C are permitted. Constant temperatures above 70°C shorten the product life.

3 Design Guidelines

Design Guidelines

The design guidelines contain all the information, equations and tables needed to design rubber rolling contact drives. Tables whose figures can easily be calculated using the specified equations have been omitted.

Use
Since the power transmission depends on the contact force, transmission ratio, rotational speed and application, mathematical verification using the relevant equations and tables (see "Designing Rubber Rolling Contact Drives", p.22) is always recommended.

Coefficient of Friction
The coefficient of friction μ is a numerical value defined for each material combination which expresses the correlation between the transmissible circumferential force F_u and the contact force F_n.

$$\mu = \frac{F_u}{F_n}$$

For a material combination in which one of the two materials is an elastomer, a coefficient of friction of $\mu = 0.7$ can usually be applied. In the case of smooth uniform drives with a contact pressure appropriate to the respective circumferential force – i.e. designed in accordance with the so-called control angle principle – a coefficient of friction of up to $\mu = 0.9$ can be applied. Operation in wet or dusty conditions reduces the coefficient of friction depending on the severity of the condition. In the worst-case scenario it is only possible to attain figures of $\mu = 0.3 - 0.1$ (Table 8, p.26).
A coefficient of friction of $\mu = 0.7$ was applied for the permitted transmissible power P_R per rolling contact gear (see graph in Fig. 15, p.27).

Principle of Proportional Contact Pressure
The advantage of proportional contact pressure is that the circumferential force always sets the respective contact pressure required for its transmission. When operating in partial-load mode the rolling contact gear is only subjected to the contact force corresponding to the respective power (see also "Design Example", p.28). This autoregulation arises from the lever and key effect principle, making use of the motor stator's reaction torque. Its effectiveness depends on the control angle ρ.

Control Angle
The control angle ρ (Figs. 10 and 11) is determined by the connecting lines formed by the rolling contact gear center point and the center point of the countergear, on the one hand, and the pitch point of the rolling contact gear with the countergear and the swing arm pivot point, on the other hand. The rotational direction of the drive motor must be taken into account in determining the swing arm pivot point. If the motor runs clock-wise, the swing arm pivot point is always to the left of the contact gear's center point.
The relationship between the control angle and coefficient of friction is

$$\tan \rho = \mu$$

For $\mu = 0.6 - 0.8$ the control angle is r = 31° - 39°. The following control angles have proven themselves in practice:
$\rho = 35°$ for an external rubber rolling contact drive
$\rho = 38°$ for an internal rubber rolling contact drive
Rubber rolling contact drives designed in accordance with the control angle principle guarantee particularly long service life.
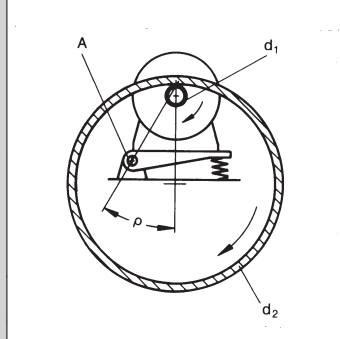

Fig.10 *Control angle in external rubber rolling contact drive*

The design described cannot be used for alternating rotational directions. A special design is required to accommodate changes in the direction of travel (see "Intermediate rolling contact drive", Fig. 12).

Fig. 11   Control angle in internal rubber rolling contact drive

Spring Force

The spring force F_f generates the contact force that guarantees contact even when idling if the control angle principle is applied. As the circumferential force increases, the requisite contact force is set automatically.

The reaction force of the circumferential force F_u acts as an external force on the rocker/motor/roller contact gear system. The following torque equation applies:

$$\Sigma M_A = 0 = F_n \cdot I_4 + F_g \cdot I_2 - F_u \cdot I_1 - F_1 \cdot I_3$$

The required pretensioning force of the spring is derived from transposition of the above equation.

$$F_f = \frac{F_n \cdot I_4 + F_g \cdot I_2 - F_u \cdot I_1}{I_3}$$

It is important to determine the required spring force. If the contact force is insufficient, slip occurs when the drive is idling. The contact gear will not be capable of functioning as required. Excessive contact force results in a high internal heat buildup during operation and leads eventually to the destruction of the roller contact gear.

The permissible contact force figures F_{max} are listed in Table 6, p.25.

Intermediate Rolling Contact Drive

The intermediate rolling contact drive (Fig. 12) is advantageous for applications involving relatively large center distances. Here a ROTAFRIX® friction wheel is used as an intermediate rolling contact gear, with the rotational direction of the driving and driven wheels becoming identical. The rotational direction must be selected such that the intermediate rolling contact gear is pressed between the gears by the circumferential force.

A favorable correlation can be achieved between the contact force, slip and related wear if the dimensions for the intermediate contact gear are calculated in accordance with the following equations.

