TRUST IN KNOWLEDGE – BUILD TIGHT!

FHRK

NEW
with requirements and solutions for existing buildings

Planning Guide Building Entries

For that your home …

Seal penetrations reliably!

Not like that, please!

Image: Kessel AG D-85101 Lenting

Wet basements or water inside of buildings are every house owner's nightmare. Leakages are very often results of nonprofessionally installed sealing systems of line bushings.

Decisive for the sealing is not only the level of ground water (assumed ground water level).

In addition further impacts of humidity could appear later.

- Extreme weather conditions with large amounts of rainfall
- Rising of ground water level caused by redevelopment of sewers
- Sealing of surfaces
- Seepage of surface water near properties
- Ground subsidence (e. g. in mining regions)
- Influences of water management (shut down of pumps)

… is tight from the beginning.

The position of supply- and disposal lines should be determined before the beginning of construction works

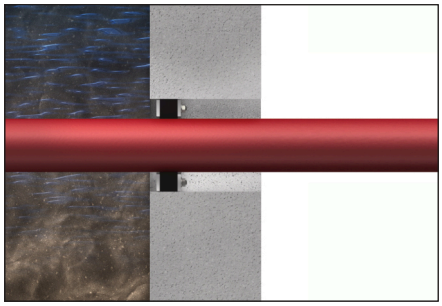
Line entries for the supply of power, water and tele-communication and at least one sewer line are necessary in every house.
In addition to this further lines and wires are entering buildings through the basement walls or floor slabs, for instance:

- Gas supply
- District heating
- Geothermal energy
- Rainwater harvesting
- Air ventilation systems
- Exterior lighting
- Power supply for garage/carport/garden area

The professional sealing of all gaps is one of the necessities for a dry home. Improvised building site solutions are neither reliable nor according to recognized technical standards. Results could be leakages and significant damages inside of buildings.

To avoid technical defects and related liability issues, a timely planning (before construction of houses) is obligatory.

Planners should always include a practice-oriented standard solution with industrial manufactured sealing systems in their tenders.



Please observe the regulations!

Standards and regulations determine that a gas- and watertight installation of cables and pipes is obligatory. Industrial manufactured sealing systems fulfil the requirements. Today such systems are state-of-the-art and should be included during the planning of each building.

So that your existing building…

From storage room to living room!

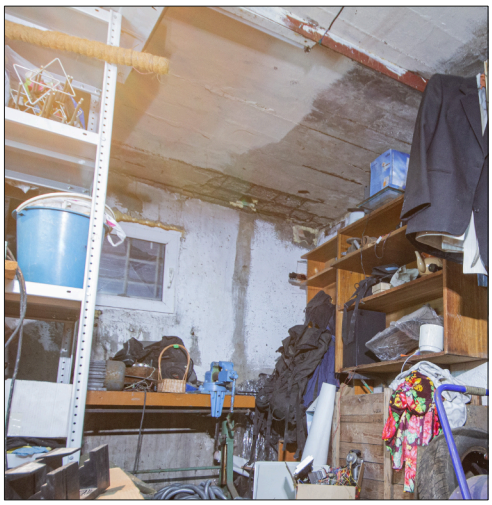


Image: iStock.com/Denis Torkhov

Cellars were originally in general not intended as living spaces but as storage rooms. Because of the relatively constant and lower temperatures of the earth, the cellar was the predecessor of the refrigerator.

Image: Say/Shutterstock.com

These days people want to use their cellars more efficiently. In the context of renovation the former work and storage rooms are repurposed into:

- Wellness area
- Home office
- Games room
- Guest room

Enormous demand in the coming years

Out of 19 million residential buildings (Germany) with approx. 42 million apartments, nearly half of these will be renovated in the next 20 years. 83 percent of these are one- or two-family houses, and of these up to 73 percent are composed of classical one-family, double, or rowhouses. The rest are two-family houses or single family homes with attached rentals.

… remains useful for your purposes or becomes so.

Characteristics of existing buildings

The challenge of existing buildings lies in the variety of construction techniques used in making wall structures out of a wide range of materials:

- Concrete
- Sand-lime brick
- Natural stone
- Single-sized concrete
- Plane brick
- Solid brick
- Porous concrete brick
- Waterproof concrete
- Element walls

Image: Rajput/Shutterstock.com

In the course of renovation, the building will, in most cases, be upgraded from a damp and cold storage room to a dry and heated living area through the use of sealing techniques and energy measures.

New connections in inventory

Life means change, nothing stays as it once was, nothing is static. "The only constant in the universe is change" wrote Heraclitus.

With reference to buildings and the need for new utility connections, the following themes should be noted that make an additional building entry necessary.

- Fibre optic connection
- Wallbox for electric mobility
- Thermal heat pump as a replacement for gas or oil heating

Standards and regulations

In Germany and several German speaking countries the following technical codes for gas- and watertight sealing systems have to be considered during the planning phase (amongst others):

- DIN 18533, Sealing of structures in contact with the ground
- DIN 18322, VOB part C, ATV for underground line laying
- DIN 18336, VOB part C, ATV for waterproofing works
- DIN 1986-100 drainage plants for buidlings and properties
- DAfStb-directive, waterproof buildings made of concrete (WU-directive)
- AGFW FW419/ DVGW GW-390 / VDE-AR-N 4223, building penetrations and how to seal them for underground pipes

For existing buildings the following guidelines are especially important to observe:

- WTA datasheet 4-6. Retroactive sealing of structures in contact with the ground.

Fundamentally the above stated guidelines, requirements, and specifications for new construction are at least analogously applicable to retroactive sealing of structures in contact with the ground, and should also be observed.

For new construction and existing buildings the Radiation Protection Act and the Radiation Protection Ordinance are still in effect for protection from radon, and must be observed.

System advantages

Industrial produced sealing systems provide the following advantages:

- Tested gas- and watertightness
- Quick, protected and time saving installation
- Requirements of valid standards and regulations are fulfilled
- According to directives AGFW, DVGW, VDE-FNN, FHRK

Liability

The question about responsibility will always arise in case of damages. For example: If water or gas penetrates into a building caused by sealing systems which are not installed properly. The responsibility for a gas- and watertight sealing of pipes and cables is usually carried by planners and executing companies. By using tested and approved sealing systems the following items are much easier to proof in case of judicial disputes:

- The sealing system is according to the valid standards and regulations.
- You have exercised your duty of diligence.

