



## SEALING PLUG

Efficient sealing of holes

# BÖLLHOFF

# SEALING PLUG – High performance, low cost

## Simply sealed! – SEALING PLUG permanently seals holes.

The SEALING PLUG is a two-part all-metal component which works according to the push/pull expansion principle. It is used to permanently close and seal holes in pneumatic and hydraulic components and systems. Simply insert the SEALING PLUG into the drilled hole, expand the plug and seal the hole. This highly efficient method means there is no need for tapping or reaming of holes. Furthermore, additional sealants are not required.

The SEALING PLUG can be used to regulate and control all types of flow as it can withstand operating pressures of up to 500 bar.

## Method / principle

The SEALING PLUG with ball works according to the push-expansion principle. The ball is pushed into the sleeve, causing it to expand.

The SEALING PLUG with mandrel and the PULLPLUG™ work according to the pull-expansion principle. The mandrel / pin is pulled into the sleeve, causing it to expand. All versions of the SEALING PLUG feature serrations on the outside of the sleeve, which anchor the SEALING PLUG into the housing material as it expands. This additionally increases the performance of the SEALING PLUG.

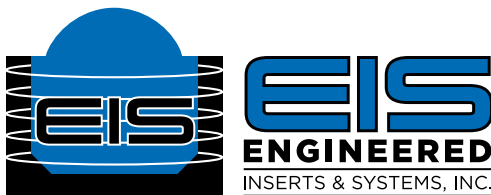
## Application areas

SEALING PLUGS can be used to control and regulate all kinds of flow. Typical applications include, for example, motors, power and drive trains, chassis and brake systems, steering and injection components as well as various hydraulic applications.

### Advantages at a glance:

- Permanent closure and sealing of holes
- Up to 500 bar operating pressure
- Easy installation
- No tapping or reaming of holes required
- Use of additional sealants not required
- Process reliable and reproducible

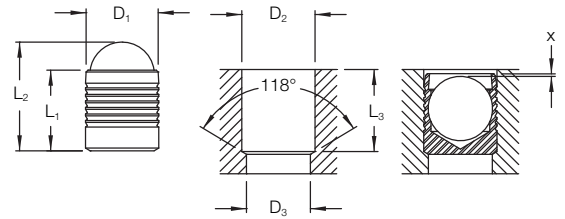
**SEALING PLUG and PULLPLUG™**  
are products by:



# SEALING PLUG with ball – Series 11

Available in diameters from 3 mm to 22 mm.

- Push-expansion principle
- Up to 350 bar operating pressure



**Version:**

**Sleeve:**

- 1 Case Hardening Steel, Zinc-Plated (CrVI-free)

**Ball:**

- 1 Bearing Steel, Black Oxide Finished

							Conversion table		
D <sub>1</sub>	L <sub>1</sub>	L <sub>2</sub>	D <sub>2</sub> +0.1 / -0.0	D <sub>3</sub> max.	L <sub>3</sub> min.	x +/-0.2	Böllhoff Article no.	KVT Article no.	Farmington Article no.
3.0	3.6	4.6	3.0	2.2	3.4	0.4	<b>ET11030</b>	MB850-030	CVMS0031110A
4.0	4.0	5.2	4.0	3.3	3.8	0.2	<b>ET11040</b>	MB850-040	CVMS0041110A
5.0	5.5	7.1	5.0	4.3	5.3	0.4	<b>ET11050</b>	MB850-050	CVMS0051110A
6.0	6.5	8.7	6.0	5.3	6.3	0.4	<b>ET11060</b>	MB850-060	CVMS0061110A
7.0	7.5	10.2	7.0	6.4	7.3	0.4	<b>ET11070</b>	MB850-070	CVMS0071110A
8.0	8.5	11.6	8.0	7.4	8.3	0.3	<b>ET11080</b>	MB850-080	CVMS0081110A
9.0	10.0	13.6	9.0	8.4	9.8	0.4	<b>ET11090</b>	MB850-090	CVMS0091110A
10.0	11.0	15.2	10.0	9.4	10.8	0.4	<b>ET11100</b>	MB850-100	CVMS0101110A
12.0	13.0	17.9	12.0	10.6	12.8	0.4	<b>ET11120</b>	MB850-120	CVMS0121110A
14.0	15.0	20.6	14.0	12.7	14.5	0.4	<b>ET11140</b>	MB850-140	CVMS0141110A
16.0	17.0	23.4	16.0	14.7	16.5	0.6	<b>ET11160</b>	MB850-160	CVMS0161110A
18.0	19.0	26.4	18.0	16.7	18.5	0.6	<b>ET11180</b>	MB850-180	CVMS0181110A
20.0	22.0	30.1	20.0	18.7	21.5	0.8	<b>ET11200</b>	MB850-200	CVMS0201110A
22.0	25.0	34.0	22.0	20.7	24.5	0.8	<b>ET11220</b>	MB850-220	CVMS0221110A