Fig. 12   Intermediate roller contact drive

$$d3 = \sqrt{\frac{8a^2 - (d_1 + d_2)^2 \cdot [1 + \cos(180° - 2\varphi)]}{4 \cdot [1 - \cos(180° - 2\varphi)]}} - \frac{d_1 + d_2}{2}$$

The equation is simplified if an angle $\varphi = 35°$ is applied.

$$d3 = \sqrt{1.490 \cdot a_2 - 0.123 \cdot (d_1 - d_2)^2} - \frac{d_1 + d_2}{2}$$

If the diameters of all the gears and the center distance are specified, it is possible to verify the angle.

$$\cos(180° - 2\varphi) = - \frac{4a^2 - (d_3 + d_1)^2 - (d_3 + d_2)^2}{2 \cdot (d_3 + d_1) \cdot (d_3 + d_2)}$$

The requisite contact force at the rolling contact gear contact points can be generated by a tension or compression spring. It should engage approximately in the center of the intermediate rolling contact gear and act in the direction of the line bisecting the angle of 180° - φ.
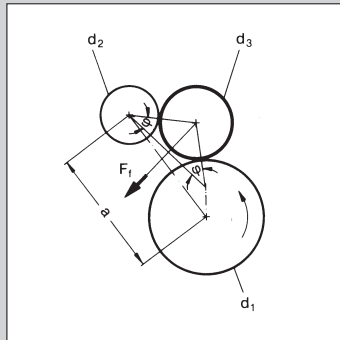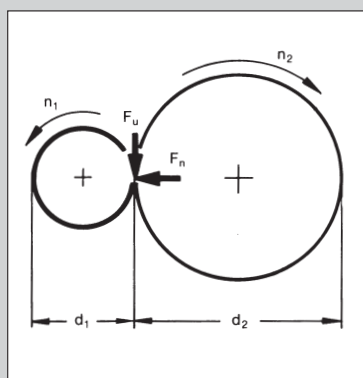
Fig. 13   *Control angle in internal rubber rolling contact drive*

Design

Rubber rolling contact drives are designed in accordance with standard principles and procedures. If optimal use is to be made of ROTAFRIX® friction rings, it is necessary to take the relevant operating conditions into account. ContiTech has decades of experience with the design of rubber rolling contact drives. Therefore we recommend consulting us in difficult cases. The key data required to design a drive are summarized on the relevant data sheet (see end of catalog).

The flex factor and the maximum contact force provide information for initial design considerations, e.g. on the size and number of ROTAFRIX® friction rings required.

Designing Rubber Rolling Contact Drives

These design guidelines refer to rubber rolling contact drives fitted with ROTAFRIX® friction wheels and friction rings.

In the case of particularly difficult drive problems and batch applications it is advisable to take advantage of ContiTech's obligation-free and free-of-charge advisory service.

Symbols, Units, Terms

Symbol	Unit	Term
c_1		Flex factor
c_2		Service factor
d_1	mm	Diameter of driving wheel
d_2	mm	Diameter of driven wheel
F_n	N	Contact force
$F_{n\ erf}$	N	Required contact force
$F_{n\ zul}$	N	Permitted contact force
F_u	N	Circumferential force
$F_{u\ erf}$	N	Required circumferential force
i		Transmission ratio
n_1	rpm	Speed of driving wheel
n_2	rpm	Speed of driven wheel
P	W	Power to be transmitted
P_{eff}	W	Application-related permissible power
P_R	W	Permissible transmissible power per roller contact gear at $\mu = 0.7$
v	m/s	Circumferential speed
z		Number of rolling contact gears required
μ		Coefficient of friction

Flex Factor c_1

The flex factor c_1 takes the transmission ratio into account. The maximum contact forces F_{max} apply only when the rolling contact gear runs against a smooth plate (diameter of the countergear = ∞). In all other cases the maximum contact force F_{max} must be corrected using the flex factor c_1. The flex factor c_1 is calculated using the following equation:

$$c_1 = \frac{1}{\sqrt[3]{1 + \frac{d_1}{d_2}}}$$

The flex factor c_1 can also be derived from the graph in Fig. 14.

$c_1 = 1$ can be assumed in the case of internal rolling contact gears because of the large contact surface.
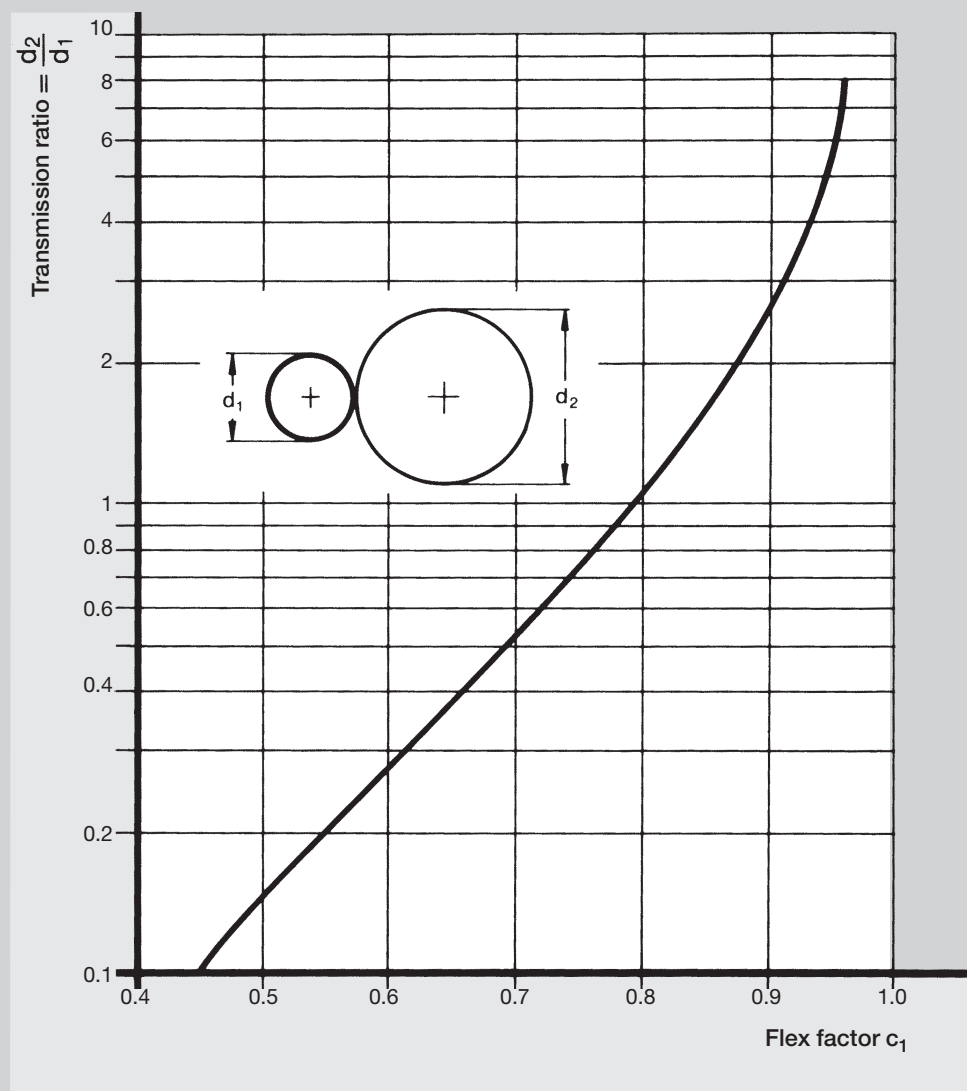
Fig. 14

