

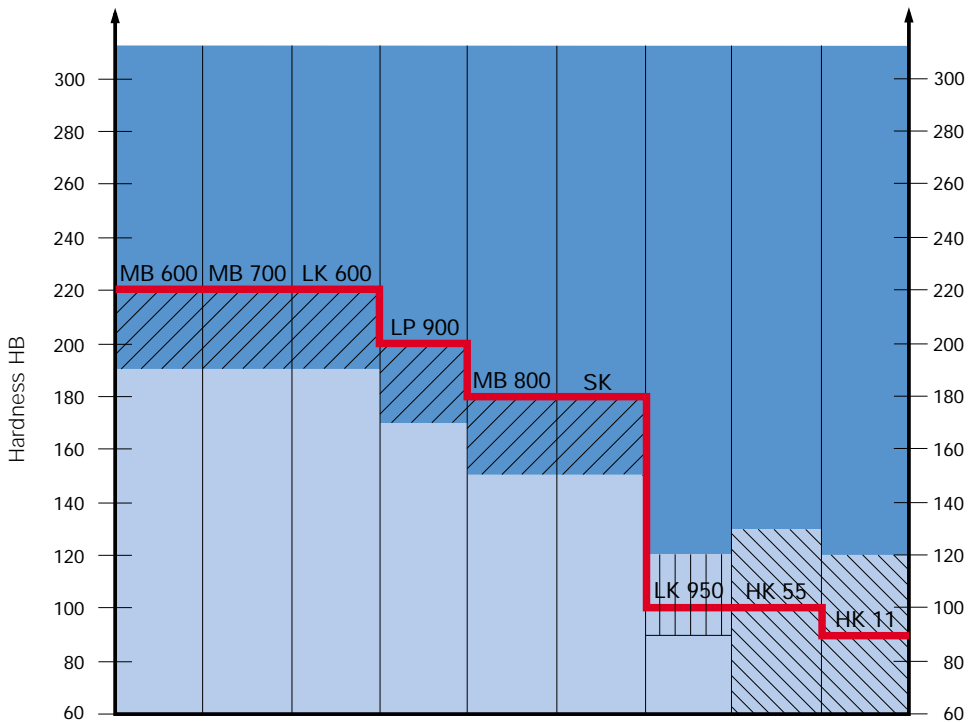
Anchorage Principle

The required bore roughness is directly related to the hardness and the mechanical characteristics of the base material. Depending on the combination of sealing plug and base material, anchorage takes place either by the groove profile of the expander sleeve biting into the base material or on anchorage to the surface roughness of the bore.






Note:

When selecting a KOENIG-Expander the bore roughness must always be adjusted according to the hardness of the base material.

Anchorage principle related to the base material



KOENIG-Expander

-  **Hard base material:** To achieve the allowable working pressure, anchorage to the bore roughness of the base material is required. **Roughness $R_z = 10$ to $30 \mu\text{m}$.**
-  **Soft base material:** Anchorage to the bore of the base material occurs automatically due to the serrations on the sleeve of the KOENIG-Expander.
-  **Soft base material:** Anchorage is not possible with the HK 55 and HK 11 Series. Such combinations are not allowed **for high pressure applications.**
-  **Transition zone:** To achieve the allowable working pressure, anchorage to the bore roughness of the base material is required. **Roughness $R_z = 10$ to $30 \mu\text{m}$.**
-  **Transition zone:** To provide for the allowable pressure rating, the serration of the sleeve, anchors into the base material.

Anchorage Principle



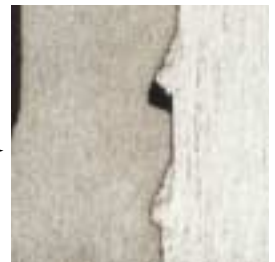
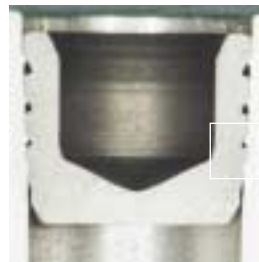
Anchorage due to plug sleeve serrations
KOENIG-Expander **Series SK**
in aluminum-alloy HB = 90

Anchorage due to plug sleeve serrations
KOENIG-Expander **Series MB 800**
in aluminum-alloy HB = 90



Anchorage due to bore roughness
KOENIG-Expander **Series HK 55**
in gray cast iron HB = 160

Anchorage due to plug sleeve serrations
KOENIG-Expander **Series LP 900**
in aluminum alloy HB = 90