Industrially manufactured sealing systems

When sealing a building entry one must distinguish between two sealing systems:

- Wet installation and
- Dry installation

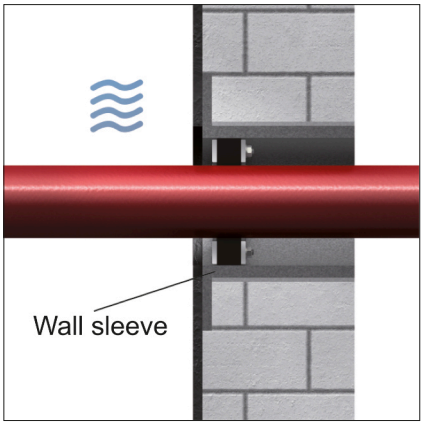
Using wet installation a flowable sealing material is introduced into the annular space between the building and the building penetration site and hardens there into a form locking, sealed connection.

Using dry installation a sealing system is introduced into the annular space between the building and the penetration and there braced to form a sealed frictional connection.

Factors influencing the mode of building entry

Influence of the type of wall

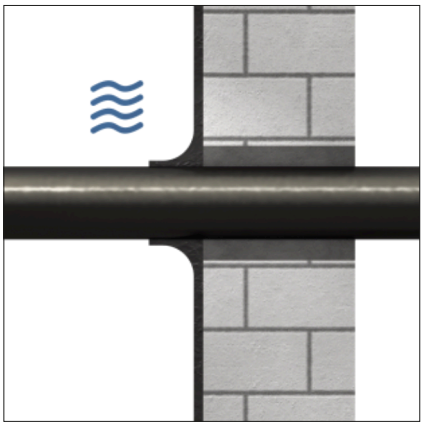
For buildings made of waterproof concrete according to the German WU-Richtlinie directive it is preferable to encase wall sleeve pipes.
Apart from this the sealing system can be installed directly inside a core drill hole. The exposed reinforced steel has to be protected against corrosion (for example through coating or the use of an expansion resin or a grouting mortar over the whole wall structure).



Should the wall be intended as masonry or similar structure, then a feeding pipe (dry installation system), expansion resin, or grouting mortar must be used.

The retroactive sealing of existing penetrations can be achieved throughwall sleeve in split version (for example, flange plates) or shared bushing systems in split version, which are installed either in front of the wall or to the base itself may be used.

Non-waterproof buildings have to be protected by a so called waterproofing sealing sheet according to the DIN 18533. This sealing sheet has to be included at the spot of entries of line(s).



Examples of sealing sheets:

- Bitumen sealing membrane and polymer bitumen membranes
- Plastic- and elastomer sealing sheets
- Plastic-modified bitumen compound (KMB)
- Plastic-modified bitumen sheets (KSK)
- Mineral crack-bridging sealing slurry (MDS)
- Liquid Synthetic (FLK)

Factors influencing the mode of building entry

Load cases

The choice of the right sealing system depends on the load case of water which impacts on the building. The load case has to be specified by the planner and is the result of determination of the assumed ground water level. Usually a time period of 20-30 years has to be taken into consideration. Further the factors influenced by water management should be taken into account.

DIN 18533 describes the following classes of water exposure:

- W1-E – Ground moisture and non-pressing water
- W2-E – Pressing water
- W3-E – Non pressing water on earth-covered surfaces
- W4-E – Splash water on wall base including capillary water on and under walls in contact with the earth

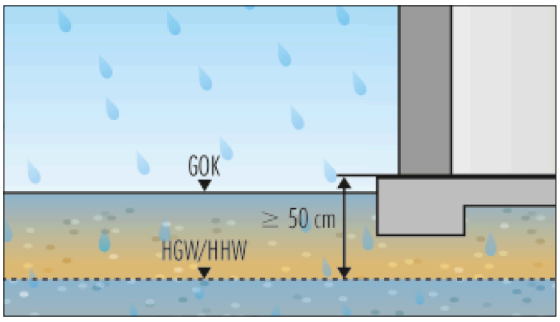
Water exposure classes according to DIN 18533

W1-E Ground moisture and non-pressing water on floor slabs and earth-contact walls.

W1.1-E Ground moisture and non-pressing water on earth-contact walls and floor slabs without drainage:

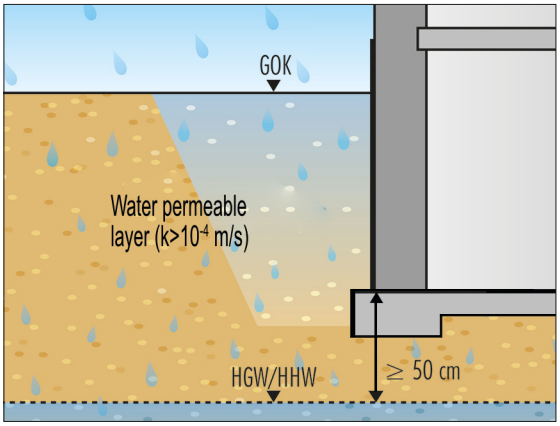
Situation 1:

Floor slabs (without basement) on very moist building site or with soil exchange (k>10-4m/s), of which the sealing surface is at least 50 cm over the design basis water level exhibit limited effect on soil moisture.



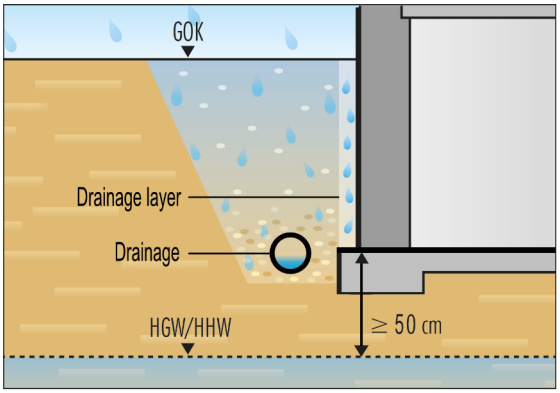
Situation 2:

Walls in contact with the ground and floor slabs in a very water permeable building site and with very water permeable construction pit fill (k>10-4m/s) and if the lowest sealing surface lies at least 50 cm over the design basis water level.



W1.2-E Ground moisture and non-pressing water on earth-contact walls and floor slabs with drainage:

Walls in contact with the ground and floor slabs in a less water permeable building site but when water build-up is avoided by permanently operating drainage compliant with DIN 4095 and when the lowest sealing level lies at least 50 cm above the measured water level.



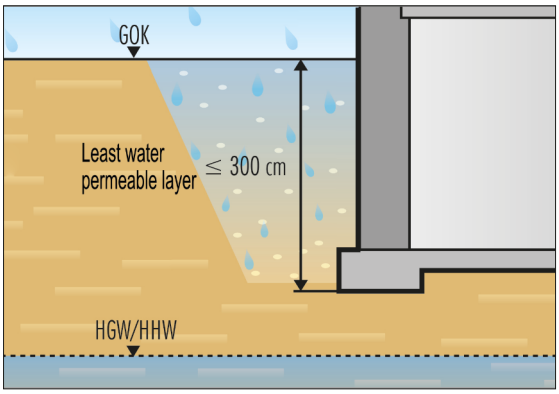
Water exposure classes according to DIN 18533

W2.1-E Moderate exposure of pressing water on floor slabs and walls in contact with the ground. The pressing water effect encompasses ≤ 3 m.