**i** Appropriate tools on request.

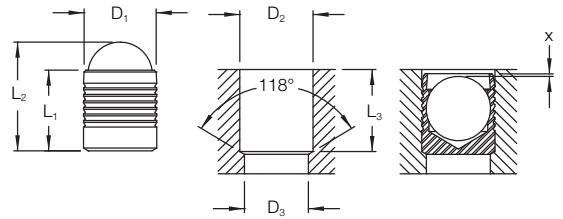
	Installation materials						
	SAE 1144 ETG100	SAE 10L15 C15Pb	ASTM A48 GG-25	ASTM A356 GGG-50	2024-T4 AlCuMg2	EN 6061-T6 AlMg1SiCu*	356-T6 G-AlSi7Mg
<b>Ø 3 – 10 mm</b>							
Test pressure	16.000 psi / 1.100 bar					14.500 psi / 1.000 bar	
Maximum operating pressure	5.000 psi / 350 bar					4.500 psi / 320 bar	
<b>Ø 12 – 22 mm</b>							
Test pressure	13.000 psi / 900 bar					11.500 psi / 800 bar	
Maximum operating pressure	4.000 psi / 280 bar					3.500 psi / 250 bar	

\* Material composition similar to AlMgSiPb / EN 6005 / EN 6012

# SEALING PLUG with ball – Series 3 1

Available in diameters  
from 3 mm to 22 mm.

- Push-expansion principle
- Up to 450 bar operating pressure



**Version:**

**Sleeve:**

- 3** Stainless Steel, AISI 300

**Ball:**

- 1** Bearing Steel, Black Oxide Finish

							Conversion table		
D <sub>1</sub>	L <sub>1</sub>	L <sub>2</sub>	D <sub>2</sub> +0.1 / -0.0	D <sub>3</sub> max.	L <sub>3</sub> min.	x +/-0.2	Böllhoff Article no.	KVT Article no.	Farmington Article no.
3.0	3.6	4.6	3.0	2.2	3.4	0.4	<b>ET31030</b>	MB700-030	CVMS0033110A
4.0	4.0	5.2	4.0	3.3	3.8	0.2	<b>ET31040</b>	MB700-040	CVMS0043110A
5.0	5.5	7.1	5.0	4.3	5.3	0.4	<b>ET31050</b>	MB700-050	CVMS0053110A
6.0	6.5	8.7	6.0	5.3	6.3	0.4	<b>ET31060</b>	MB700-060	CVMS0063110A
7.0	7.5	10.2	7.0	6.4	7.3	0.4	<b>ET31070</b>	MB700-070	CVMS0073110A
8.0	8.5	11.6	8.0	7.4	8.3	0.3	<b>ET31080</b>	MB700-080	CVMS0083110A
9.0	10.0	13.6	9.0	8.4	9.8	0.4	<b>ET31090</b>	MB700-090	CVMS0093110A
10.0	11.0	15.2	10.0	9.4	10.8	0.4	<b>ET31100</b>	MB700-100	CVMS0103110A
12.0	13.0	17.9	12.0	10.6	12.8	0.4	<b>ET31120</b>	MB700-120	CVMS0123110A
14.0	15.0	20.6	14.0	12.7	14.5	0.4	<b>ET31140</b>	MB700-140	CVMS0143110A
16.0	17.0	23.4	16.0	14.7	16.5	0.6	<b>ET31160</b>	MB700-160	CVMS0163110A
18.0	19.0	26.4	18.0	16.7	18.5	0.6	<b>ET31180</b>	MB700-180	CVMS0183110A
20.0	22.0	30.1	20.0	18.7	21.5	0.8	<b>ET31200</b>	MB700-200	CVMS0203110A
22.0	25.0	34.0	22.0	20.7	24.5	0.8	<b>ET31220</b>	MB700-220	CVMS0223110A

