Datasheet

Transmission of rotary movements, where a direct connection is not possible

Features at a glance

Flexible shafts type **TR** are highly versatile, which are also available with different types of protective covers based on the area of application.

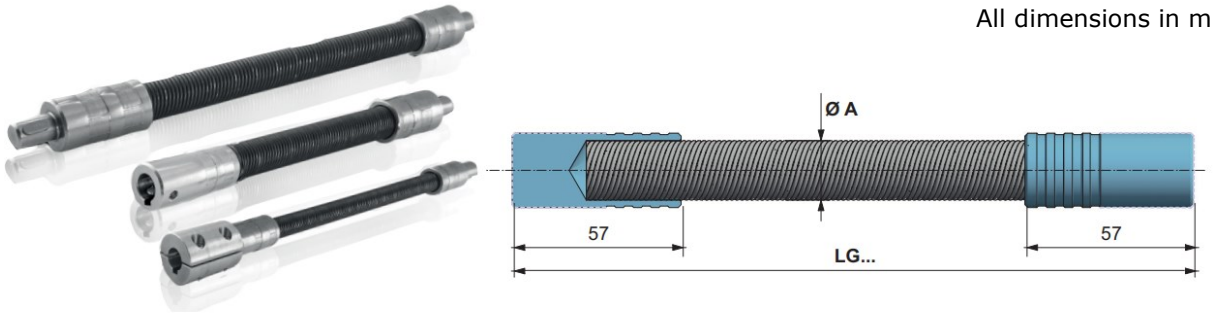
- Transmission of rotary movements where a direct connection is not possible.
- Easy bypassing of obstacles.
- Substitution of unprotected, complex, or dangerous mechanisms.
- Reduction of the overall weight of the unit due to remote controllability.
- Suitable for manual and motorised drives.

Available terminal couplings: **CL** = cylindrical shaft; **CF** = cylindrical hollow shaft; **CM** = cylindrical solid shaft with key; **CMB** = cylindrical solid shaft with two-piece bushings with set screws for easy assembly.

Dimensions and efficiency table

TR-A without protective cover

All dimensions in mm



Type	Flexible shaft	Torsion	Bending radius**	Torque	Weight
	Ø A	(°)	mm	Nm	g
TR-A-6	6	80	70	3	400
TR-A-8	8	70	90	4.5	600
TR-A-10	10	70	130	7.5	800
TR-A-12	12	50	160	9	950
TR-A-15	15	28	300	12	1200
TR-A-20	20	18	400	18.5	1700

The data refer to a length of 1000 mm. ** Minimal bending radius.

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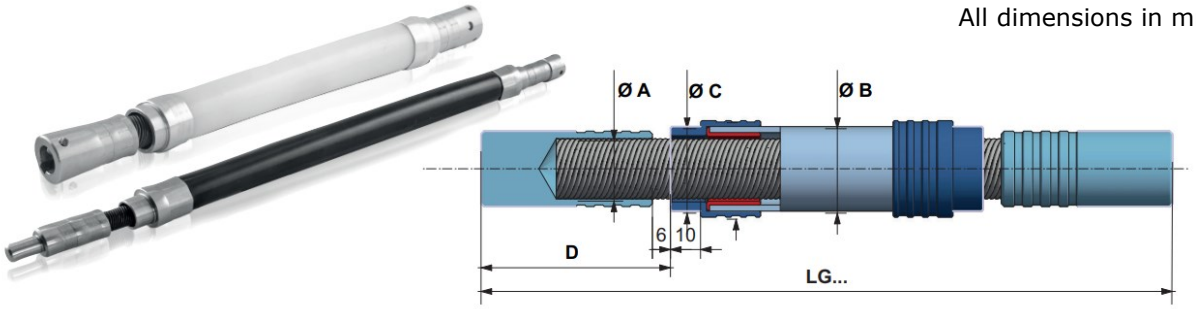
TR-B with protective cover made of Rilsan® plastic