d_1 - diameter of the ROTAFRIX® friction ring
d_2 - diameter of the countergear or drum.

Service factor c_2

The service factor c_2 takes account of the daily operating time, switching frequency, starting torques and ambient temperature.

Table 5	Service factor c_2					
Switching frequency	Without shock load			With shock load and high startup overload		
	Daily operating time in h			Daily operating time in h		
	up to 10	over 10 to 16	over 16	up to 10	over 10 to 16	over 16
Continuous operation	1.0	1.1	1.2	1.1	1.2	1.3
Low switching frequency	1.1	1.2	1.3	1.2	1.3	1.4
Moder. switching frequency	1.2	1.3	1.4	1.4	1.5	1.6
High switching frequency	1.3	1.4	1.5	1.6	1.7	1.8

Transmission ratio i

The transmission ratio i is the ratio of the speeds n_1 to n_2 or the gear diameter d_2 to d_1.

$$i = \frac{n_1}{n_2} = \frac{d_2}{d_1}$$

Circumferential Speed v

The circumferential speed v is derived from the diameter d and speed n of the gear.

$$v = \frac{\pi \cdot d \cdot n}{60 \cdot 10^3}$$

v in m/s
d in mm
n in rpm
The circumferential speed of the rolling contact gear should not exceed v = 25 m/s.

Circumferential Force F_u

The circumferential force F_u is determined by the power P to be transmitted and the circumferential speed v.

$$F_u = \frac{P}{v}$$

F_u in N
P in W
v in m/s

Contact Force F_n

As with all friction drives, the contact force F_n is crucial to the performance and service life of a drive.
- Insufficient contact force results in inadequate power transmission, insufficient efficiency, and premature destruction of the rolling contact gear as a result of slip.
- Excessive contact force results in increased flexing, higher loading, and premature rolling contact gear destruction due to high internal thermal buildup.

The contact force F_n is a function of the circumferential force F_u and the coefficient of friction μ.

$$F_n = \frac{F_u}{\mu} \qquad \text{(The coefficient of friction μ is listet in Table 8, p.26)}$$

The maximum contact forces F_{max} are listed in Table 6 and Table 7.
The permissible contact force F_{zul} is applied when carrying out the design calculation for the drive. This takes account of both the flex factor c_1 and the other drive and ambient conditions.

| Maximum Contact Force F_{max} in N for Friction Rings | | | | | | | | | | | | | | *Table 6* |

ROTAFRIX® Friction Ring	Speed n (rpm)													
D/B-d	4	6.3	10	16	25	40	63	100	160	250	400	630	1000	1600
60/50-30								400	360	320	270	210	150	90
71/60-34								800	690	590	490	390	280	120
86/50-40								850	430	370	280	200	140	90
85/60-40								850	730	610	490	390	280	150
95/50-50						560	520	490	420	340	250	170	120	70
95/60-50						820	760	700	600	480	360	250	170	90
100/45-60						910	840	780	650	530	380	270	190	110
125/50-75						1120	1020	940	800	660	500	330	200	120
160/50-100						2100	1830	1550	1250	940	640	420	260	150
180/50-120						2500	2170	1850	1460	1080	730	480	300	160
200/50-140				3520	3220	2900	2520	2150	1680	1220	820	540	340	180
200/75-100				6050	5500	4900	4150	3550	2750	1950	1320	850	550	320
230/50-170				4850	4500	4000	3400	2850	2100	1500	1050	650	400	200
230/75-120				7000	6300	5750	4850	4100	3100	2150	1500	950	550	350
250/60-170				6550	5850	5300	4500	3700	2750	1900	1300	850	500	320
250/75-140				7900	7100	635	5400	4450	3300	2200	1450	950	600	350
280/60-190				7300	6700	6150	5000	4150	3050	2000	1350	850	550	320
310/60-220				8500	7350	6450	5350	4350	3150	2100	1400	850	550	320
360/60-270				9300	8000	7000	5700	4500	3200	2000	1300	850	550	320
360/75-270				11300	9500	8400	6800	5300	3800	2500	1500	950	640	
400/60-305				11200	9600	8300	6500	4800	3300	2300	1550	950	550	
415/75-305				11200	9750	8700	6850	5350	3600	2500	1700	1050	600	
500/65-410			13500	11500	10300	8800	6800	4850	3250	2150	1320	820	500	
500/85-370			15000	13600	12000	9900	7700	5650	3800	2600	1700	1000	600	
560/100-410	19000	18050	17300	15050	13100	10300	7700	5700	3950	2550	1700	1000		
750/75-640	18000	17300	16400	13900	11500	9000	6400	4400	2800	1850	1100			
1000/100-850	19000	18200	17000	14400	11850	8800	6200	4100	2650	1650	850			