**i** Appropriate tools on request.

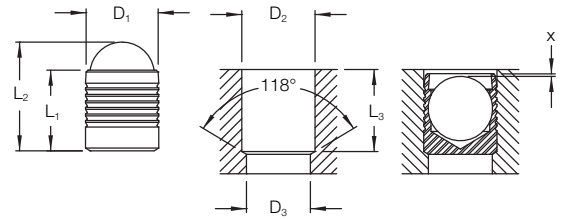
	Installation materials						
	SAE 1144 ETG100	SAE 10L15 C15Pb	ASTM A48 GG-25	ASTM A356 GGG-50	2024-T4 AlCuMg2	EN 6061-T6 AlMg1SiCu*	356-T6 G-AlSi7Mg
<b>Ø 3 – 10 mm</b>							
Test pressure	20.000 psi / 1.400 bar					17.500 psi / 1.200 bar	
Maximum operating pressure	6.500 psi / 450 bar					5.500 psi / 380 bar	
<b>Ø 12 – 22 mm</b>							
Test pressure	16.500 psi / 1.150 bar					13.000 psi / 900 bar	
Maximum operating pressure	5.000 psi / 350 bar					4.000 psi / 280 bar	

\* Material composition similar to AlMgSiPb / EN 6005 / EN 6012

**SEALING PLUG with ball – Series 3 3**

Available in diameters from 3 mm to 22 mm.

- Push-expansion principle
- Up to 450 bar operating pressure



**Version:**

**Sleeve:**

**3** Stainless steel, AISI 300

**Ball:**

**3** Stainless steel, AISI 300

							Conversion table		
D <sub>1</sub>	L <sub>1</sub>	L <sub>2</sub>	D <sub>2</sub> +0.1 / -0.0	D <sub>3</sub> max.	L <sub>3</sub> min.	x +/-0.2	Böllhoff Article no.	KVT Article no.	Farmington Article no.
3.0	3.6	4.6	3.0	2.2	3.4	0.4	<b>ET33030</b>	MB600-030	CVMS0033130A
4.0	4.0	5.2	4.0	3.3	3.8	0.2	<b>ET33040</b>	MB600-040	CVMS0043130A
5.0	5.5	7.1	5.0	4.3	5.3	0.4	<b>ET33050</b>	MB600-050	CVMS0053130A
6.0	6.5	8.7	6.0	5.3	6.3	0.4	<b>ET33060</b>	MB600-060	CVMS0063130A
7.0	7.5	10.2	7.0	6.4	7.3	0.4	<b>ET33070</b>	MB600-070	CVMS0073130A
8.0	8.5	11.6	8.0	7.4	8.3	0.3	<b>ET33080</b>	MB600-080	CVMS0083130A
9.0	10.0	13.6	9.0	8.4	9.8	0.4	<b>ET33090</b>	MB600-090	CVMS0093130A
10.0	11.0	15.2	10.0	9.4	10.8	0.4	<b>ET33100</b>	MB600-100	CVMS0103130A
12.0	13.0	17.9	12.0	10.6	12.8	0.4	<b>ET33120</b>	MB600-120	CVMS0123130A
14.0	15.0	20.6	14.0	12.7	14.5	0.4	<b>ET33140</b>	MB600-140	CVMS0143130A
16.0	17.0	23.4	16.0	14.7	16.5	0.6	<b>ET33160</b>	MB600-160	CVMS0163130A
18.0	19.0	26.4	18.0	16.7	18.5	0.6	<b>ET33180</b>	MB600-180	CVMS0183130A
20.0	22.0	30.1	20.0	18.7	21.5	0.8	<b>ET33200</b>	MB600-200	CVMS0203130A
22.0	25.0	34.0	22.0	20.7	24.5	0.8	<b>ET33220</b>	MB600-220	CVMS0223130A