Situation 1:

Dammed water effect up to 3 m.

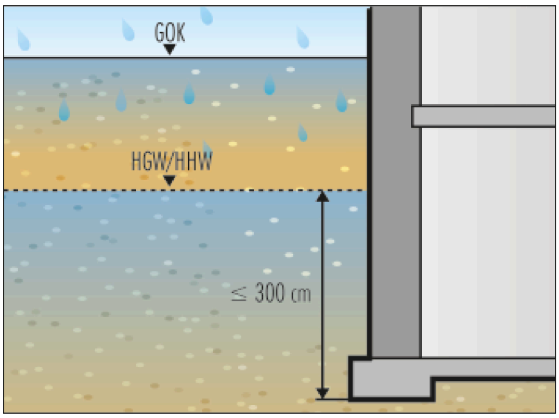
The sealing level lies/extends ≤ 3m beneath the upper edge of the grounds. Building structures in contact with the ground are situated without drainage in accordance with DIN 4095 in least water permeable ground, so that dam water is expected up to the upper edge of the grounds.



Situation 2:

Groundwater effect up to 3 m

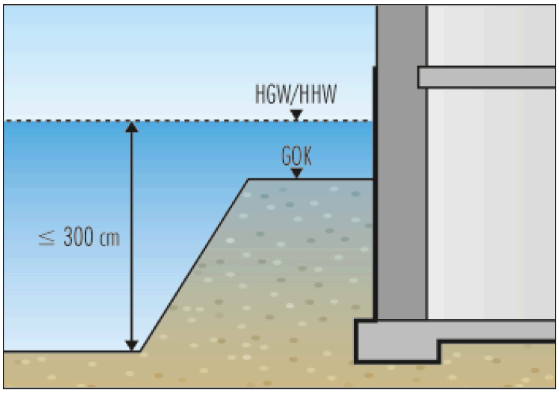
The sealing level lies in groundwater effect area from ≤ 3 m high.



Situation 3:

High-water effect up to 3 m

The sealing level lies in the area of high water above-ground waters. The pressurized water effect encompasses ≤ 3 m.



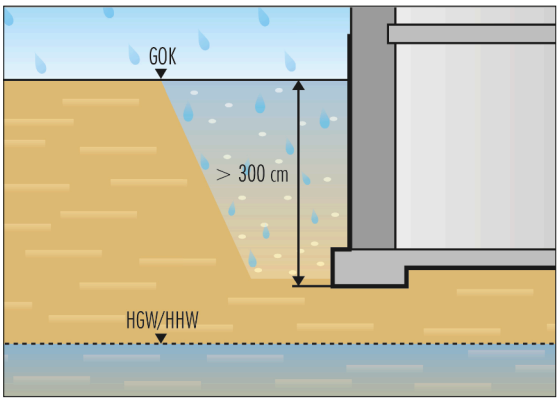
GOK = Upper edge of the grounds
HGW = Design basis ground water level
HHW = Design basis high water level

Water exposure classes according to DIN 18533

W2.2-E High effect of pressing water. The pressing water effect encompasses > 3 m.

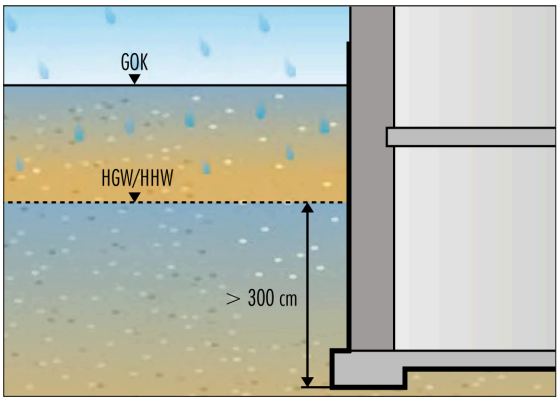
Situation 1: Dammed water effect > 3 m

Structures in contact with the ground are situated without drainage in accordance with DIN 4095 in least water permeable ground, so that in worst case, more than 3 m high dam water may impact.



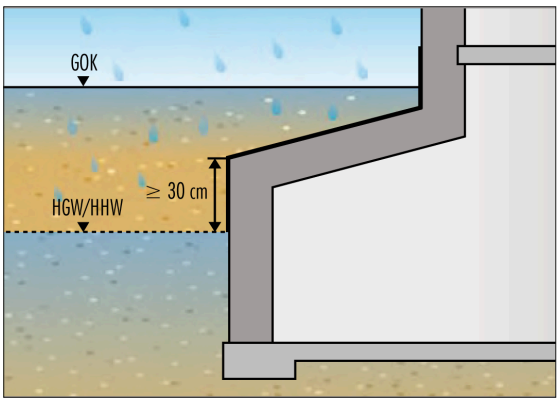
Situation 2: Groundwater or high water effect > 3 m

The sealing level lies in groundwater effect area from more than 3 m high.



W3-E Non-pressing water on soil-covered surfaces

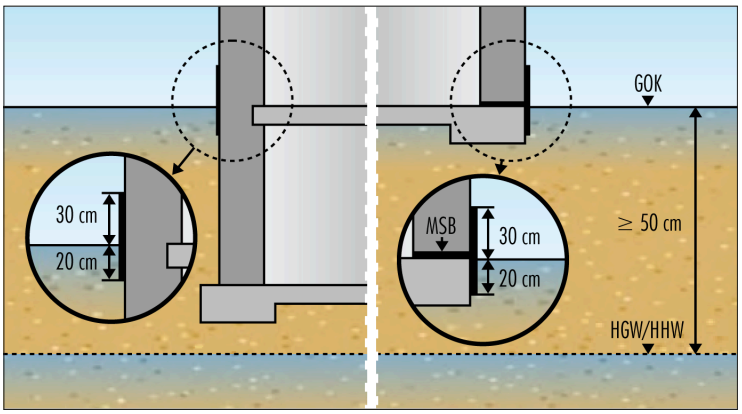
Rainwater that seeps through the earth covering up to the sealing level and is drained off there without dam water accumulation. In such a way, a dam effect level of 100 mm may not be exceeded.



Water exposure classes according to DIN 18533

W4-E Splash water on wall base including capillary water on and under walls in contact with the ground

Defined for an area of ca. 0.20 m under the upper edge of the grounds up to 0.30 m over the upper edge of the grounds and when it is not to be counted with an effect in accordance with W2.1-E.



