



## Bore Clamp

Block-type, without centring function, double acting,  
for bore diameter 7.8-17.7 mm, max. operating pressure 250 bar



### 1 Description of the product

The bore clamp is a double-acting pull-type cylinder. An exchangeable clamping bushing is fixed to the piston.

The 4 segments of the clamping bushing are radially expanded with spring force by a pyramid-shaped clamping bolt. Thus the expansion force is always the same and independent of the hydraulic clamping pressure.

Both unclamping of the clamping bushing and pull-down clamping of the workpiece are controlled hydraulically. Connecting the positive air pressure protection the clamping bushing is protected against swarf and coolants.

In the hardened support surface for the workpiece there is a bore hole for connection of a pneumatic seat control.

### 2 Validity of the documentation

This document applies to the following products:

Bore clamps as per data sheet B14841.

The following types or part numbers are concerned:

- 4318-111A, -111B, -111C, -111D, -111E
- 4318-211F, -211G, -211H, -211K, -211L, -211M, -211N

### 3 Target group of this document

- Specialists, fitters and set-up men of machines and installations with hydraulic expert knowledge.

#### Qualification of the personnel

**Expert knowledge** means that the personnel must

- be in the position to read and completely understand technical specifications such as circuit diagrams and product-specific drawing documents,
- have expert knowledge (electric, hydraulic, pneumatic knowledge, etc.) of function and design of the corresponding components.

An **expert** is somebody who has due to its professional education and experiences sufficient knowledge and is familiar with the relevant regulations so that he

- can judge the entrusted works,
- can recognize the possible dangers,
- can take the required measures to eliminate dangers,
- knows the acknowledged standards, rules and guidelines of the technology.
- has the required knowledge for repair and mounting.

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## 4 Symbols and signal words

### **WARNING**

#### **Person damage**

Stands for a possibly dangerous situation.

If it is not avoided, death or very severe injuries will result.

### **CAUTION**

#### **Easy injuries / property damage**

Stands for a possibly dangerous situation.

If it is not avoided, minor injuries or material damages will result.



#### **Hazardous to the environment**

The symbol stands for important information for the proper handling with materials that are hazardous to the environment.

Ignoring these notes can lead to heavy damages to the environment.

### **Note**

This symbol stands for tips for users or especially useful information. This is no signal word for a dangerous or harmful situation.

## 5 For your safety

### 5.1 Basic information

The operating instructions serve for information and avoidance of dangers when installing the products into the machine as well as information and references for transport, storage and maintenance.

Only in strict compliance with these operating instructions, accidents and property damages can be avoided as well as trouble-free operation of the products can be guaranteed.

Furthermore, the consideration of the operating instructions will:

- avoid injuries
- reduce down times and repair costs,
- increase the service life of the products.

### 5.2 Safety instructions

The product was manufactured in accordance with the generally accepted rules of the technology.

Observe the safety instructions and the operating instructions given in this manual, in order to avoid personal damage or material damage.

- Read these operating instructions thoroughly and completely, before you work with the product.
- Keep these operating instructions so that they are accessible to all users at any time.
- Pay attention to the current safety regulations, regulations for accident prevention and environmental protection of the country in which the product will be used.
- Use the ROEMHELD product only in perfect technical condition.
- Observe all notes on the product.
- Use only accessories and spare parts approved by the manufacturer in order to exclude danger to persons because of not suited spare parts.
- Respect the intended use.

- You only may start up the product, when it has been found that the incomplete machine or machine, in which the product shall be mounted, corresponds to the country-specific provisions, safety regulations and standards.
- Perform a risk analysis for the incomplete machine, or the machine.

Due to the interactions between the product and the machine/fixture or the environment, risks may arise that only can be determined and minimized by the user, e.g. :

- generated forces,
- generated movements,
- Influence of hydraulic and electrical control,
- etc.

## 6 Application

### 6.1 Intended use

The products are used in industrial applications to transform hydraulic pressure to a radial movement and /or force. They must only be operated with hydraulic oil.

Furthermore the following belongs to possible uses:

- Use within the capacity indicated in the technical characteristics (see data sheet).
- Use as per operating instructions.
- Compliance with service intervals.
- Qualified and trained personnel for the corresponding activities.
- Mounting of spare parts only with the same specifications as the original part.