**i** Appropriate tools on request.

	Installation materials						
	SAE 1144 ETG100	SAE 10L15 C15Pb	ASTM A48 GG-25	ASTM A356 GGG-50	2024-T4 AlCuMg2	EN 6061-T6 AlMg1SiCu*	356-T6 G-AlSi7Mg
<b>Ø 3 – 10 mm</b>							
Test pressure	20.000 psi / 1.400 bar					17.500 psi / 1.200 bar	
Maximum operating pressure	6.500 psi / 450 bar					5.500 psi / 380 bar	
<b>Ø 12 – 22 mm</b>							
Test pressure	16.500 psi / 1.150 bar					13.000 psi / 900 bar	
Maximum operating pressure	5.000 psi / 350 bar					4.000 psi / 280 bar	

\* Material composition similar to AlMgSiPb / EN 6005 / EN 6012

# SEALING PLUG with mandrel – RS/RSL series

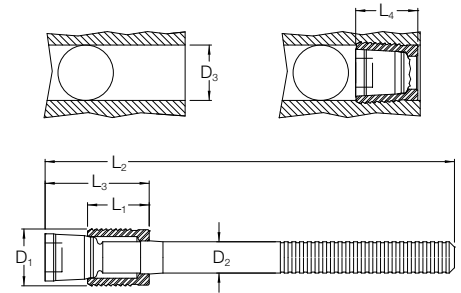
Available in diameters  
from 4 mm to 10 mm.

- Pull-expansion principle
- Up to 500 bar operating pressure

Version:

**Sleeve:** Case Hardened Steel, Black Oxide Finish

**Pin:** Heat Treatable Steel, Black Oxide Finish



With either standard (RS) or long mandrel (RSL).

## Standard mandrel length (RS)

							Conversion table	
D <sub>1</sub>	L <sub>1</sub>	D <sub>2</sub>	L <sub>2</sub>	L <sub>3</sub> max.	L <sub>4</sub> max.	D <sub>3</sub> +0.12/-0.0	Böllhoff Article no.	KVT Article no.
4.0	4.5	2.50	39.0	9.0	6.5	4.0	<b>ETRS040</b>	SK550-040
5.0	5.5	3.00	41.0	10.0	7.5	5.0	<b>ETRS050</b>	SK550-050
6.0	6.5	3.40	43.0	12.0	8.0	6.0	<b>ETRS060</b>	SK550-060
7.0	7.5	4.10	38.0	14.0	9.0	7.0	<b>ETRS070</b>	SK550-070
8.0	8.5	4.20	40.0	15.0	10.5	8.0	<b>ETRS080</b>	SK550-080
9.0	9.5	4.50	43.0	17.0	11.0	9.0	<b>ETRS090</b>	SK550-090
10.0	10.5	4.75	45.0	19.0	12.5	10.0	<b>ETRS100</b>	SK550-100

**i** Appropriate tools on request. Special materials on request.

## Long mandrel (RSL)

							Conversion table	
D <sub>1</sub>	L <sub>1</sub>	D <sub>2</sub>	L <sub>2</sub>	L <sub>3</sub> max.	L <sub>4</sub> max.	D <sub>3</sub> +0.12/-0.0	Böllhoff Article no.	KVT Article no.
4.0	4.5	2.50	69.0	9.0	6.5	4.0	<b>ETRSL040</b>	SK552-040
5.0	5.5	3.00	71.0	10.0	7.5	5.0	<b>ETRSL050</b>	SK552-050
6.0	6.5	3.40	73.0	12.0	8.0	6.0	<b>ETRSL060</b>	SK552-060
7.0	7.5	4.10	68.0	14.0	9.0	7.0	<b>ETRSL070</b>	SK552-070
8.0	8.5	4.20	70.0	15.0	10.5	8.0	<b>ETRSL080</b>	SK552-080
9.0	9.5	4.50	73.0	17.0	11.0	9.0	<b>ETRSL090</b>	SK552-090
10.0	10.5	4.75	75.0	19.0	12.5	10.0	<b>ETRSL100</b>	SK552-100