GOK = Upper edge of the grounds
HGW = Design basis ground water level
HHW = Design basis high water level

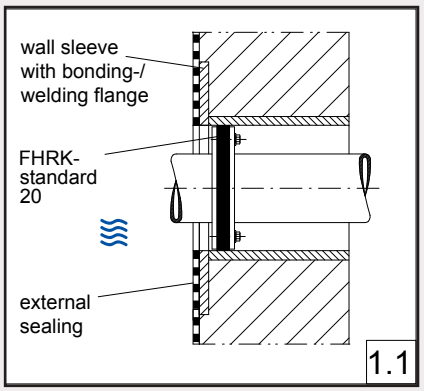
Overview of detailed solutions

Penetration position	Water exposure		
	Ground moisture and non-pressing water	Pressing water	
		≤ 3 m water column	> 3 m water column
Waterproof membranes in compliance with DIN 18533 for dry and wet installation			
Wall made of masonry or concrete - Dry installation -	Detail 1.1 – 1.3	Detail 2.1 – 2.3	Detail 3.1 – 3.3
Wall made of masonry or concrete - Wet installation -	Detail 1.4 – 1.6	Detail 2.4 – 2.6	
Floor slab made of concrete - Dry installation -		Detail 2.7	Detail 3.4
Floor slab made of concrete - Wet installation -		Detail 2.8	
Rigid sealant made of waterproof concrete for dry installation			
Wall made of waterproof concrete	Detail 4.1 – 4.6	Detail 5.1 – 5.6	
Floor slab made of waterproof concrete	Detail 4.7 – 4.8	Detail 5.7 – 5.8	
Rigid sealant made of waterproof concrete for wet installation			
Wall made of waterproof concrete	Detail 6.1 – 6.6		
Floor slab made of waterproof concrete	Detail 6.7 – 6.8		

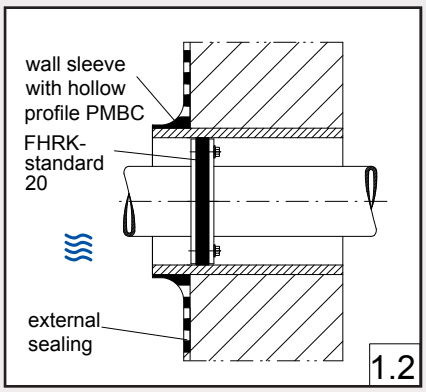
Solutions for wall/floor slab made of masonry or concrete

Water exposure class W1-E+W3-E: (ground moisture + non-pressing water)
Wall made of masonry or concrete with external sealing according to DIN 18533

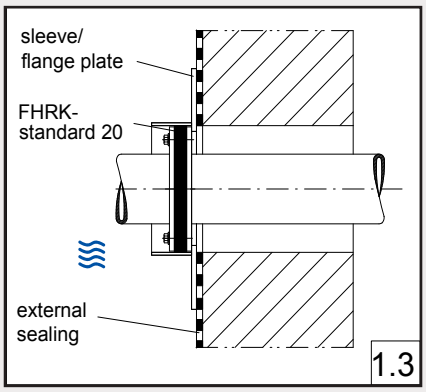
Dry installation with press seals



Wall entry masonry-/ concrete wall with bonding-/ welding flange, width ≥ 50 mm

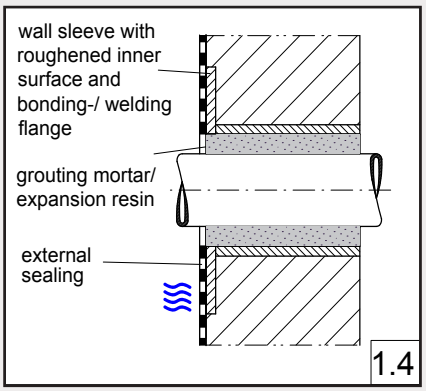


Wall entry masonry-/ concrete wall with wall sleeve

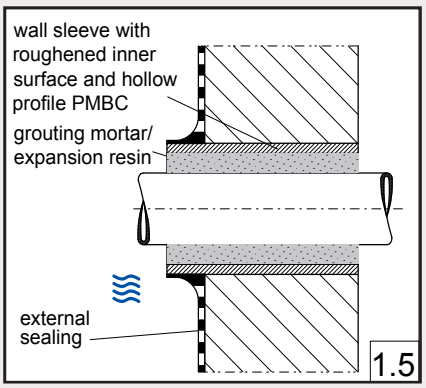


Wall entry masonry-/ concrete wall with flange plate

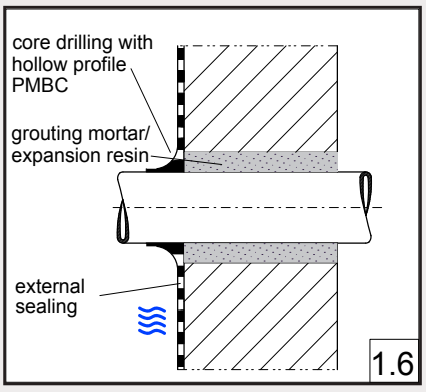
Wet installation



Wall entry masonry-/ concrete wall with bonding-/ welding flange, width ≥ 50 mm



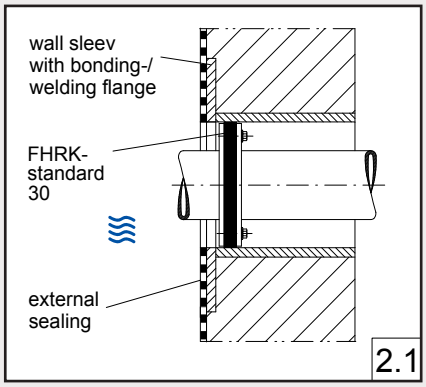
Wall entry masonry-/ concrete wall with wall sleeve



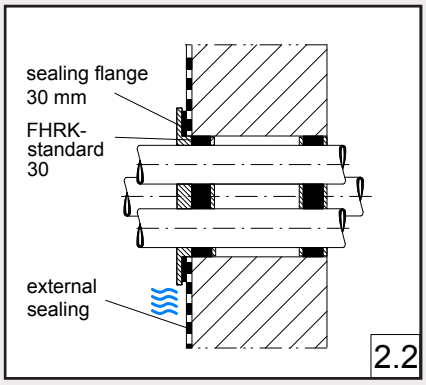
Wall entry masonry-/ concrete wall with connection to line (to be agreed in advance with the line operator)

Water exposure class W2.1-E (moderate exposure of pressing water)
Wall of concrete with external sealing according to DIN 18533

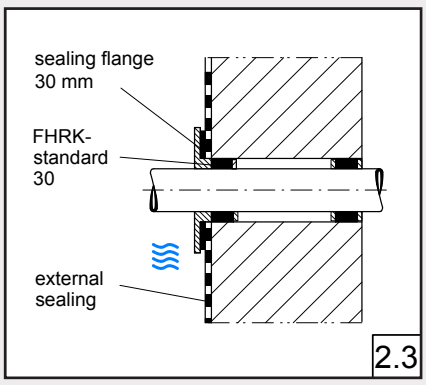
Dry installation with press seals



Wall entry, concrete wall with bonding-/ welding flange (width ≥ 120 mm or ≥ 50 mm tested)