## 6.2 Misapplication

### **⚠ WARNING**

#### **Injuries, material damages or malfunctions!**

- Do not modify the product!

The use of these products is not admitted:

- For domestic use.
- On pallets or machine tool tables in primary shaping and metal forming machine tools.
- If due to physical / chemical effects (vibrations, welding currents or others) damages of the products or seals can be caused.
- In machines, on pallets or machine tool tables that are used to change the characteristics of the material (magnetise, radiation, photochemical procedures, etc.).
- In areas for which special guidelines apply, especially installations and machines:
  - For the use on fun fairs and in leisure parks.
  - In food processing or in areas with special hygiene regulations.
  - For military purposes.
  - In mines.
  - In explosive and aggressive environments (e.g. ATEX).
  - In medical engineering.
  - In the aerospace industry.
  - For passenger transport.
- For other operating and environmental conditions e.g.:
  - Higher operating pressures than indicated on the data sheet or installation drawing.
  - With hydraulic fluids that do not correspond to the specifications.
  - Higher flow rates than indicated on the data sheet or installation drawing.

**Special solutions are available on request!**

## 7 Installation

### **⚠ WARNING**

#### **Injury by high-pressure injection (squirting out of hydraulic oil under high pressure)!**

- Improper connection can lead to escapes of oil under high pressure at the connections.
- Mounting or dismounting of the element must only be made in depressurised mode of the hydraulic system.
- Connection of the hydraulic line as per DIN 3852/ISO 1179.
- Unused connections have to be locked professionally.
- Use all mounting holes.

#### **Injury by high-pressure injection (squirting out of hydraulic oil under high pressure)!**

Wear, damage of the seals, ageing and incorrect mounting of the seal kit by the operator can lead to escapes of oil under high pressure.

- Before using them make a visual control.

#### **Injury by falling parts!**

- Keep hands and other parts of the body out of the working area.
- Wear personal protection equipment!

### **⚠ WARNING**

#### **Poisoning due to contact with hydraulic oil!**

Wear, damage of the seals, ageing and incorrect mounting of the seal kit by the operator can lead to escapes of oil.

Incorrect connection can lead to escapes of oil at the ports.

- For handling with hydraulic oil consider the material safety data sheet.
- Wear protection equipment.

### **⚠ CAUTION**

#### **Great weight may fall**

Some product types have a considerable weight. These have to be secured against working free during transport.

Weight specifications see chapter "Technical characteristics".

#### **Side loads and forced conditions acting on the piston lead to increased wear**

- Provide external guides.
- Avoid forced conditions (overdetermination) of the piston.

## 7.1 Design

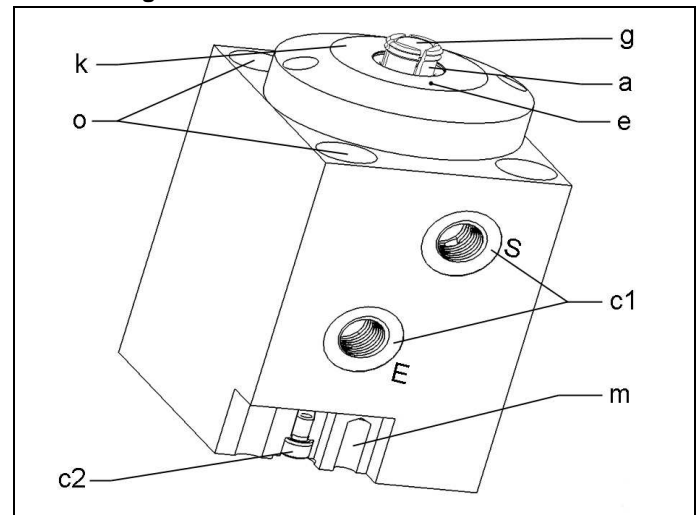


Figure 1: Components

c1 Hydraulic ports with pipe thread (S Clamping, E Unclamping) Back with ports A seat control, L positive air pressure protection, Bleeding screw (only for 4318-210X)	a Clamping bushing e Pneumatic seat check g Slotted screw k Support face m Bore hole for radial alignment o Fixing possibility
c2 Hydraulic connection without pipes, closed with screw and Bonded Seal	