**i** Appropriate tools on request. Special materials on request.

	Installation materials						
	SAE 1144 ETG100	SAE 10L15 C15Pb	ASTM A48 GG-25	ASTM A356 GGG-50	2024-T4 AlCuMg2	EN 6061-T6 AlMg1SiCu*	356-T6 G-AlSi7Mg
<b>Ø 4 – 10 mm</b>							
Test pressure	23.000 psi / 1.600 bar				20.000 psi / 1.400 bar		
Maximum operating pressure	7.000 psi / 500 bar				6.500 psi / 450 bar		

\* Material composition similar to AlMgSiPb/EN 6005/EN 6012

All dimensions specified in mm.

**NEW PULLPLUG™ – RST series**

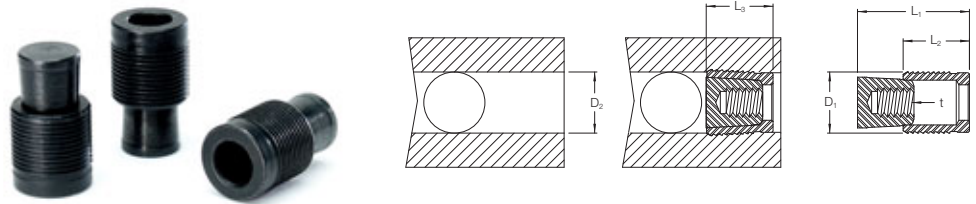
**Available in diameters  
from 6 mm to 22 mm.**

- Pull-expansion principle
- Up to 500 bar operating pressure

**Version:**

**Sleeve:** Case Hardening Steel, Black Oxide Finish

**Pin:** Heat Treatable Steel, Black Oxide Finish



D <sub>1</sub>	L <sub>1</sub>	D <sub>2</sub> +0.1/-0.0	L <sub>2</sub>	L <sub>3</sub>	t	Böllhoff Article no.
6.0	11.0	6.0	6.5	7.0	M 3	<b>ETRST060</b>
7.0	13.0	7.0	7.5	8.0	M 3.5	<b>ETRST070</b>
8.0	14.0	8.0	8.5	9.0	M 4	<b>ETRST080</b>
9.0	16.0	9.0	9.5	10.0	M 4	<b>ETRST090</b>
10.0	18.0	10.0	10.5	11.0	M 5	<b>ETRST100</b>
12.0	21.0	12.0	12.5	13.0	M 5	<b>ETRST120</b>
14.0	25.0	14.0	14.5	15.0	M 6	<b>ETRST140</b>
16.0	28.0	16.0	16.5	17.0	M 8	<b>ETRST160</b>
18.0	31.5	18.0	18.5	19.0	M 8	<b>ETRST180</b>
20.0	35.0	20.0	20.5	21.0	M 10	<b>ETRST200</b>
22.0	38.5	22.0	22.5	23.0	M 10	<b>ETRST220</b>

**i** Appropriate tools on request. Special materials on request.

**Advantages of PULLPLUG™ compared  
to SEALING PLUG with mandrel**



- Less material = lower price
- No noise when mandrel breaks off
- No disposal of broken mandrel required
- No raw material after mandrel breaks off
- Higher process reliability as controlled by stroke and not by nominal breaking force
- Therefore, particularly suited to harder installation materials
- Creates a usable internal thread

# SEALING PLUG – Installation guidelines

## Installation guidelines for:

**SEALING PLUG series 1 1** (ET11)

**SEALING PLUG series 3 1** (ET31)

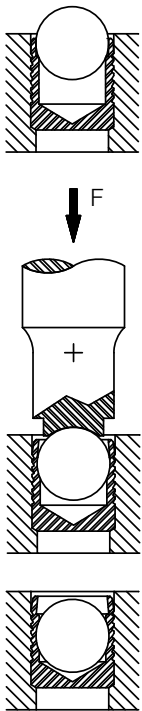
**SEALING PLUG series 3 3** (ET33)

### Drill holes

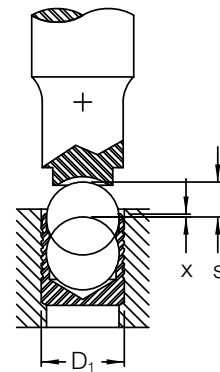
- Use the relevant catalogue sheet or drawing to determine the correct dimensions and tolerances.
- The roundness tolerances of the hole must be held within  $t = 0.05$  mm.
- The surface roughness of the hole must be  $RZ = 10 - 30$   $\mu\text{m}$ .
- Longitudinal and spiral grooves may affect the performance and must be avoided.
- The holes must be free from burrs, oil and grease.

