BIAX
Flexible Power

ADDITIONAL INFORMATION ABOUT SHAFT CORE DATA SHEETS

from
Schmid & Wezel GmbH, Werk Hilsbach

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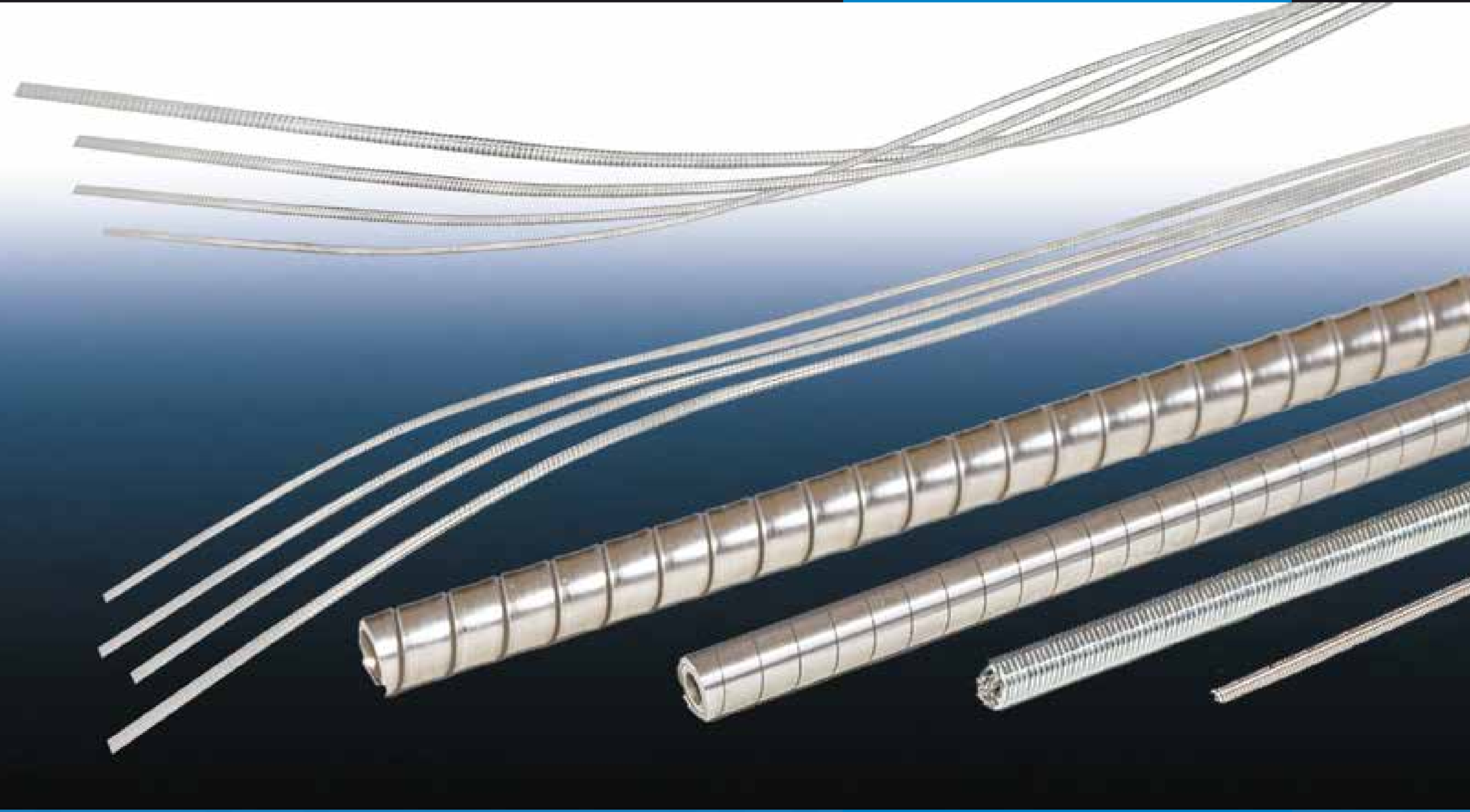

Table of contents

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1 General

There is currently no standard to define the data, measurement methods or other features of shaft cores. This document should offer some assistance to better understand the data on our data sheets and determine the possible feasibility of the planned application in advance. The application's function must always be tested. Adherence to all the critical values and details is still no guarantee of the entire shaft's function and stability.

2 Type of manufacture

Shaft cores may be manufactured in two different ways.

2.1 Machined shafts

Machined shafts are manufactured on winding machines. A winding machine consists of several winding units that wind the layers directly one after another. Machined shafts are always solid shafts with a mandrel. The shaft core is manufactured "endlessly".

2.2 Manual shafts

In manual shafts, the layers are wound individually on a manufacturing mandrel. The single layers are pushed over one another in a second operation. The maximum production length is 12 metres. This may be even less for small diameters and depending on the construction.