## 7.2 Mounting types

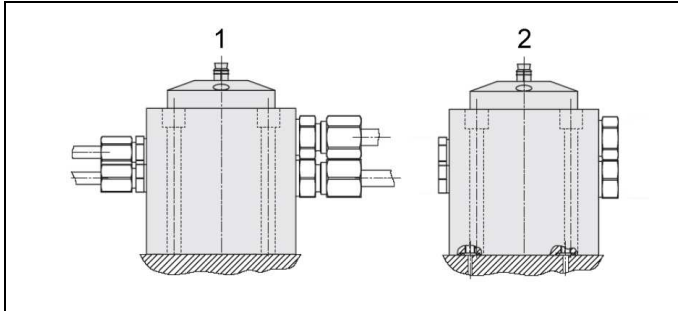


Figure 2: Fixing possibilities

1 Pipe thread	2 Manifold-mounted hydraulic connection
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## 7.3 Admissible oil flow rate

### ⚠ WARNING

#### Injury due to overload of the element

#### High-pressure injection (squirting out of hydraulic oil under high pressure) or flying components!

- Due to throttling or closing of ports a pressure intensification can occur.
- Connect the ports professionally!

### ⚠ CAUTION

#### Maximum flow rates do not exceed

The maximum flow rate must not be exceeded.

### 7.3.1 Calculation of the admissible flow rate

#### Admissible oil flow rate

The admissible flow rate or the admissible stroke speed is valid for vertical mounting positions in combination with standard add-on parts as clamping arms or contact bolts, etc.

In case of other mounting positions and/or add-on parts the flow rate has to be reduced.

If the pump flow rate divided by the number of elements is larger than the admissible flow rate of one element, the flow rate has to be throttled.

This prevents an overload and therewith an early failure.

The flow rate can be checked as follows:

$$Q_p \leq 0,06 \cdot \dot{V}_Z \cdot n \text{ and/or } Q_p \leq 6 \cdot v_Z \cdot A_K \cdot n$$

for clamping elements and work supports (indicated on the data sheets)

#### Maximum piston speed

At specified pump flow rate **Q** and with the effective piston area **A** the piston speed can be calculated as follows:

$$v_m < \frac{Q_p}{6 \cdot A_K \cdot n}$$

## Legend

$\dot{V}_Z$  = Admissible flow rate of the element in [cm<sup>3</sup>/s]

$Q_p$  = Flow rate of the pump in [l/min]

$A_K$  = Piston area in [cm<sup>2</sup>]

$n$  = Number of elements, same dimensions

$v_Z = v_m$  = Admissible/maximum stroke speed in [m/s]

## NOTE

### Oil volume

- The maximum oil volume and/or the maximum stroke speed depend on the corresponding product.
  - For clamping cylinders see data sheet A 0.100.
  - or clamping elements, work supports, hydraulic valves, power units and other hydraulic elements indicated on the corresponding data sheets.

Further " things worth knowing about hydraulic cylinders, basics, detailed knowledge and calculations on hydraulic cylinders" see in the [Technical library](#) on the internet!

or download



### 7.3.2 Throttling of the flow rate

The throttling always has to be effected in the supply line to the swing clamp. Only thus pressure intensification and thereby pressures exceeding the operating pressure are avoided. The hydraulic circuit diagram shows flow control valves which allow oil return from the element without any impediments.

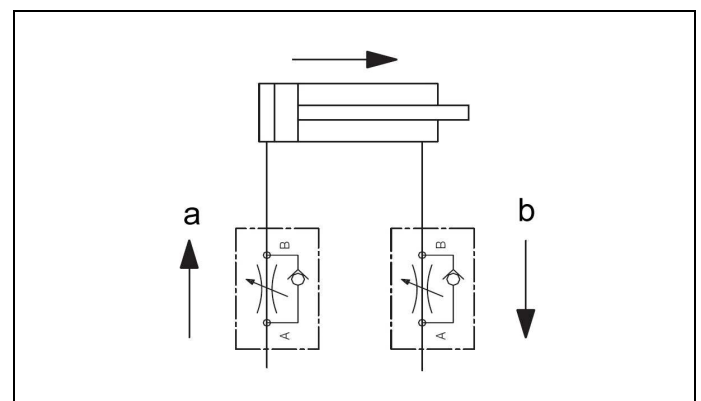


Figure 3: Hydraulic circuit diagram without flow control valves

a Throttling direction	b Free flow
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If a return-flow throttling is required due to a negative load, it must be guaranteed that the max. operating pressure (see technical characteristics) will not be exceeded.