### How to install

- Insert the SEALING PLUG with the ball facing outwards into the counterbored hole.
- The top of the sleeve must be below the contour of the workpiece.
- This can be ensured by complying with the hole dimensions and tolerances in the catalogue sheet.
- Push the ball into the sleeve so that the top of the ball is slightly below the top of the sleeve. The table below contains guideline values for the stroke  $s$  and the dimension  $x$  (position of ball).
- Please make sure that you use the correct installation tool for each size.



$D_1$	Stroke $s$	Position of top of ball relative to top of sleeve $x$
3.0	1.2	0.4
4.0	1.5	0.2
5.0	2.0	0.4
6.0	2.5	0.4
7.0	3.0	0.4
8.0	3.5	0.3
9.0	4.0	0.4
10.0	4.5	0.4
12.0	5.5	0.4
14.0	6.4	0.4
16.0	7.0	0.6
18.0	8.0	0.6
20.0	9.0	0.8
22.0	10.0	0.8



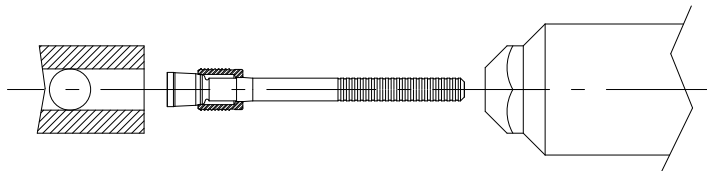


**Installation guidelines for:  
SEALING PLUG RS/RSL series (ETRS – Rivet Style)**

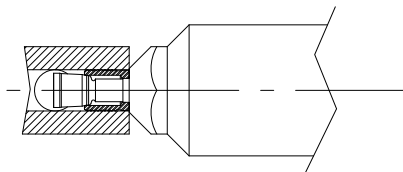
**Drill holes**

- Use the relevant catalogue sheet or drawing to determine the correct dimensions and tolerances.
- The roundness tolerances of the hole must be held within  $t = 0.05$  mm.
- The surface roughness of the hole must be  $RZ = 10 - 30$   $\mu\text{m}$ .
- Longitudinal and spiral grooves may affect the performance and must be avoided.
- The holes must be free from burrs, oil and grease.

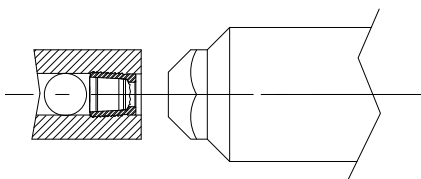
**How to install**



- Insert mandrel side into tool.



- Insert sleeve side into hole to be sealed.



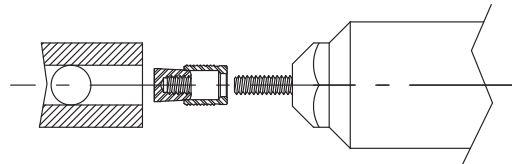
- By triggering the setting process, the pin is pulled until the nominal breaking force is reached and the mandrel breaks off. The pin is pulled into the sleeve, causing the sleeve to expand, and anchors itself in the installation material.

## Installation guidelines for: PULLPLUG™ RST series (ETRST)

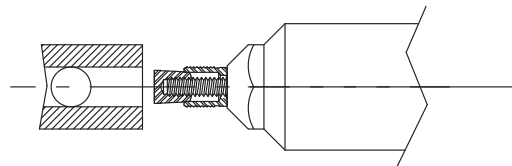
### Drill holes

- Use the relevant catalogue sheet or drawing to determine the correct dimensions and tolerances.
- The roundness tolerances of the hole must lie within  $t = 0.05$  mm.
- The surface roughness of the hole must be  $RZ = 10 - 30$   $\mu\text{m}$ .
- Longitudinal and spiral grooves may affect the performance and must be avoided.
- The holes must be free from burrs, oil and grease.