3 Main direction of rotation

Flexible shafts consist of wound wires that are wound alternately right or left. The winding direction of the outermost layer is the main direction of rotation. If the shaft core is held upright, the gradient falls to the right for a right-hand shaft core. In a left-hand shaft core, the gradient falls to the left.

Right shaft core
(falling to the right, rising to the left)

4 Measured lengths for torques and torsions

To determine the torques, the shaft cores are clamped on a test rig. The free length of the shaft core is generally 1000 mm. The shaft core is not turned during measurement; this is a static measurement.

5 Maximum torque

The shaft core leaves its extended position at this torque. The shaft core starts to bend (see image). If force is eased from the shaft core, it goes back to its starting position.
There are shaft cores in which this bending motion is in the opposite direction to the preferred direction at a higher torque. The shaft core should only be loaded up to 80% of the maximum value of the preferred direction in these cases.

The following contingencies should also be met:

Speed <100 rpm:	1.25
Speed 100 - 999 rpm:	1.75
Speed >1000 rpm:	2.50

Example: A load of just 285 Ncm should be applied to a shaft core with the detail 500 Ncm at a speed of 500 rpm (500 Ncm / 1.75 = 285 Ncm)

5.1 Special features

Significantly higher loads can often be applied to short shaft cores, as these are not able to leave the extended length. This has to be checked in the individual case.

6 Fracture torque

At this torque, the shaft core breaks at the static measurement. For most shaft cores, this value is 3 to 6 times as great as the value when the extended position is exited (maximum torque). The shaft core is destroyed at this torque and cannot be repaired. The fracture torque cannot be used as a safety function, as many wires can still be connected after a break! Flexible shafts may not be used as predetermined breaking points.

7 Torque at X° torsion

For certain applications, the shaft core must not exceed a maximum angle of twist. If the shaft core may only twist 45° per metre, for example, this may only be loaded up to the maximum of 45° applied torque. The torque is not linear with respect to the angle of twist. Doubling the shaft core length doubles the expected angle of twist. Halving the shaft core length does **NOT** double the torque. An additional contingency should be considered, even at this value.

8 Minimum permitted bending radius

Flexible shafts can bent down maximal to a minimum bending radius before they snap off. The bending radius should always be chosen so that it is as large as possible.

The following contingencies should be met:
Speed <100 rpm: 1.30
Speed 100 - 999 rpm: 1.70
Speed >1000 rpm: 2.00

Example: a shaft core with the details 100 mm for a speed of 500 rpm should keep to a minimum bend radius of 170 mm. (100 mm * 1.70 = 170 mm)

9 Maximum speed

This is generally not given in the data sheet. The maximum speed of a shaft core depends on many factors. The following factors influence the maximum speed (this list is not exhaustive):

- Method used to secure the shaft coupling (solder, press, etc.)
- Concentricity of the shaft coupling
- Concentricity of the connected components
- Protective sleeve
- Fat / lubricant
- Permitted vibrations during operation
- Change in position of the shaft
- …

10 Cutting suitability

Shaft cores that are suitable for cutting can be cut with a cutting wheel. Shaft cores that are not suitable for cutting have to be cut and seal welded or cut using a laser.

10.1 Cut and seal welding

During cut and seal welding, the shaft is clamped in a butt-welding machine and heated up with electricity until the sectioning point is melted. We recommend the use of butt-welding machines from August Strecker & Co. KG (http://www.streckerusa.com) for this.

10.2 Laser cutting

During laser welding, the outer layer is welded initially at low power. The shaft core is then cut at high power next to the weld seam. The front should also be laser welded after cutting. This increases the strength of the shaft core.

11 Annealing

Heat treatment after winding changes the properties of the shaft core. Heat treatment can make a machined shaft suitable for cutting. Heat treatment improves impact / concentricity significantly; the maximum torque is reduced and the torsion increases. The sag can become larger. The surface is given annealing colours. A protective gas is not generally used here.

12 Sag

We clamp one side of the shaft core horizontally to measure the sag. On the other side, the distance is measured by which the free end of the shaft moves down under the force of gravity. The measured length is generally 50 times the diameter. The shaft is turned through 180° after the initial measurement and measured again. The value given on the data sheet is the arithmetic mean of the two measurements. The higher this value, the softer the shaft core.

13 Maximum impact / moment of force / internal friction

For this measurement, the shaft core is bent into a "U" shape and turned at low speed. The internal friction is the maximum torque that is required to turn the shaft core. The required torque is not constant during a revolution. The impact is the difference between the maximum and the minimum torque. The lower the impact of a shaft core, the better its concentricity.

14 Disclaimer

The technical data (mean values) and material details are based on our current findings and experience. However, because of the range of possible influences when using our products, they do not release the processor from carrying out their own tests and trials in advance of the actual application. Given the particular features of each application, we are unable to accept any liability for our information. We are happy to assist you with information on request.

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