Table 7	Permissible Contact Force F_{max} in N for Friction Wheels												
ROTAFRIX® Friction Wheel[1]	Speed n (rpm)												
	100[2]	200	300	500	700	950	1200	1450	1800	2850	4000	6000	10000
40/10 - 25	157	147	137	118	103	86	75	64	57	40	32	23	16
45/11 - 28	196	183	172	147	124	100	87	75	67	46	37	26	19
50/12 - 32	255	235	216	177	149	111	95	85	76	52	43	30	
56/14 - 35	304	280	255	211	180	148	126	107	95	66	54	37	
63/16 - 40	412	363	319	255	213	174	150	129	115	81	66	45	
71/18 - 45	540	461	392	299	248	205	179	157	140	95	77	54	
80/20 - 50	677	559	476	353	287	240	210	182	161	110	89	62	
90/22 - 55	873	697	559	425	349	270	242	209	185	129	104		
100/25 - 65	1030	814	667	496	404	324	278	238	211	146	118		
112/28 - 70	1295	981	785	589	471	382	328	280	248	168	135		
125/32 - 80	1717	1275	981	701	564	452	387	330	293	204	165		
140/36 - 90	2364	1619	1226	883	687	548	446	393	347	241			
160/40 - 100	2820	2020	1720	1240	956	750	639	542	480	329			
v (m/s)					5	10		15	20	25			

Coefficient of Friction μ

The coefficient of friction μ is dependent on the material combination and on environmental influences such as wetness and dirt (see also "Use", p.20).

Table 8	Coefficient of Friction μ		
Coefficient of Friction μ	Environmental Influence	Surface	Application (examples)
0.9 - 0.7	dry	▽▽▽	Precision engineering
0.7 - 0.5	damp		to machine construction
0.7 - 0.5	dry	▽▽	Precision engineering
0.5 - 0.3	damp		to machine construction
0.5 - 0.3	dry	▽	Drives under
0.3 - 0.1	damp to wet		unfavorable conditions

Application-Related Permissible Power P_{eff}

The application-related permissible power P_{eff} is the permissible transmissible power P_R, corrected by the flex factor c_1, the service factor c_2, and the coefficient of friction μ.

$$P_{eff} = \frac{P_R \cdot c_1 \cdot \mu}{c_2 \cdot 0.7}$$

Number z of Rolling Contact Gears Required

The required number z of rolling contact gears is derived from the power P to be transmitted and the application-related permissible power P_{eff}.

$$z = \frac{P}{P_{eff}} = \frac{P \cdot c_2 \cdot \mu}{P_R \cdot c_1 \cdot 0.7}$$