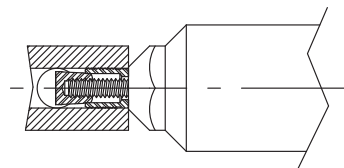
### How to install



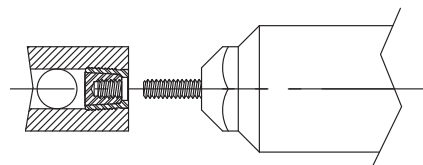
- Position tool and PULLPLUG™.



- Push PULLPLUG™ onto thread of tool. The PULLPLUG™ will automatically screw/thread itself on.



- Insert into hole to be sealed.

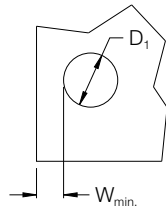


- By triggering the setting process, the pin is pulled along the preset stroke and then automatically unthreads itself. The pin is pulled into the sleeve, causing the sleeve to expand, and anchors itself in the installation material.

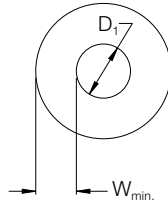
# SEALING PLUG – Design guidelines for wall thicknesses and edge distances

Through semi-plastic radial expansion, the SEALING PLUG/PULLPLUG™ is anchored in the installation material. In order to optimise the anchoring and withstand the hydraulic pressures and thermal stresses that exist in the application, it is important to comply with minimal wall thicknesses/edge distances

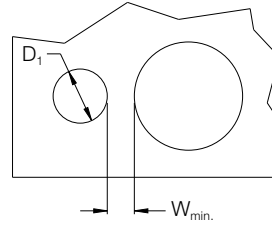
**Distance to external contour (straight)**



**Distance to external contour (round)**



**Distance between holes**



The guideline values for the minimum wall thicknesses and edge distances ( $W_{min}$ ) are set out below. If you comply with these guideline values, only slight deformations ( $\leq 20 \mu m$ ) may occur on the external contours of the installation material. This will not affect the performance of the SEALING PLUG/PULLPLUG™. If the wall thicknesses and edge distances are below the  $W_{min}$  guideline values, the function of the SEALING PLUG/PULLPLUG™ cannot be guaranteed. If this is the case, please contact us and we will be happy to advise you. Together we can find a solution for your application.

**Guideline value  $W_{min}$  for wall thicknesses and edge distances**

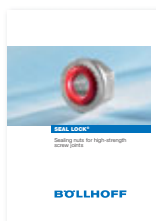
$D_1 \geq 4 \text{ mm: } W_{min} = f_{min} \times D_1$   
 $D_1 < 4 \text{ mm: } W_{min} = f_{min} \times D_1 + 0,5 \text{ mm}$

Article	Installation materials						
	SAE 1144 ETG100	SAE 10L15 C15Pb	ASTM A48 GG-25	ASTM A356 GGG-50	2024-T4 AlCuMg2	EN 6061-T6 AlMg1SiCu*	356-T6 G-AISi7Mg
	Factor $f_{min}$						
SEALING PLUG series 1 1	0.5	0.6	1.0	0.6	0.6	1.0	1.0
SEALING PLUG series 3 1	0.6	0.8	1.0	0.8	0.8	1.0	1.0
SEALING PLUG series 3 3	0.6	0.8	1.0	0.8	0.8	1.0	1.0
SEALING PLUG RS/RSL series	0.5	0.6	1.0	0.6	0.6	1.0	1.0
PULLPLUG™ RST series	0.5	0.6	1.0	0.6	0.6	1.0	1.0

\* Material composition similar to AlMgSiPb/EN 6005/EN 6012

All dimensions specified in mm.

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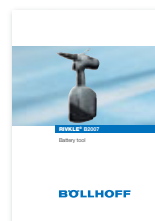
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