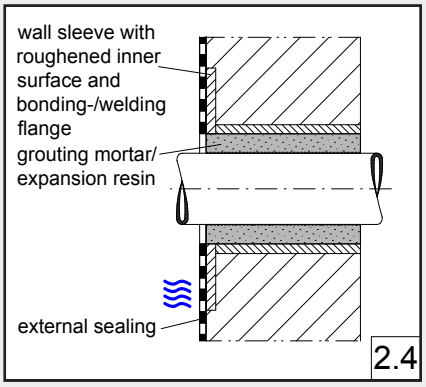


Multiple service with sealing flange according to DIN18533 (width ≥ 30 mm)

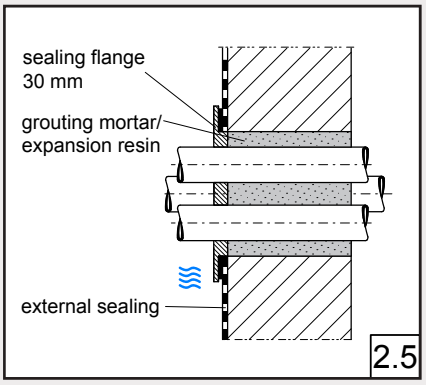


Wall entry, concrete wall with sealing flange according to DIN18533 (width ≥ 30 mm)

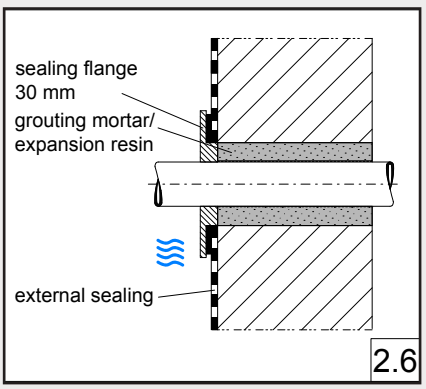
Wet installation



Wall entry, concrete wall with bonding-/ welding flange (width ≥ 120 mm or ≥ 50 mm tested)

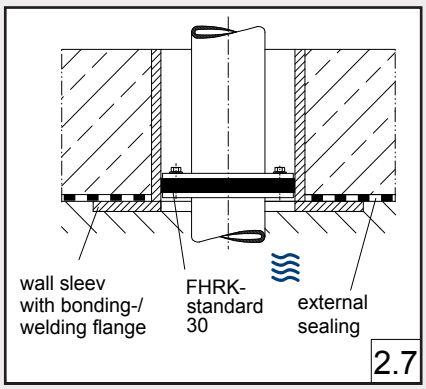


Multiple service with sealing flange according to DIN18533 (width ≥ 30 mm)

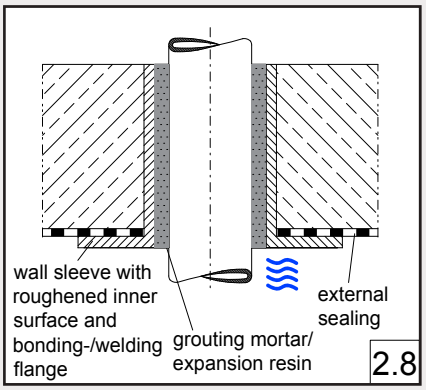


Wall entry, concrete wall with sealing flange according to DIN18533 (width ≥ 30 mm)

Floor slab made of concrete with external sealing according to DIN 18533



Floor entry, wall sleeve bonding-/ welding flange (width ≥ 120 mm or ≥ 50 mm tested)

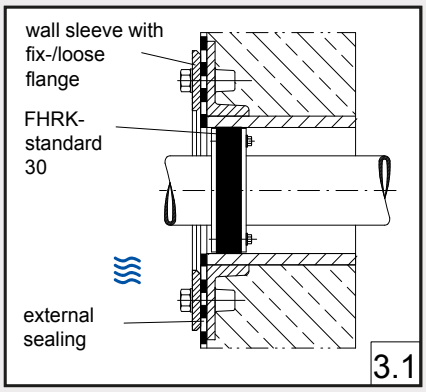


Floor entry, wall sleeve bonding-/ welding flange (width ≥ 120 mm or ≥ 50 mm tested)

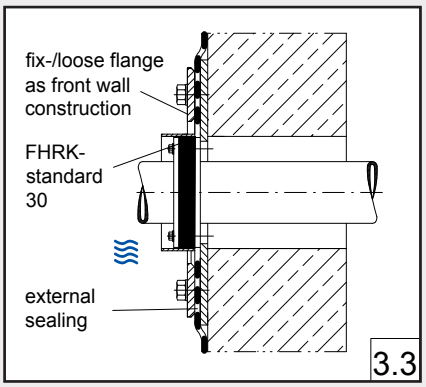
Solutions for wall/floor slab made concrete with external sealing

Water exposure class W2.2-E (high exposure of pressing water)
Wall made of concrete with external sealing according to DIN 18533

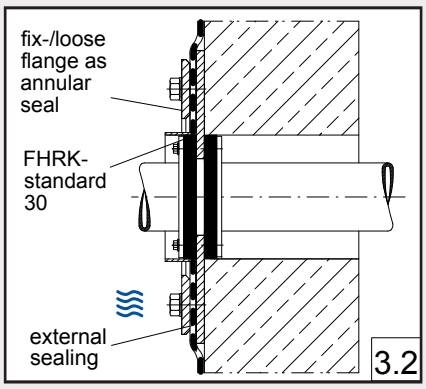
Dry installation with press seals



Wall entry concrete wall, wall sleeve with fix-/loose flange

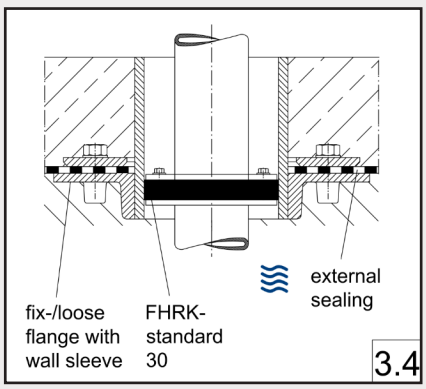


Wall entry concrete wall, core drilling with fix-/loose flange as front wall contruction



Wall entry in concrete wall with core drilling and fix-/loose flange with press seal

Floor slab made of concrete with external sealing according to DIN 18533 - W2.2-E