Permissible Transmissible Power P_R per Friction Wheel
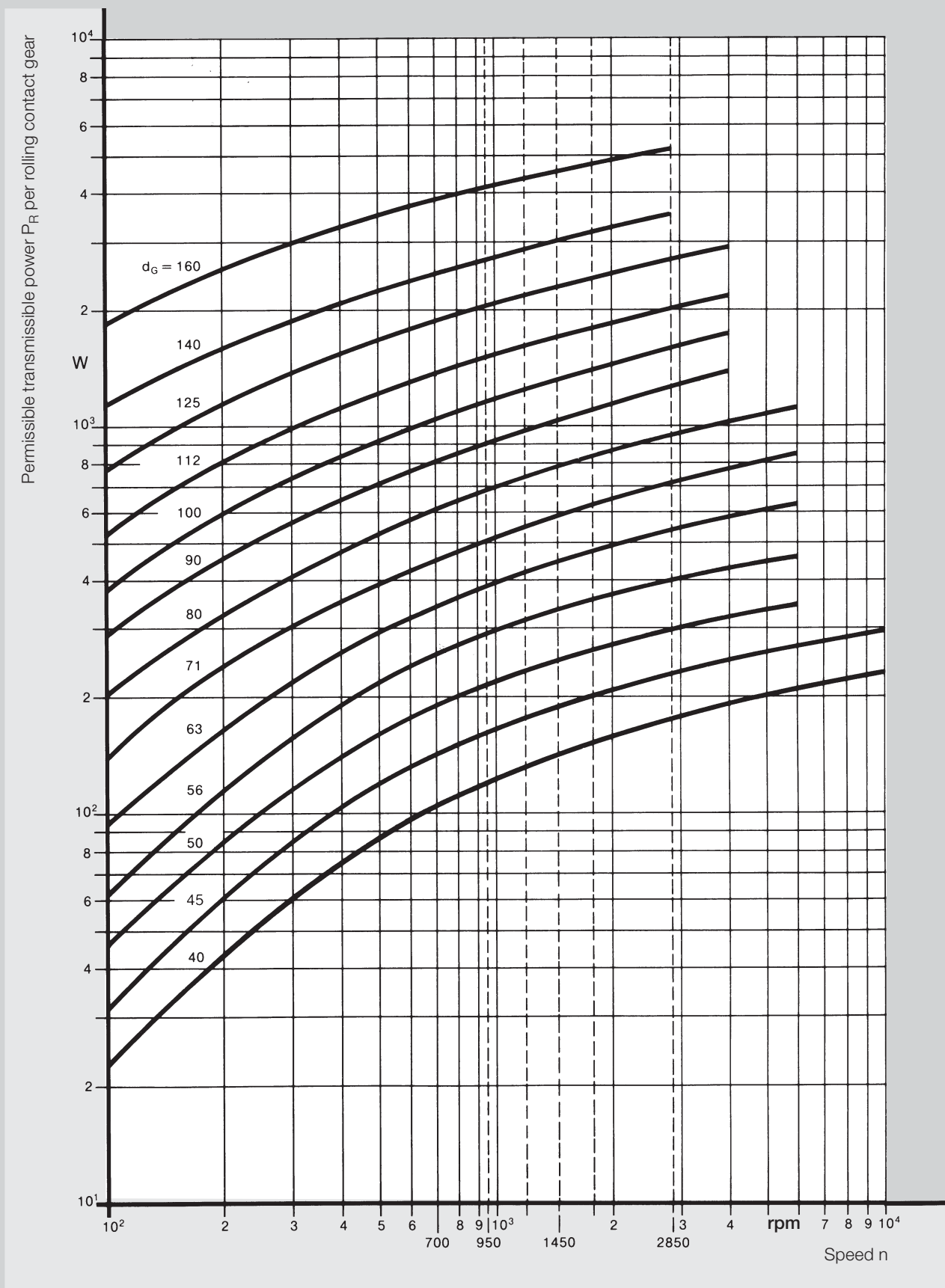
Fig. 15
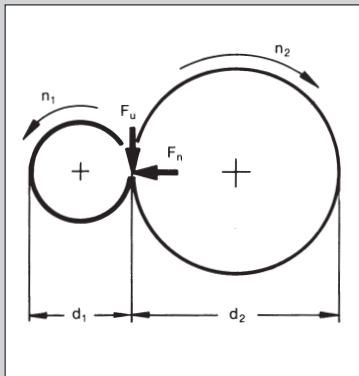
Rubber Rolling Contact Drive Design Example

Drive motor: Electric motor   P = 150 W

                                         $n_1 = 2850$ rpm

Machine: Printing machine $n_2 = 800$ rpm

Operating conditions: Friction wheel on motor shaft.

                                           Specified diameter $d_1 = 40$ mm.

                                           The drive is switched on and off frequently and

                                           runs in a single shift.

Service Factor c_2 from Table 5, p.24	$c_2 = 1.6$
Transmission Ratio $i = \dfrac{n_1}{n_2} = \dfrac{d_2}{d_1}$	$i = \dfrac{2850}{800} = 3.56$
Diameter of Countergear $d_2 = i \cdot d_1$	$d_2 = 3.56 \cdot 40 = 142.4$ mm
Flex Factor $c_1 = \dfrac{1}{\sqrt[3]{1 + \dfrac{d_1}{d_2}}}$	$c_1 = \dfrac{1}{\sqrt[3]{1 + \dfrac{40}{142.5}}} = 0.92$
Circumferential Speed $v = \dfrac{\pi \cdot d \cdot n}{60 \cdot 10^3}$	$v = \dfrac{\pi \cdot 40 \cdot 2850}{60 \cdot 10^3} = 5.97$ m/s
Circumferential Force $F_{u\,erf} = \dfrac{P}{v}$	$F_{u\,erf} = \dfrac{150}{5.97} = 25.1$ N
Contact Force $F_{n\,erf} = \dfrac{F_{u\,erf}}{\mu}$ μ from Table 8, p.26 F_{max} from Table 6/7, p.25/26 $F_{maxl} > F_{n\,erf}$	$F_{n\,erf} = \dfrac{25.1}{0.7} \approx 35.9$ N $\mu = 0.7$ $F_{max} = 40$ N for ROTAFRIX® 40/10-25 friction wheel $F_{max} = 40$ N $> F_{n\,erf} = 36$ N
Permissible Transmissible Power P_R from graph in Fig. 15, p.29	$P_R = 167$ W for $\mu = 0.7$ alternativ $P_R = F_{max} \cdot \mu \cdot V$
Application-Related Permissible Power $P_{eff} = \dfrac{P_R \cdot c_1 \cdot \mu}{c_2 \cdot 0{,}7}$	$P_{eff} = \dfrac{167 \cdot 0.92 \cdot 0.7}{1.6 \cdot 0.7} = 96$ W

Number of Required Contact Gears

$$z = \frac{P}{P_{eff}} = \frac{P \cdot c_2 \cdot \mu}{P_R \cdot c_1 \cdot 0.7}$$

$$z = \frac{150 \cdot 1.6 \cdot 0.7}{167 \cdot 0.92 \cdot 0.7} = 1.56$$

Specification:
2 ROTAFRIX® friction wheels
40/10-25 mold no. 31674

The use of 2 ROTAFRIX® friction wheels inevitably means that the drive is oversized. The requisite contact force must be recalculated with fixed pressure in order to be able to exploit this power reserve fully throughout the service life of the drive.