All dimensions in mm

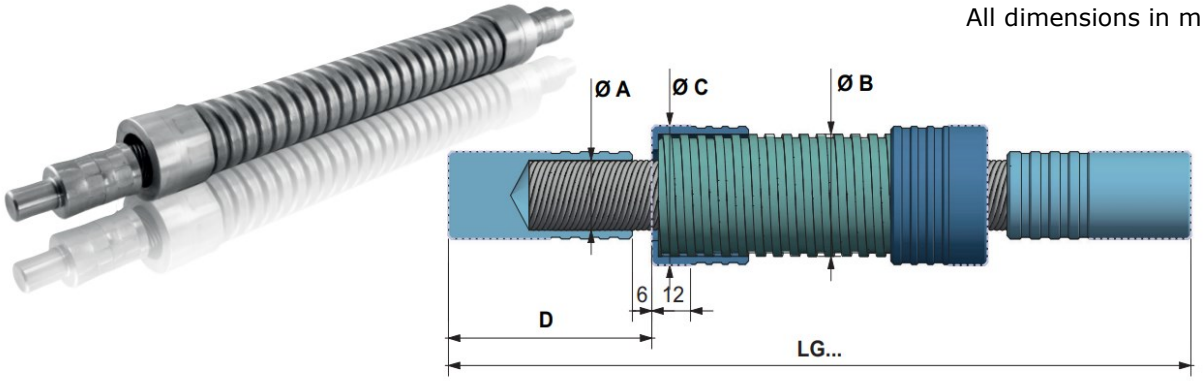


Type	Flexible shaft	Protective cover	Terminal coupling	L*	Torsion	Bending radius**	Torque	Weight
	Ø A	Ø B	Ø C	mm	(°)	mm	Nm	g
TR-B-6	6	12	11	34	80	70	3	400
TR-B-8	8	14	13	44	70	90	4.5	800
TR-B-10	10	18	15	50	70	130	7.5	1000
TR-B-12	12	20	18	64	50	160	9	1350
TR-B-15	15	22	50	56	28	300	12	1750
TR-B-20	20	30	28	63	18	400	18.5	2150

* Length + 6 mm between terminal coupling and protective cover. ** Minimal bending radius.
The data refer to a length of 1000 mm.
Protective cover made of Rilsan® plastic; recommended against oil, grease, dirt, corrosive agents, etc. for flexible shaft ∅6, ∅8, ∅10, ∅12, ∅15 mm in black Rilsan®; for ∅20 mm in white Rilsan®.

TR-C with protective hose made of galvanized steel

All dimensions in mm



Type	Flexible shaft	Protective cover	Terminal coupling	L*	Torsion	Bending radius**	Torque	Weight
	Ø A	Ø B	Ø C	mm	(°)	mm	Nm	g
TR-C-6	6	14	18	34	80	70	3	800
TR-C-8	8	17	21	44	70	90	4.5	1150
TR-C-10	10	50	24	50	70	130	7.5	1450
TR-C-12	12	25	30	64	50	160	9	1800
TR-C-15	15	30	35	56	28	300	12	2200
TR-C-20	20	35	40	63	18	400	18.5	3600

* Length + 6 mm between terminal coupling and protective cover. ** Minimal bending radius.
The data refer to a length of 1000 mm.

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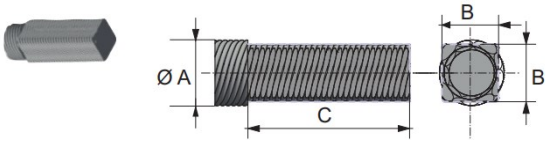
Terminal couplings for TR, ASR, GR made of solid stainless steel (AISI 303), available versions

Q	CL	CF	CM	CMB
				

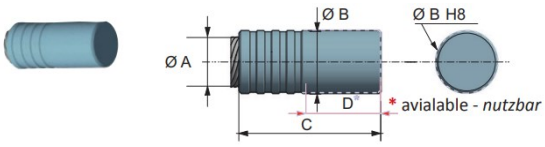
Legend	
Ø A	Diameter of flexible shaft
Ø B	Diameter of square shaft
C	Total length
D	Available length / bore depth
E	Key
Ø F	Diameter hollow-/solid shaft
Ø G	Outer diameter bushing

Q = cylindrical square shaft



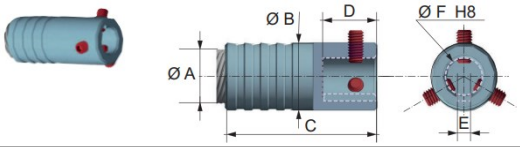
Ø A	B	C
6	5	30
8	6.5	35
10	8 – 8.5	40
12	10	40
15	12 - 13	45
20	16.5 – 17.5	45

CL = cylindrical solid shaft



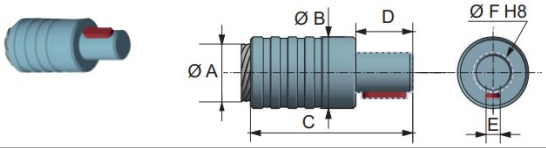
Ø A	Ø B	C	D
6	10	28	12
8	12	38	16
10	14	44	20
12	16	48	22
15	20	50	25
20	25	57	30

CF = cylindrical hollow shaft



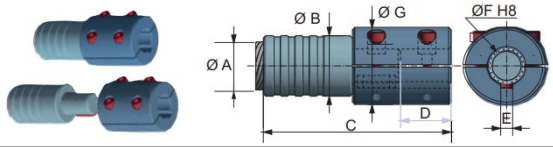
Ø A	Ø B	C	D	E	Ø F
6	10	28	10	-	6
8	12	38	15	-	8
10	14	44	15	-	8
12	16	48	16	3	10
15	20	50	16	3	10
20	25	57	20	5	14