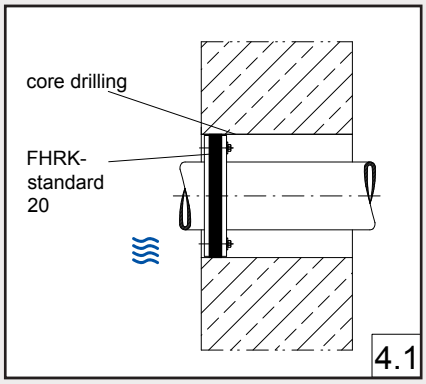


Floor entry, fix-/loose flange with wall sleeve

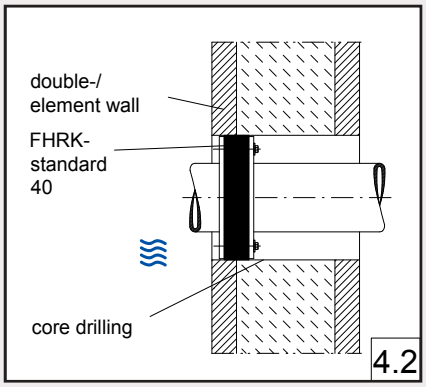
Solutions for waterproof concrete - load class 2

Water exposure class „ground moisture and non-pressing water“
Wall made of waterproof concrete - load class 2 (waterproof concrete)

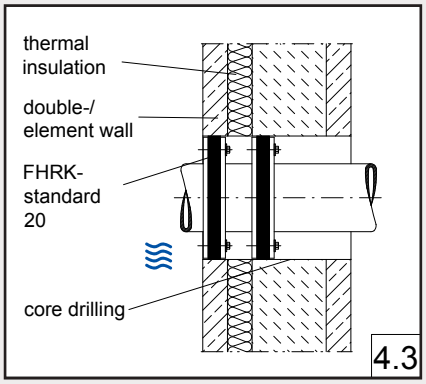
Dry installation with core drilling



Wall entry concrete wall with core drilling

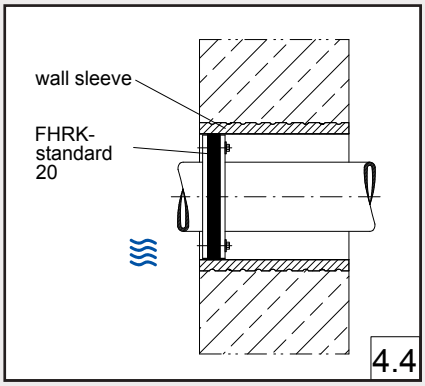


Wall entry double-/element wall with core drilling

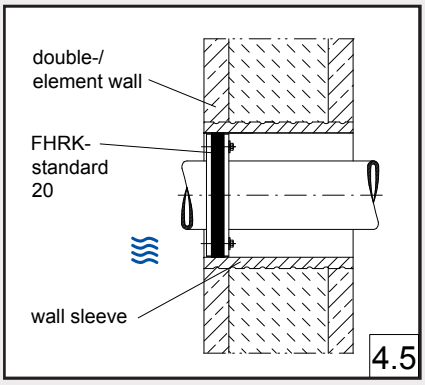


Wall entry double-/element wall with thermal insulation in core drilling

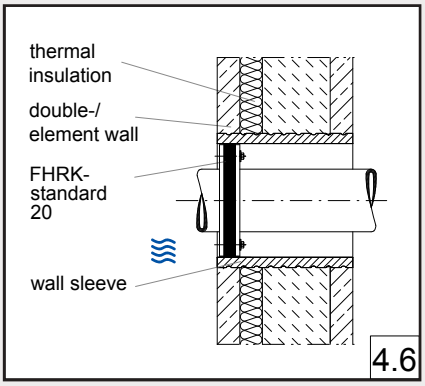
with wall sleeve



Wall entry concrete wall with wall sleeve

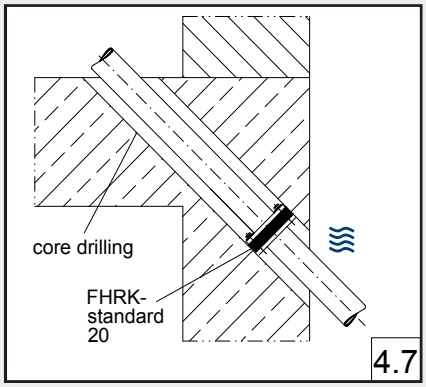


Wall entry double-/element wall with wall sleeve

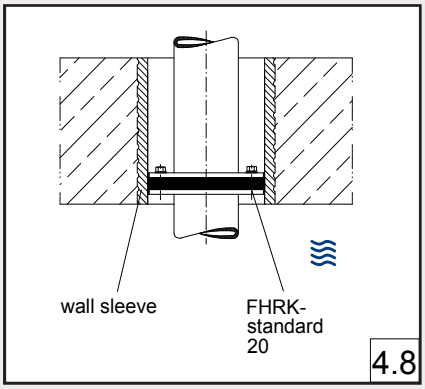


Wall entry double-/element wall with thermal insulation and wall sleeve

Floor slab made of waterproof concrete - load class 2



Floor entry with core drilling

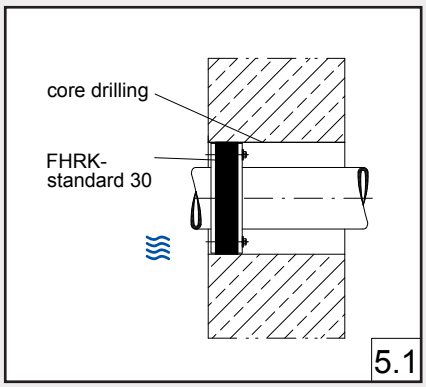


Floor entry with wall sleeve

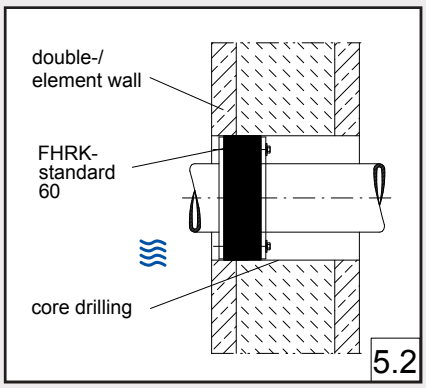
Solutions for wall/floor slab made of waterproof concrete load class 1

Water exposure class „pressing water“
Wall made of waterproof concrete – load class 1