This verification is unnecessary if the control angle principle is applied since the optimal requisite contact force is then set automatically. It is advisable to correct the spring force required to generate the contact pressure when idling.

Recalculation of the Requisite Contact Force with Fixed Contact Pressure

$$F_{n\ erf} = \frac{P \cdot c_2}{v \cdot \mu \cdot z \cdot c_1}$$

$$P_{eff} = \frac{150 \cdot 1.6}{5.97 \cdot 0.7 \cdot 2 \cdot 0.92} = 31.2\ N$$

This contact force is required to generate the fixed contact pressure
for 1 contact gear, so 62.4 N is correspondingly required for 2 contact gears.
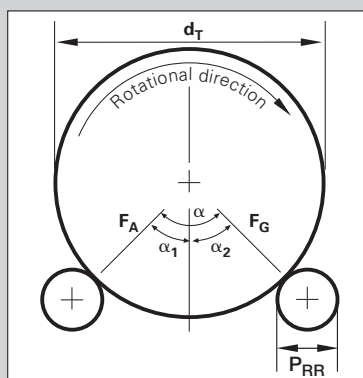
Drum Drive Design Example

Drive motor:	Electric motor P = 110 kW
	n = 74 rpm
Machine:	Pipe mill
Operating conditions:	No shock load
	Low switching frequency
	Operating time approx. 12 h/day
Surface of contact area:	Dry $\triangledown\triangledown$
Drive shaft:	20 pcs 560/100/-410z, RM
Countershaft:	16 pcs 560/100-410z, RM
Drum diameter d_T:	1645 mm
Drum weight + weight of filling = $G_T + G_F$:	20,700 kg
Angle to drive shaft α_1:	38°
Angle to countershaft α_2:	32.8°

Calculation of Forces Acting

The following calculation is based on the conditions shown on the right and the corresponding laws of mechanics.
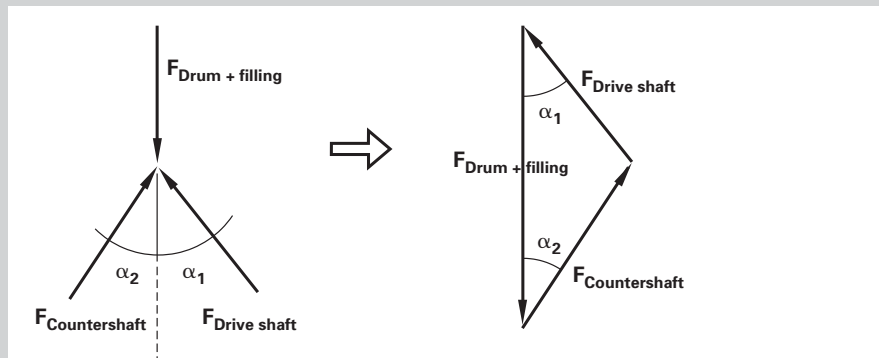
Mass of Drum

$$F_T = (G_T + G_F) \cdot 9.81$$

$$F_T = 20,700 \cdot 9.81 = 203,067 \text{ N}$$

Contact Force on Drive Shaft

$$F_A = \frac{F_T}{\dfrac{\sin \alpha_1 \cdot \cos \alpha_2}{\sin \alpha_2} + \cos \alpha_1}$$

$$F_A = \frac{203,067}{\dfrac{\sin 38 \cdot \cos 32.8}{\sin 32.8} + \cos 38} = 116,457 \text{ N}$$

Contact Force on Countershaft

$$F_G = F_A \cdot \frac{\sin \alpha_1}{\sin \alpha_2}$$

$$F_G = 116.457 \cdot \frac{\sin 38}{\sin 32.8} = 132,392 \text{ N}$$

Circumferential Speed

$$v = \frac{\pi \cdot d_{RR} \cdot n}{60 \cdot 10^3}$$

$$v = \frac{\pi \cdot 560 \cdot 74}{60 \cdot 10^3} \qquad v = 2.17 \text{ m/s}$$

Circumferential Force

$$F_u = \frac{P}{v}$$

$$F_u = \frac{110}{2.17} = 50,696 \text{ N}$$

Verification of Maximum Load on Friction Rings

Load per Ring

$$F_{Ring} = \frac{F}{\text{No. of rings}}$$

$$F_{A,\,Ring} = \frac{116,457}{20} = 5,823 \text{ N}$$

$$F_{G,\,Ring} = \frac{132,392}{16} = 5,823 \text{ N}$$

Calculation of Required Contact Force for Transmission of Power

Flex Factor c_1

$$c_1 = \frac{1}{\sqrt[3]{1 + \dfrac{d_{RR}}{d_T}}}$$

$$c_1 = \frac{1}{\sqrt[3]{1 + \dfrac{560}{1,645}}} = 0.907$$

Service Factor c_2
as per Table 5, p.24

$$c_2 = 1.2$$

Coefficient of Friction μ
as per Table 8, p.26

$$\mu = 0.7$$

Required Contact Force

$$F_N = \frac{F_u \cdot c_2}{\mu \cdot c_1}$$

$$F_{N,\,ges} = \frac{50,696 \cdot 1.2}{0.7 \cdot 0.907} = 95,819 \text{ N}$$

Since the required contact force is less than the available contact force no action is required.

$$F_{N,\,ges} = 95,819$$

$$F_A = 116,457 \text{ N}$$

The loads on the individual rings now have to be verified:

The maximum permissible contact force for the available 560/100-410 rings is approx. 7,000 N at a speed of 74 rpm according to Table 6, p.25 (figure determined using linear interpolation). The actual load per ring, as calculated above, is only 5,823 N. This configuration is therefore permissible.