CM = cylindrical solid shaft with key



Ø A	Ø B	C	D	E	Ø F
6	10	28	10	-	6
8	12	38	14	-	8
10	14	44	14	-	8
12	16	48	15	3	10
15	20	50	15	3	10
15	20	50	15	5	14*
20	25	57	20	5	14

CMB = cylindrical solid shaft, two-piece bushings



Ø A	Ø B	C	D	E	Ø F	Ø G
6	10	10	39	-	6	14
8	12	12	53	-	8	22
10	14	14	59	-	8	22
12	16	16	64	3	10	24
15	20	20	66	3	10	24
15	20	20	76	5	14*	32*
20	25	25	78	5	14	32

* optional

All dimensions in mm

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Mechanical characteristics

Flexible shafts are mechanical elements subjected to torque and elastic deformation.
When considering a single flexible shaft, the equal and opposite torques acting on both sides cause a relative rotation of the different sections that is proportional to the length.

The relationship between applied torque **T [Nm]** and twist angle of the extremities **φ [°]** is obtained as a function of the following three parameters:

- Torsional rigidity **k [103Nm / °]**,
- which depends on the section diameter and the construction characteristics
- - length of the shaft **L [mm]**
- - Rotation direction **r**,
- dimensionless parameter characterising the asymmetrical behaviour of the shaft

$$\varphi = \frac{T}{rK} \cdot L \qquad T = \frac{rk}{L} \cdot \varphi$$

The parameter **r** is equal to **1** when the shaft is loaded according to the winding direction of the spiral.
When loaded in the opposite direction, **r < 1**, as indicated in the following table:

Flexible shaft parameters				
∅	k[10^3 Nm/°]	r	T_{max} [Nm]	Φ [°]*
4	17	0.55	1.1	46.71
5	26	0.55	1.8	69.23
6	38	0.55	3.0	78.95
8	67	0.55	4.5	67.16
10	101	0.55	7.5	74.26
12	180	0.65	9.0	50.00
15	405	0.80	12.5	30.86
20	1050	0.85	18.5	17.62

* The data refer to a length of T_{max} = 1000 mm.

Direction of rotation and winding
Flexible shafts differ both in their construction and in their direction of winding
A left-wound shaft (related to its outermost layer) can transmit a higher torque in clockwise direction than in counter-clockwise direction. A right-wound shaft can transmit a higher torque in counter-clockwise direction than in clockwise direction.

Outermost layer **left-wound**, for **operation in clockwise** (right-hand) **direction**.
Outermost layer **right-wound**, for **operation in counter-clockwise** (left-hand) **direction**.

Efficiency diagrams and tables

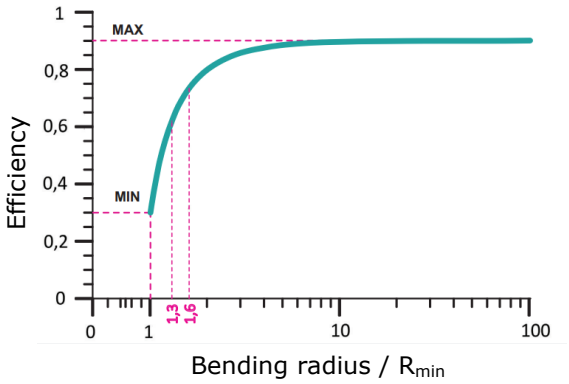
To identify the flexible shaft most suitable for your requirements, refer to the values in the tables.

If the actual loads and efficiency cannot be clearly determined, please contact our technical department.

All tables show linear dimensions in [mm] unless otherwise specified.
All forces, efficiency and loads are given in [N] or [Nm] (10 N = 1 kg or 10 N·m = 1 kg·m) unless otherwise specified.

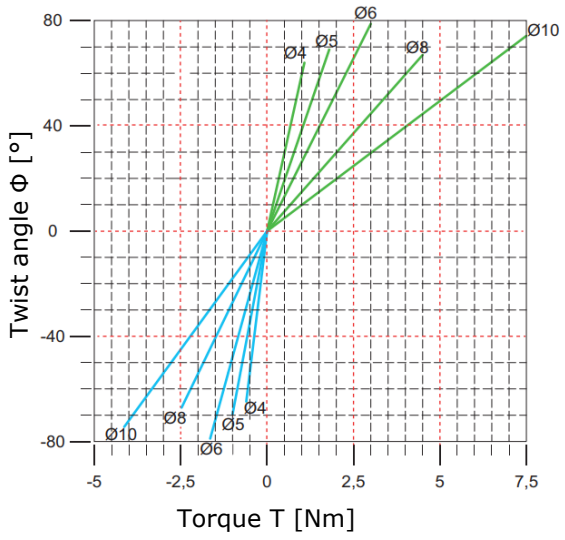
Bending radius

The diagram shows a qualitative-quantitative curve of the efficiency of the flexible shafts as a function of the bending radius. For configurations with a pseudo-straight line, the efficiency is equal to the maximum value of 0.9. The efficiency is nearly constant for high values of the bending radius and decreases rapidly towards the minimum bending radius of 0.2.