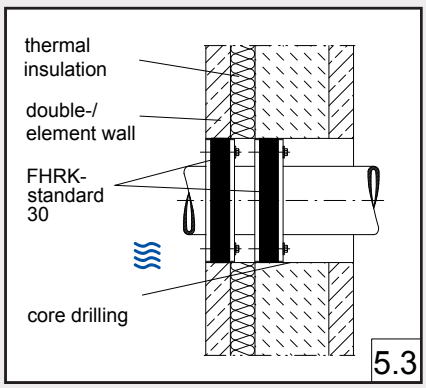
Dry installation with press seals



Wall entry, waterproof concrete wall with core drilling

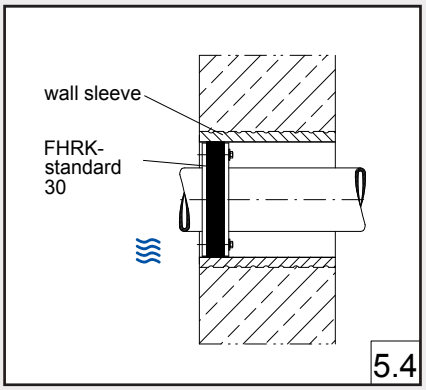


Wall entry, waterproof double-/element wall with core drilling

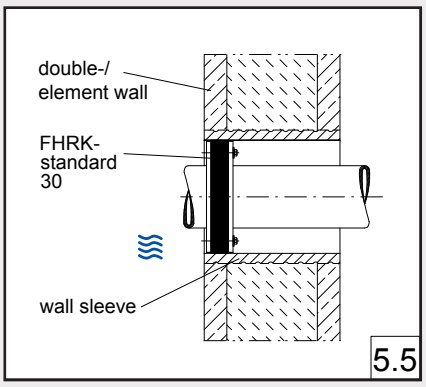


Wall entry, waterproof double-/element wall with thermal insulation and core drilling

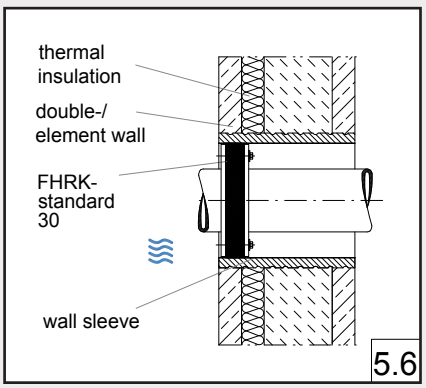
with wall sleeve



Wall entry, waterproof concrete wall with wall sleeve

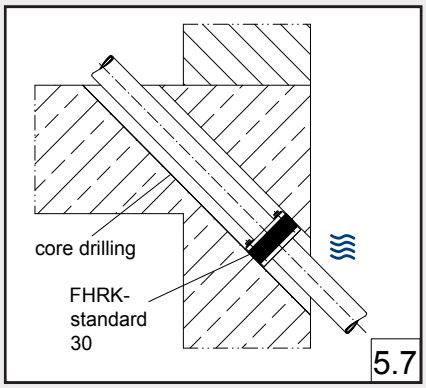


Wall entry, waterproof double-/element wall with wall sleeve

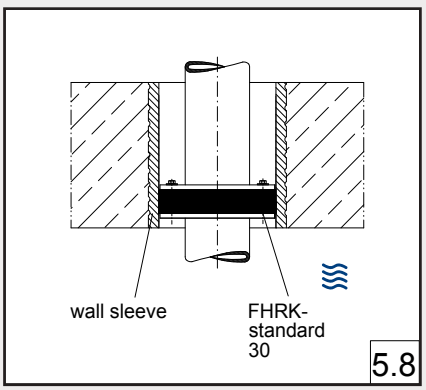


Wall entry, waterproof double-/element wall with thermal insulation and wall sleeve

Floor slab made of waterproof concrete - load class 1



Floor entry, waterproof concrete-floor slab with core drilling

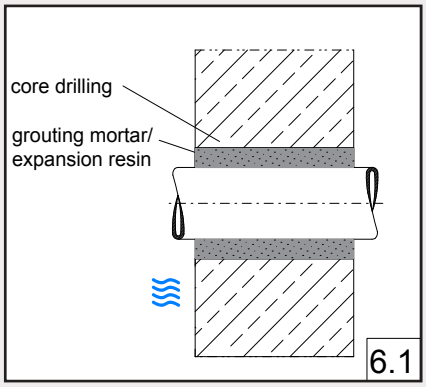


Floor entry, waterproof concrete-floor slab with wall sleeve

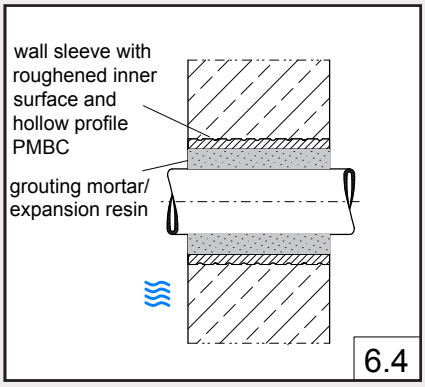
Solutions for waterproof concrete - load class 1 + 2

Water exposure class „ground moisture, non-pressing water, pressing water“
Wall made of waterproof concrete – load class 1 + 2 (waterproof concrete)

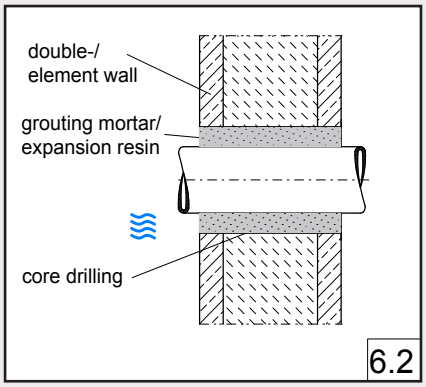
Wet installation



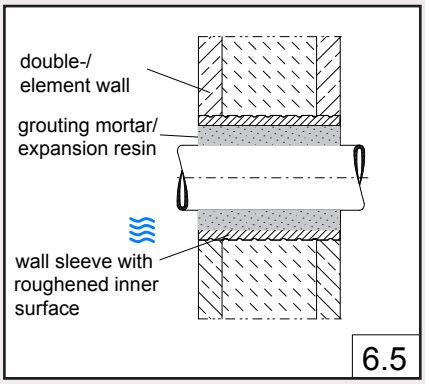
Wall entry concrete wall with core drilling



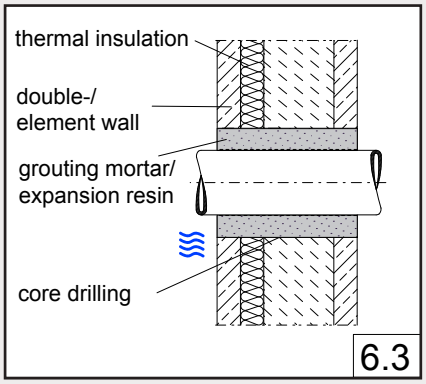
Wall entry concrete wall with wall sleeve



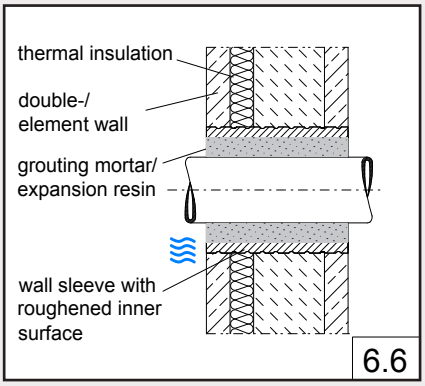
Wall entry double-/element wall with core drilling