For the countershaft with 16 rings there is a load per ring of 8,275 N as calculated above.

This load is greater than the permitted approx. 7,000N, so it is recommended that the number of friction rings used here also be increased to 20.

$$F_{G, \text{Ring, korr}} = \frac{F_G}{\text{No. of rings}}$$

$$F_{G, \text{Ring, korr}} = \frac{132,392}{20} = 6,620 \text{ N}$$

Contilan® Rollers

High-quality polyurethanes are used to manufacture tires, rollers, and wheels under the Contilan® trademark. Contilan® is a particularly abrasion-resistant material with an extremely high structural strength.

Application

Contilan® tires, rollers, and wheels are mainly used on lift trucks, electric forklifts, reach trucks, picking machines etc. with speeds up to 16 km/h, especially those carrying heavy loads with a low center of gravity operating on firm, level surfaces.

Properties

- High load capacity with small dimensions
- Particularly abrasion-resistant with extremely high structural strength, thus highly durable
- Low deflection, therefore high stability
- Puncture-free
- Maintenance-free
- Non-marking, even on sensitive floors
- Resistant to oils, greases and fuels; because of their chemical composition only sensitive to certain media (e.g. acids, lyes, amines, phenols and water vapour)

Material Properties				*Table 9*
Mechanical Properties				
Shore hardness A		DIN 53 505	93°	
Density	g/cm^3	DIN 53 479	1.27	
Tensile strength	N/mm^2	DIN 53 504	40	
Elongation at break		DIN 53 455		
		DIN 53 504	500	
Modulus of elasticity	N/mm^2	DIN 53 457	~ 80	
Tensile stress DIN 53 504	N/mm^2	20% elongation	7	
		300% elongation	17.5	
Tear strength (Graves)	N/mm	DIN 53 515	70	
Impact resilience	%	DIN 53 512	45	
Coefficient of friction		Polished steel: dry	0.15 – 0.20	
		Polished steel: wet	0.05 – 0.15	
Abrasion resistance	mm^3	DIN 53 516	50	
Needle tear resistance	N/mm	DIN 53 506	110	
Thermal Properties				
Operating temperature	°C	max. transient	+130	
		max. steady-state	-20/+80	
Melting temperature	°C		>200	
Coeff. of linear thermal expansion	K^{-1} * 10^{-6}	VDE 0304 Part 1	190	
Coeff. of thermal conductivity	W/mK	After Erk	0.29	
Specific heat	kJ/kg K		1.89	

The figures in the table have been obtained from our own test results, recommendations from our raw materials suppliers, and customer feedback. Nevertheless, they must only be regarded as a guide. They are not necessarily transferable to all operating conditions. Details of available sizes and finishes available on request.

Index

	Company
	Name
	Department
ContiTech	Street/PO Box
Vibration Control GmbH	Zip/City
Industry Sales	Country
Jädekamp 30	Telephone
	Fax

D-30419 Hannover

Germany
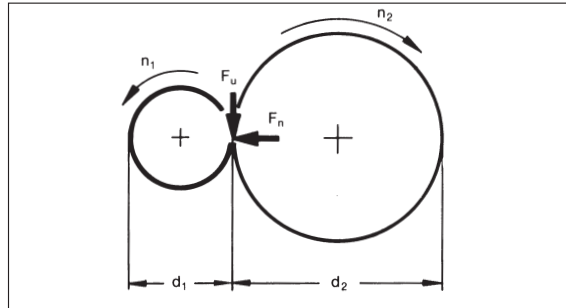
Drive Design for

O New design	O Trial	O Requirement	O pcs/year

O Existing drive - currently using:

Drive Data

	Drive motor	Machine
Type	(e.g. electric motor, i.c. engine)	(e.g. machine tool, fan)
Speed	n^1 rpm	n^2 rpm
Power	P kW	P kW P_{max} kW
	Startup characteristics (e.g. starting torque, startup mode)	Type of load: uniform non-uniform shock
External Ø of rings	d_1 mm	d_2 mm
Permitted Ø range for new design	from mm to mm	from mm to mm
Max. permissible ring width	mm	mm
Transmission ratio i	i_{min} i_{max}	
Center distance a	mm	Center distance range (for new designs) a_{min} mm a_{max} mm
Contact pressure of motor	O Control angle	O Fixed contact pressure
Rolling contact gear configuration	O Internal O External	O Intermediate rolling contact gear