#### 7.4 Installation of pipe-mounted types

1. Clean the support surfaces.
2. Fasten the element support at the flange surface (see figure "Mounting types").

### **WARNING**

#### **Injury by falling products!**

Safety shoes have to be worn to avoid injuries due to falling objects.

### **NOTE**

#### **Tightening**

- To determine the tightening torque of the fixing screws a screw calculation as per VDI 2230 page 1 has to be effected. The screw material is indicated in the chapter "Technical characteristics".

### **NOTE**

#### **Tightening torques**

- The tightening torques for the fixing screws have to be designed with reference to the application (e. g. as per VDI 2230).

Proposals and approximate values for the tightening torques see chapter "Technical characteristics".

#### 7.5 Installation of manifold-mounted types

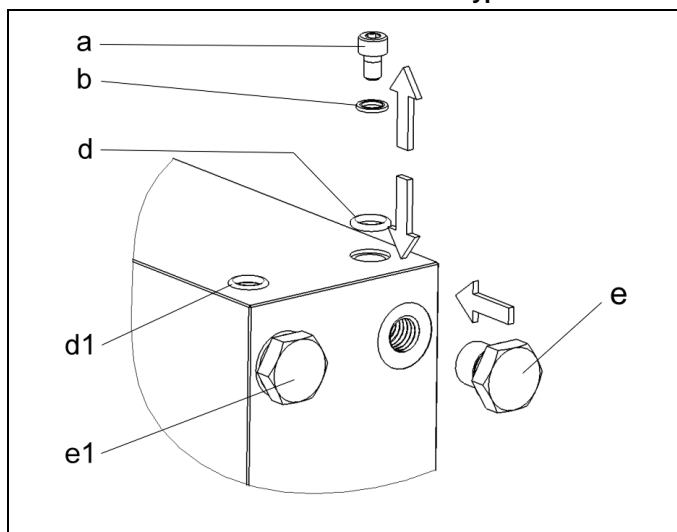


Figure 4: Example, preparation for hydraulic ports without pipes

### **NOTE**

#### **The arrangement of the ports**

- The shown figure is a schematic diagram. The arrangement of the ports depends on the respective product (see chapter "Design").

a Socket head cap screw	d1 Mounted O-ring
b Sealing ring	e Screw plug (accessory)
d O-ring (accessory, depending on the version)	e1 Mounted screw plug

1. Drill the holes for hydraulic oil supply and return in the fixture (see also data sheet).

2. Grind or finish mill the manifold-mounting surface ( $Ra \geq 0.8$  and a flatness of 0.04 mm to 100 x 100 mm, marks, scratches, shrink holes, concentric machining marks are inadmissible).

For some versions:

- 3a. Remove socket head cap screws and sealing rings, insert o-rings (accessories, if required).
  - 3b. Tighten pipe ports with screw plugs (accessories, if required)
4. Clean the support surfaces.
  5. Position and fasten on the fixture.
  6. Install bleeding screws at the upper ends of the piping.

### **NOTE**

#### **Tightening torques**

- The tightening torques for the fixing screws have to be designed with reference to the application (e. g. as per VDI 2230).

Proposals and approximate values for the tightening torques see chapter "Technical characteristics".

#### 7.6 Connection of hydraulic and pneumatic equipments

1. Connect hydraulic and pneumatic lines to qualifying standards and pay attention to scrupulous cleanness (S = Clamping, E = Unclamping, A= Seat check, L= Positive air positive air pressure connection)!

### **NOTE**

#### **More details**

- See ROEMHELD data sheets A 0.100, F 9.300, F 9.310 and F 9.360.

#### **Screwed Plug**

- Use only fittings "screwed plug B and E" as per DIN 3852 (ISO 1179).

#### **hydraulic connection**

- Do not use sealing tape, copper rings or coned fittings.

#### **Pressure fluids**

- Use hydraulic oil as per ROEMHELD data sheet A 0.100.