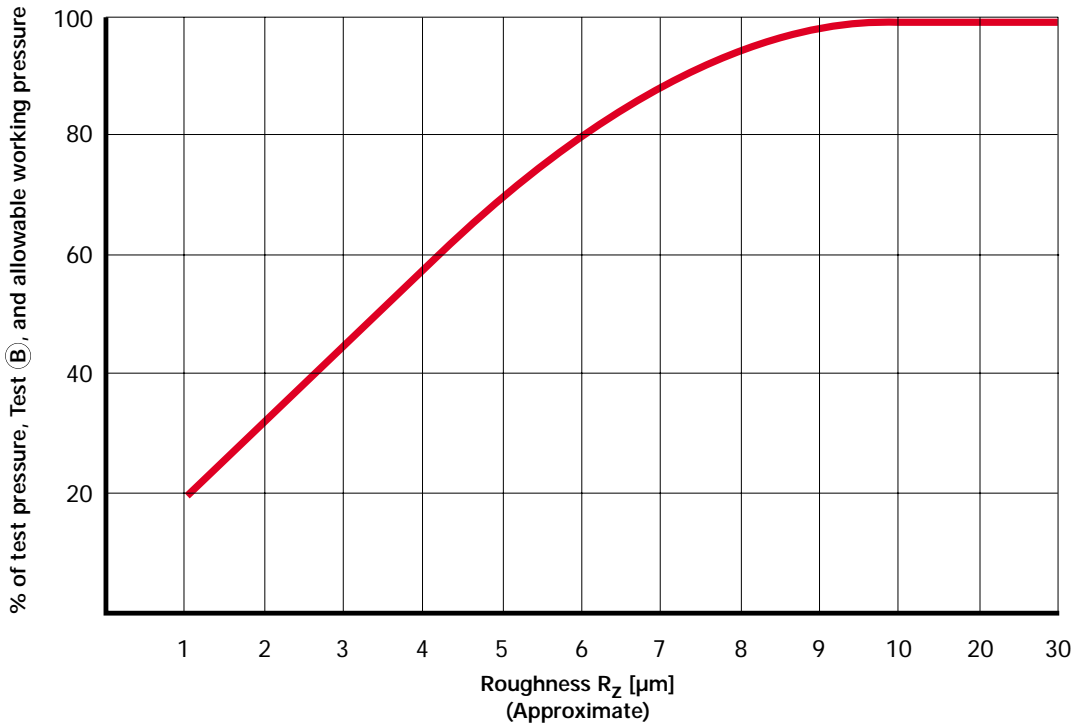


Sufficient anchorage due to plug sleeve
serrations KOENIG-Expander **Series LK 950**
in aluminum alloy HB = 90

Bore Roughness Requirements

When installing KOENIG-Expanders in hard base material no positive anchoring is possible. So, to attain suitable working pressures and anchorage, it is necessary to have a bore roughness of $R_z = 10 - 30 \mu\text{m}$. At a roughness greater than $R_z = 30 \mu\text{m}$ leakage might occur.

Pressure performance correlation to bore roughness.



Roughness Profile

Required roughness profile



The ideal bore roughness for anchorage is attained by drilling with a twist drill or core drill.

Undesirable roughness profile



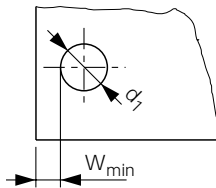
By reaming, a one-sided, smooth roughness profile is created. This is not desirable.

Design Guidelines

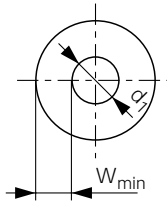
Wall thickness/distance from edge

As the radial expansion of the KOENIG Expander sleeve occurs, the base material in which it will be anchored plastically deforms. The resultant strength, as well as the hydraulic pressure and temperature service conditions depending on the Expander type and characteristics of the base material, require minimum wall thickness, or distance from edge.

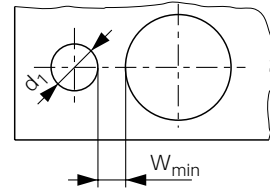
Distance to external wall



Distance to exterior wall



Wall thickness between bores



The guideline values for minimum wall thickness and distance from edge (W_{min}) express these influencing factors. At these minimum values, only slight deformation on the exterior profile of the base material of less than 20 μm is likely. This does not affect the function of the KOENIG Expander. Below the guideline values (W_{min}) the possibility of overloading the base material exists, which can adversely influence the function of the KOENIG Expander. In such cases tests must be conducted.

Guideline values W_{min} for wall thickness and distance from edge

At KOENIG-Expander diameters

$$d_1 \geq 4\text{mm: } W_{min} = f_{min} \cdot d_1$$

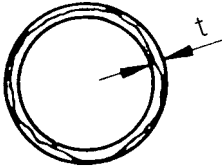
$$d_1 < 4\text{mm: } W_{min} = f_{min} \cdot d_1 + 0,5 \text{ mm}$$

Base Material	Description	①	②	③	④	⑤	⑥	⑦
		Avg. tensile strength [N/mm ²]	1000	560	250	500	480	340
	Min. elongation A5 [%]	6	6	-	7	8	8	4
	Avg. ultimate strength R_p 0,2 [N/mm ²]	865	300	-	320	380	300	250
KOENIG Expander Series		Factor f_{min}						
MB 600		0,6	0,8	1,0	0,8	0,8	1,0	1,0
MB 600, Inch-Version		0,6	0,8	1,0	0,8	0,8	1,0	1,0
MB 700		0,6	0,8	1,0	0,8	0,8	1,0	1,0
MB 800		0,5	0,6	1,0	0,6	0,6	1,0	1,0
SK		0,5	0,6	1,0	0,6	0,6	1,0	1,0
HK 55		0,4	0,5	0,8	0,5	0,5	0,8	0,8
HK 11		0,4	0,5	0,8	0,5	0,5	0,8	0,8
LP 900		0,3	0,3	0,5	0,3	0,4	0,5	0,5
LK 600		on demand						
LK 950		on demand						

Design Guidelines

Roundness Tolerance

To assure reliable functioning of the KOENIG-Expander with regard to pressure performance and to assure leak tight sealing, a **roundness tolerance of $t = 0.05 \text{ mm}$** must be held.



By using a double lipped twist drill, the called out hole and roundness tolerances are reached. Better tolerances, particularly for larger diameter holes, can be held by using a **triple lipped** twist drill.

Conicity of the bore

Within the **effective sealing area** of the KOENIG-Expander, the bore must be according to the dimensional sheets. The bore lead in can be beveled up to a depth of **$0.25 \times d_1$ (LK: $0.15 \times d_1$)** because this area has no significant effect on the sealing function.