Operating conditions

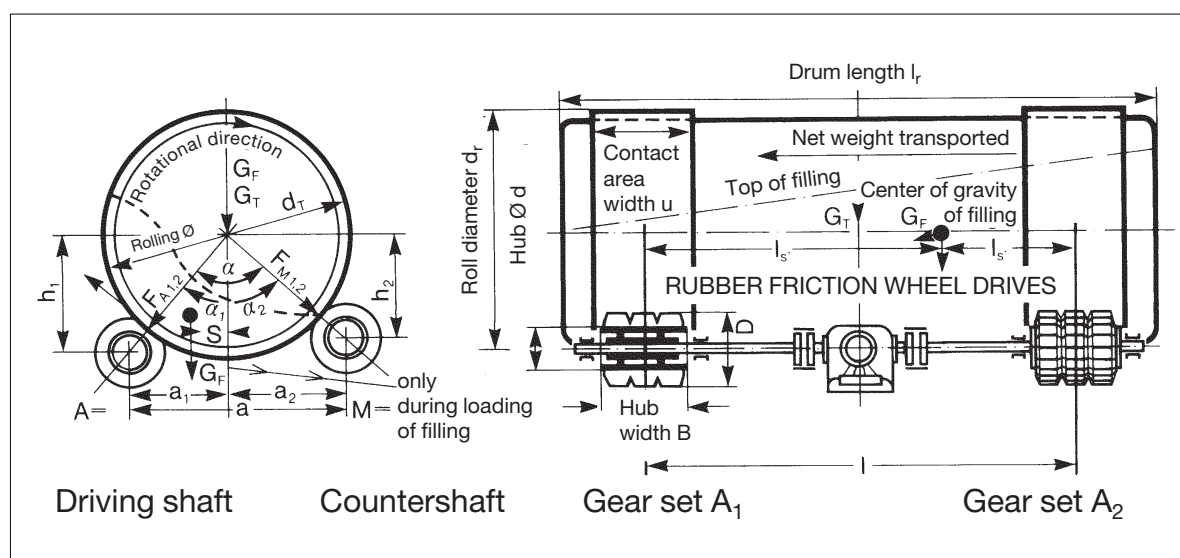| Ambient temperature in °C	Ambient humidity in %
Other influences (e.g. oil, dust)	
Daily operating period h/day	No. of daily switch offs

City, date

Signature and company stamp

Continental ContiTech

Company	
Street/PO Box	
Zip/City	

ContiTech

Vibration Control GmbH

Industry Sales

Jädekamp 30

D-30419 Hannover

Germany

Country	
Telephone	
Fax	
E-mail:	
Function of drum	
Quantity	
In operation at (company)	

Drum length l$_r$

Driving shaft   Countershaft   Gear set A$_1$ Gear set A$_2$

Dimensions

Rolling Ø dr (corresponding to drum Ø without extra contact area)					mm
Contact area width u	mm	Drum length lr	mm	Gear set center distance l	mm
Center distance a	mm	a$_1$	mm	a$_2$	mm
Opening angle a	deg	Angle of incidence a$_1$	deg	Angle of incidence a$_2$	deg
Vertical center distance to drum axis		h$_1$	mm	h$_2$	mm
Drum axis		O horizontal		O Incline	deg
Distance from center of gravity l$_{S1}$	mm	(only if top of filling is not horizontal)			
Preferred friction ring Ø D		from	mm	to	mm

Weights

Weight of drum (including attached rotating masses)				G$_T$	kg
Possible deposits of filling	O No	O Yes	Approx. weight	G$_A$	kg
Weight of filling (throughput)				G$_F$	kg
Type of filling (material, grain size etc.)					
(only during loading of filling) Distance of center of gravity S of filling from center				S	mm

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Drive

Change in rotational direction	O Yes	O No		
Motor power	P	kW		
Motor speed	n_M	rpm		
Transmission ratio				
Required power	Startup	kW	Operational max.	kW
Drum speed	n_T	rpm		
Friction ring speed	n_R	rpm		

Drive

Surface of drum contact area	O Rolled sheet raw		O Extra surface treatment	
System outdoors	O Covered		O Not covered	
System indoors	O Covered against dust		O Not covered	
Contact surface	O Dry	O Dry + dust	O Wet, clean	O Wet, dirty
Chemical influences?	O No	O Yes, which?		
Ambient temperature (air)	T_L		°C	
Drum surface temperature	T_O		°C	
Temperature of filling	T_F		°C	
Operating period per day	max.		h min.	h
No. of times switched on per day	times	Startup:	O Smooth, uniform	O Jerky
In operation	O Smooth operation	O Jerky operation	O Severe shocks (e.g. due to grinding media)	
Charging process	O Smooth	O If no, what fluctuations?		

_____   _____
City, date   Signature and company stamp

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The ContiTech Division is a development partner and an original equipment supplier to many industries, and it provides high-grade functional parts, components and systems. With their know-how in rubber and plastics technology, the seven business units make a constribution to safe and comfortable mobility. ▶ That's what ContiTech is all about.

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ContiTech   Rubber and plastics technology

Vibration Control

Market segments

Vibration Control Automotive

Vibration Control Industry

Sealing Systems Chassis

Certifications

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QS-9000

EN ISO 9001

Umweltmanagementsystem
Dr. Kühnemann   Institut
und Partner   für
                  Umwelt
                  technik
Zertifiziert nach DIN EN ISO 14001
Reg.- Nr. 01-0146-06-01

EN ISO 14001

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WT 5556 E 03.08 (Be)   Printed with ContiTech offset printing blankets on leached paper free of chlorine

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