#### 7.7 Leakage due to the system

The piston rod is set in motion by the hydraulic oil to perform the clamping task.

The hydraulic oil must be sealed at the piston rod to the atmosphere. During extension of the piston rod, the hydraulic oil must remain in the cylinder.

For ROEMHELD products, sealing systems are used for the piston rod, generally consisting of several sealing elements. Those sealing systems enable the sealing points to be absolutely leak-proof in the total specified pressure area, when the system is not in operation. Neither does oil escape at the piston rod, nor is oil transferred from the piston side and piston rod side.

**Important:** ROEMHELD products do not leak oil when static.

To ensure an adequate working life, the sealing systems must be lubricated by the hydraulic fluid while in motion, in dynamic operation. Since the hydraulic fluid must reach the sealing lip, a certain amount of oil is lost from leakage, in the process .



According to the used sealing and the corresponding application conditions the amount can be very different depending on the product group. However the leakage should be very little (see A 0.100 General characteristics of hydraulic equipment).

**Leakage-free cylinders (leakage re-circulation or special sealing) are available on request.**

## 8 Start up

### **WARNING**

#### **Poisoning due to contact with hydraulic oil!**

Wear, damage of the seals, ageing and incorrect mounting of the seal kit by the operator can lead to escapes of oil.

Incorrect connection can lead to escapes of oil at the ports.

- For handling with hydraulic oil consider the material safety data sheet.
- Wear protection equipment.

### **CAUTION**

#### **Operating pressure of 250 bar does not exceed**

The maximum operating pressure of 250 bar must not be exceeded.

- Check tight seating (check tightening torque of the fixing screws, see chapter "Technical characteristics").
- Check tight seating of hydraulic connections (check tightening torque of the hydraulic connections, see chapter "Technical characteristics").
- Bleed the hydraulic system.

### **NOTE**

#### **Clamping time**

- Without bleeding the clamping time will be considerably prolonged and function problems may occur.

#### **8.1 Bleeding of pipe-mounted types**

1. Loosen carefully at low pressure union nut of the pipe at the hydraulic ports.
2. Pump until bubble free oil comes out.
3. Fasten union nuts of the pipe.
4. Check tightness.

#### **8.2 Bleeding of manifold-mounted types**

1. Loosen carefully the bleeding screws of the fixture at low pressure.
2. Pump until bubble free oil comes out.
3. Fasten the bleeding screws.
4. Check correct function.
5. Check sealing of the hydraulic connections!

## 9 Operation

### **NOTE**

#### **Centring function**

The bore clamp has no centring function.

### **9.1 Workpiece clamping**

1. Put the workpiece onto the hardened support surfaces and position by external stops or pins, if required.
2. Start the clamping process by switching the valves.
3. With pressure relief of the unclamping port the clamping bushings will be radially expanded very quickly. According to the material the toothing penetrates more or less deep into the bore hole wall and a form fit will be obtained.
4. In case of pressure increase at the clamping port, the hydraulic piston pulls the expanded clamping bushing and thereby also the workpiece onto the support surface.

#### **What happens in case of pressure drop of the clamping pressure?**

In case of pressure drop the workpieces is no longer pulled onto the hardened support surface.

The radial expansion of the clamping jaws and thereby the form fit with the workpiece are maintained by the spring tension.

### **9.2 Workpiece unclamping**

1. For unclamping a minimum pressure of 100 bar is required. In case of pressure increase at the unclamping port, the hydraulic piston returns to its off-position and the spring tension of the clamping bushing will be released. Very light workpieces can be slightly lifted.
2. Remove the workpiece.

#### **What happens in case of pressure drop of the unclamping pressure?**

The clamping bushing is expanded by spring force and can only be released with the minimum unclamping pressure of 75 bar.

If there is no oil pressure the workpiece can neither be taken out nor a new workpiece can be inserted.

### **NOTE**

#### **Questions**

For operating pressures < 100 bar please contact us.

## 10 Maintenance

### **WARNING**

#### **Burning due to hot surface!**

- In operating conditions, surface temperatures of more than 70 °C can appear at the product.
- All maintenance and repair works must only be effected in cooled mode or with safety gloves.

