Function and structure

Friction springs Type TAS

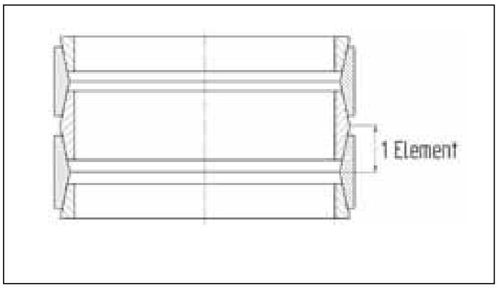

Fig. 1: Friction spring with 4 elements

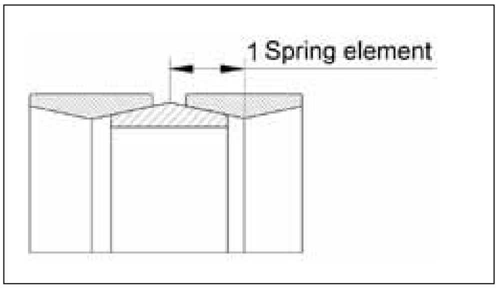

Bild 3: Drawing 2 outer rings and 1 inner ring

The primary function of a friction spring is the damping / absorbing of introduced energy. A friction spring consists of closed outer and inner rings which intermesh with their conical surfaces. As a result of the energy introduced axially, the outer and inner rings on the conical surfaces are shifted apart from each other so that the spring column is shortened. This has the effect that the outer rings stretch and the inner rings reduce in diameter. As a result of the friction arising on the conical surfaces, the introduced energy is absorbed and converted into heat which is to be removed. Resonance effects are suppressed completely.

Principle of the friction spring

Friction springs consist of outer and inner rings which contact each other on their conical surfaces, with the application of a special lubricant.

If an axial load acts on the friction spring, the conical surfaces slide over one another and cause the outer rings to be lengthened (stretched) and the inner rings to be shortened (compressed). The conical surfaces cause a force and path translation.
As a result, a linear spring diagram is plotted.

An effective conical surface is designated as a spring element, i.e. half an outer ring and half an inner ring.

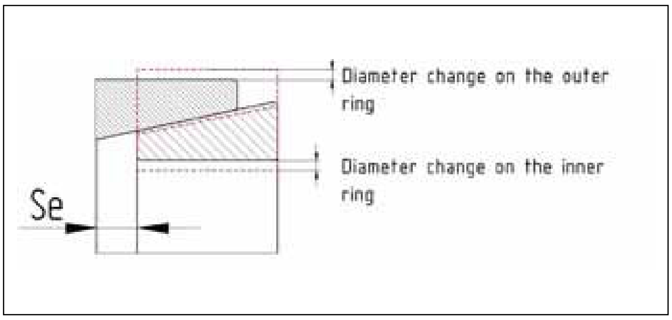

Fig. 2: Friction spring with diameter deviation

Friction springs are structured from similar-type outer and inner rings. As a result of changing the element number, any arbitrary spring travel can be achieved and, as a result, every level of spring stiffness. However, the end force always remains identical in case of different element numbers. Only the spring travel, as well as the spring length, change.

With the selection of the ring type, the outer and inner diameter, as well as the spring end force, are stipulated. On the other hand, the length spring, spring travel and work energy absorption depend on the number of elements. The necessary element number is calculated from the required spring travel s or the required spring work
W. e = stotal / se = Wtotal / We

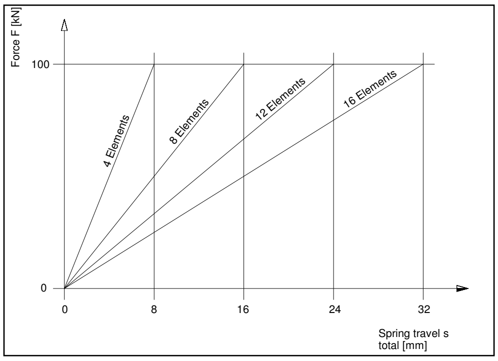

Fig. 4: Characteristic curve changeable by selection of ring number

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The friction spring should be designed as far as possible so that it comes to its end with half an inner rings on both sides. This is the most favorable variant. Thus the friction spring consists of:

2 Outer rings
1 Inner ring
2 Half inner rings

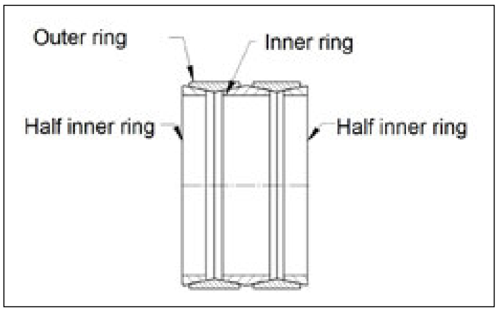

Fig. 5: Friction spring with two HIR

If, for construction-technical reasons, the friction spring must end with an uneven element number, it is composed as follows.

1 Outer ring
1 Inner ring
1 Half outer ring
1 Half inner ring

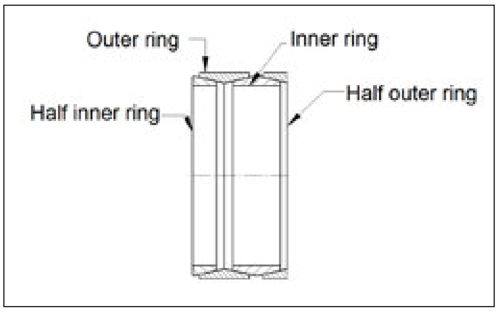

Fig. 6: Friction spring with HOR + HIR

Alternatively, a friction spring can also end with 2 half outer rings or whole rings. If friction springs end with one or even two whole rings then, for the calculation of Lo, half the ring width or twice the half ring width are to be added.

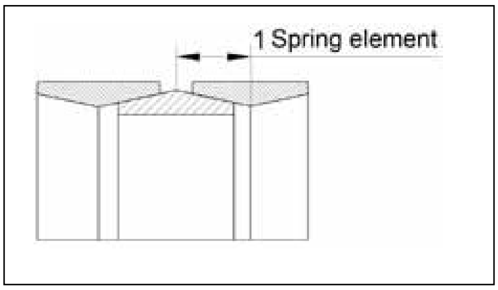

Fig. 7: Friction spring with whole rings at the end

Check: For all correctly composed friction springs, the following applies:

Element number e = sum of all spring rings minus 1

Also nothing changes here if the friction springs are closed off with whole spring rings instead of with half spring rings. The friction spring in Fig. 8 consists of 7 spring rings and accordingly has 7 - 1 = 6 elements. With the calculation of the spring length, half the ring width is also to be added.

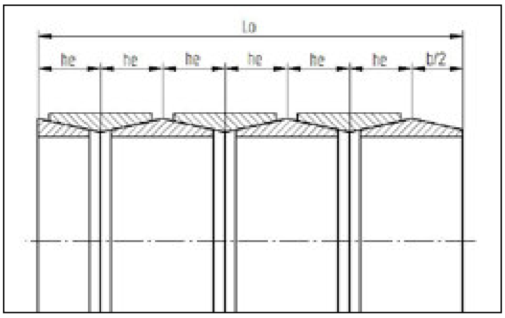

Fig. 8: Friction spring with 6 elements, ends 1 IR + 1 HIR

With this, the non-stressed length Lo of the friction spring in Fig. 8 is
Lo = 6 x he + b/2
Values from friction spring table on page 9

For the verification of the spring length, it is not appropriate to measure the non-stressed spring length Lo.
Because of certain non-circularity values of the spring rings without a load and grease between the tapered surfaces, a spring length Lo which is too large is mostly measured.
So that the spring rings make complete contact on the tapered surfaces, measuring should be carried out under test load only.