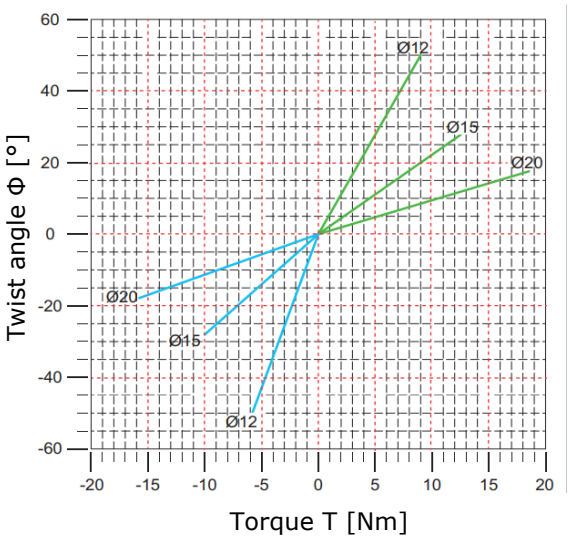


Twist angle / Torque*

For diameters from ∅4 to ∅10 mm



For diameters from ∅12 to ∅20 mm



* The data refer to flexible shafts with a total length of 1000 mm.

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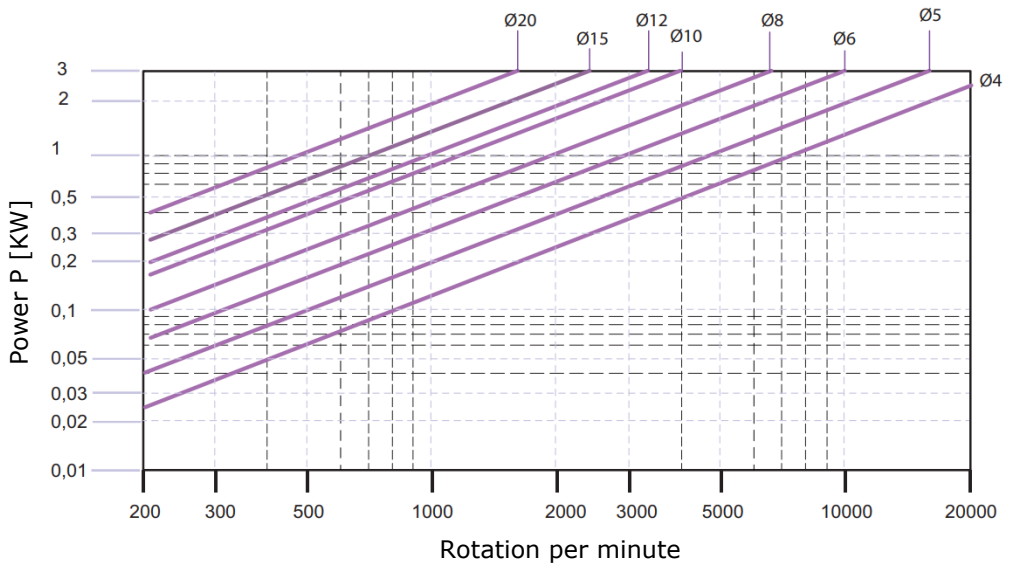
Power / Rotation per minute



Ordering example

Type	**TR-A**	-	**12**	-	**500**	-	**DX**	-	**CL-CM**
TR-A, TR-B, TR-C									

Diameter

06	= flexible shaft ∅6 mm
08	= flexible shaft ∅8 mm
10	= flexible shaft ∅10 mm
12	= flexible shaft ∅12 mm
15	= flexible shaft ∅15 mm
20	= flexible shaft ∅20 mm

Total length (mm)
In **xxx** mm (on request)

Rotation

DX	= for operation in clockwise (right-hand) direction
SX	= for operation in counter-clockwise (left-hand) direction

Terminal couplings (indication per shaft end)

CL	= cylindrical shaft
CF	= cylindrical hollow shaft
CM	= cylindrical solid shaft with key
CMB	= cylindrical solid shaft with two-piece bushings
Q	= cylindrical square shaft

Other versions that cannot be generated from the order code are available on request as special versions.

Manufacturer: FIAMA since 1913

The manufacturer reserves the right to make changes to the products that it deems necessary for their improvement without prior notice.

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