### **10.1 Cleaning**

### **CAUTION**

#### **Avoid damages of the moved components**

Avoid damages of the moved components (rods, plungers, bolts, etc.) as well as of wiper and seal.

The element must be cleaned at regular intervals.

**NOTE**

Clean the support surface and blast clean the clamping bushing before every clamping cycle.

If swarf fall into an open clamping bore, blast air must be continuously switched on.

**10.2 Regular checks**

1. Check tightness of hydraulic connections (visual control).
2. Check running surfaces (of the piston rod or bolt) if there are marks and scratches. Traces of marks can be an indication for a contaminated hydraulic system or an inadmissible side load of the block cylinder.
3. Leakage check at the housing - piston rod, bolt or flange.
4. Clamping force control by pressure control.
5. Check if the maintenance intervals are kept.

**10.3 Renew clamping bushing**

Exchange clamping bushings and wiper after 10,000 operations.

**NOTE**

To exchange the clamping set, port E (unclamping) has to be pressurised with a minimum pressure of 100 bar.

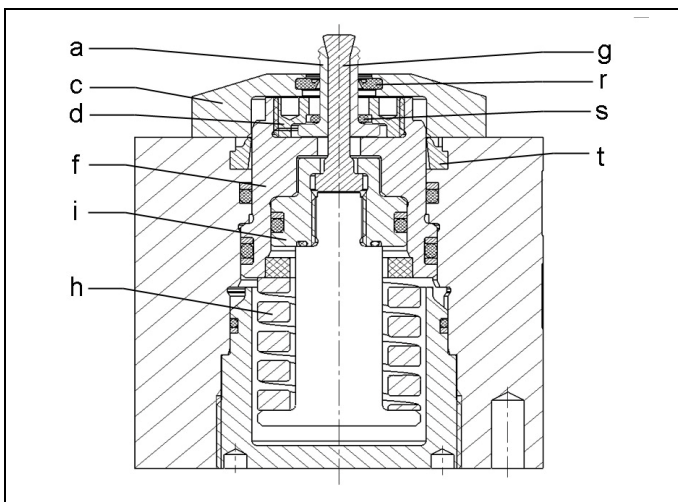


Figure 5: Components

a Clamping bushing	h Pressure spring (expanding function)
c Workpiece support	i Expansion bolt
d Threaded bushing	r Sealing ring
f Clamping piston	s O-ring
g Clamping bolt	t Wiper

1. Workpiece support (e) is untightened and detached by means of screws.
2. Unscrew threaded bushing (d). Use screw tools (see chart) and hold the clamping piston (f).
3. Remove used clamping bushing (a).
4. Push the new clamping bushing (a) complete with O-ring onto the clamping bolt (g) and put it onto the clamping piston (f).
5. Screw in threaded bushing (d) into clamping piston (f). Use screw tools with torque wrench (see chart) and hold the clamping piston (f).

6. Insert a new sealing ring (r) into the workpiece support (c).
7. Carefully put the workpiece support (c) onto the clamping bushing and fix it with 2 screws M4 (tightening torque 3 Nm).

Clamping set	Screw-in tool	Tightening torque
0431 704 A-E	2010 911	40 Nm
0431 703 F-N	2010 912	60 Nm

**10.4 Adjust clamping bushing**

**NOTE**

To adjust the clamping bushing, port E (unclamping) has to be pressurised with a minimum pressure of 100 bar.

**Unclamping diameter = smallest bore diameter - 0.2 mm**

Example:

Clamping range = 11.3 – 11.7 mm

Unclamping diameter = 11.3 – 0.2 = 11.1 mm

Adjustment:

1. Push the vernier calliper or adjusting sleeve (unclamping diameter) onto the clamping bushing (a see Figure components)
2. Carefully screw in clamping bolt (g) until the clamping bushing (a) has the required unclamping diameter or the adjusting sleeve is slightly locked.
3. Remove vernier calliper or adjusting sleeve.
4. Now port E can be depressurised again.

**10.5 Exchange seal kit**

The exchange of the seal kit is made in case of external leakages. For high availability, the seals have to be changed at the latest after 1,000,000 cycles or 2 years.

The seal kit is available as spare part. An instruction for the exchange of the seal kit is available on request.

**NOTE**

**Seal Kits**

- Do not install seal kits which were exposed to light for a longer time.
- Pay attention to the storage conditions (see chapter "Technical characteristics").
- Only use original seals.

**11 Trouble shooting**

Trouble	Cause	Remedy
Piston does not extend:	hydraulic oil supply or return is impeded	check and blow through tubes or channels
Piston extends jerkily:	air in the hydraulic system	hydraulic bleeding
System pressure reduces:	hydraulic port leaky	seal
	wear of seals	replace seals

## 12 Technical characteristics

### General characteristics

Types	Maximum operating pressure [bar]	Maximum low-clamping force [kN]
4318-111X	250	5.1
4318-211X	250	9.8

### Weights

Types	Weight [kg]
4318-111X	2.3
4318-211X	3.9

The indicated weights can deviate according to the version.

### Proposal, tightening torques for screws of tensile strength 8.8, 10.9, 12.9

#### NOTE

The indicated values are approximate values and have to be interpreted according to the user's application!

See note!

Thread	Tightening torque [Nm]		
	8.8	10.9	12.9
M6	10	15	18
M8	25	36	45
M10	49	72	84
M12	85	125	145
M14	135	200	235
M16	210	310	365
M20	425	610	710
M24	730	1050	1220
M30	1,450	2100	2450

**Note:** Valid for workpieces and set screws made of steel with metric thread and connecting surface dimensions as per DIN 912, 931, 933, 934 / ISO 4762, 4014, 4017, 4032

In the table values for tightening torques the following is considered:

Design steel/steel, friction value  $\mu_{ges} = 0.14$  - not oiled, utilisation of the minimum yield point = 90%.

#### NOTE

##### Further information

- For further technical data see ROEMHELD data sheet.

## 13 Accessory

#### NOTE

##### Accessories

- See data sheet.

## 14 Storage

### CAUTION

#### Storage of components!

- The product may not be exposed to direct solar radiation, because the UV light can destroy the seals.
- A storage differing from the storage conditions is inadmissible.
- In case of improper storage, the seals can embrittle and resinification of the anti-corrosive oil or corrosion at the element can occur.

The elements are tested by default with mineral oil. The exterior of the elements is treated with a corrosion inhibitor.

The oil film remaining after the test provides for a six-month interior corrosion protection, if stored in dry and uniformly tempered rooms.

For longer storage times, the element has to be filled with a non-resinifying corrosion inhibitor and the outside surfaces must be treated.

## 15 Disposal

### Hazardous to the environment



Due to possible environmental pollution, the individual components must be disposed only by an authorised expert company.

The individual materials have to be disposed as per the existing regulations and directives as well as the environmental conditions.

Special attention has to be drawn to the disposal of components with residual portions of hydraulic fluids. The instructions for the disposal at the material safety data sheet have to be considered.

For the disposal of electrical and electronic components (e.g. stroke measuring systems, proximity switches, etc.) country-specific legal regulations and specifications have to be kept.



## 16 Declaration of manufacture

### Manufacturer

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### Declaration of manufacture of the products

Bore clamps as per data sheet B14841.

The following types or part numbers are concerned:

- 4318-111A, -111B, -111C, -111D, -111E
- 4318-211F, -211G, -211H, -211K, -211L, -211M, -211N

They are designed and manufactured in line with the relevant versions of the directives **2006/42/EC** (EC MSRL) and in compliance with the valid technical rules and standards.

In accordance with EC-MSRL and EN 982, these products are components that are not yet ready for use and are exclusively designed for the installation in a machine, a fixture or a plant.

According to the pressure equipment directives the products are not to be classified as pressure reservoirs but as hydraulic placing devices, since pressure is not the essential factor for the design, but the strength, the inherent stability and solidity with regard to static or dynamic operating stress.

The products may only be put into operation after it was assessed that the incomplete machine/machine, in which the product shall be installed, corresponds to the machinery directives (2006/42/EC).

The manufacturer commits to transmit the special documents of the products to state authorities on request.

The technical documentation as per appendix VII part B was prepared for the products.

Responsible person for the documentation:

Dipl.-Ing. (FH) Jürgen Niesner, Tel.: +49(0)6405 89-0.

**Römheld GmbH**

**Friedrichshütte**

Laubach, 25.03.2014