Wall entry double-/element wall with wall sleeve

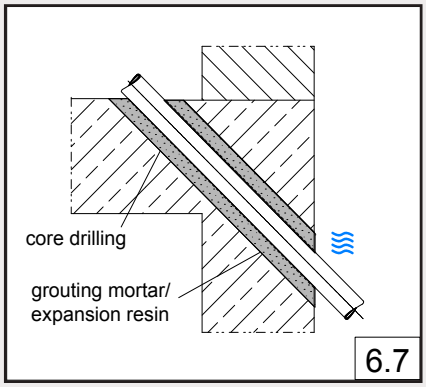


Wall entry double-/element wall with thermal insulation and core drilling

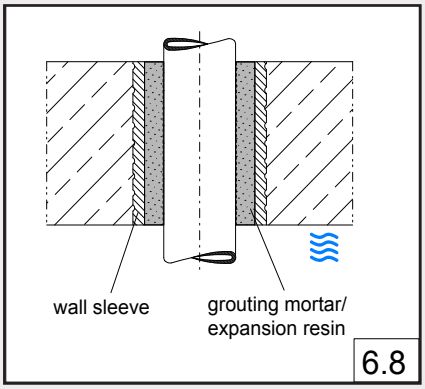


Wall entry double-/element wall with thermal insulation and wall sleeve

Floor slab made of waterproof concrete - load class 1 + 2



Floor entry with core drilling



Floor entry with wall sleeve

Solutions for buildings without sealing

Existing buildings, general

Building entries in buildings, that were constructed without sealant, can not be made to be gas- and waterproof in any reliable manner.

Before planning and carrying out a building entry in an existing building the current condition of the work area of the intended penetration site should above all be evaluated and documented. (For example, existing moisture sites).

Existing damp walls may indicate lacking or damaged sealing, that cannot be repaired through an expert building entry.

Buildings without sealing in water exposure class W1-E or load class 2

It is the case that the works being done in the context of a building inlet, do not lead to a change in the prior applying water exposure class or load class, allow the penetration without further measures to be made. The existing openings must be properly closed off.

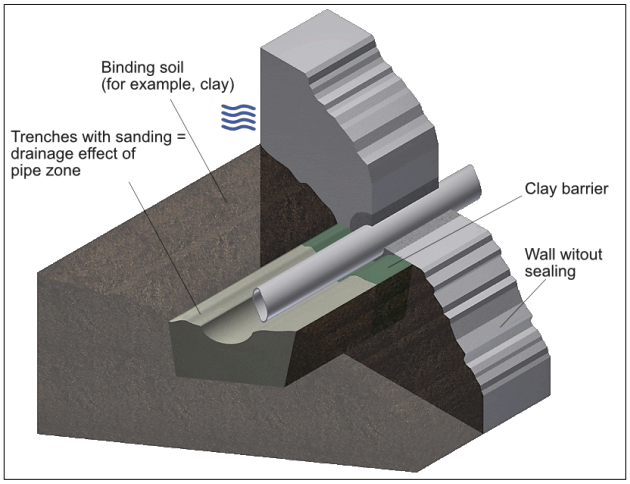
Buildings without sealing if there is any change in water exposure.

Should underground works in the course of media coverage lead to a change in the prior applying water exposure class or load class for the building wall (for example drainage effect of the drainage zone, change in the ground structure) additional measures are to be expected.

In principle, the penetration and its sealing must be gas- and water-tight. In this is for example the annular space or the opening between wall and medium pipe or between wall and wall sleeve must be closed off with grouting mortar or corresponding expansion resin.

Still other additional measures are to be recommended, as for example:

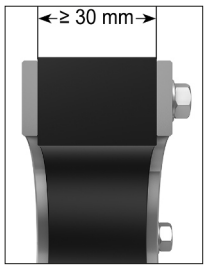
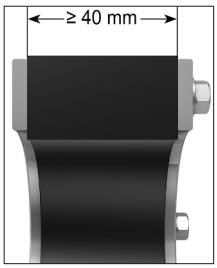
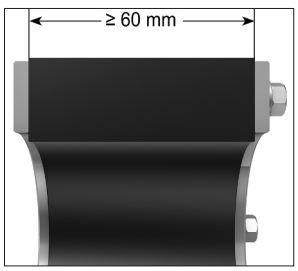
- Use of trenchless methods of installation
- Installation of floors with low water permeability (for example clay barriers)
- Reinstallation of excavation materials (in this the pipe materials should be proofed)
- Sealing of exposed floors directly contacting walls binding soils (for example, clay)



Minimum thickness of the seal

Minimum sealing width for dry installation

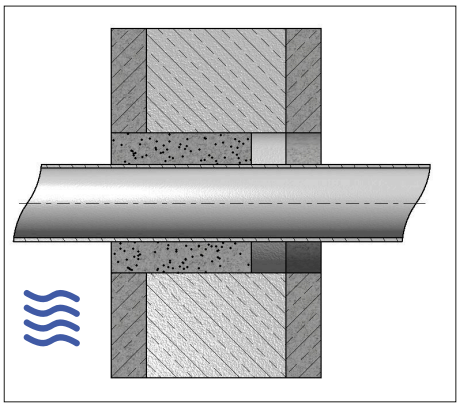
In accordance to the load case (stress of humidity) it requires a sufficient thickness of the seal. In the following table you can find the minimum thickness of annular seals according to the FHRK-standard.

Press Seal				
Minimum thickness*	≥ 20 mm	≥ 30 mm	≥ 40 mm	≥ 60 mm
FHRK-standard	**20**	**30**	**40**	**60**

* For special sorts of wires/lines or special situations on site larger thicknesses of the seal could be necessary.

Minimum grouting length for wet installation

In general by wet installation the annular space will be filled in over the whole wall thickness. Should this not be possible, the minimum casting lengths on the side turned toward the water are available from the manufacturer of the system and should be followed. The minimum casting length also assures the uptake of static forces.

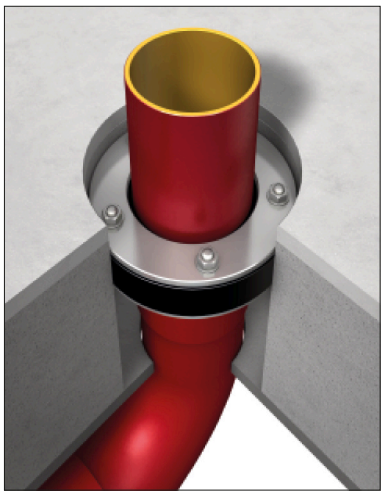


For the insertion of a flowable sealing system a minimum annular gap is required, in this the manufacturer's specifications for the breakthrough diameters corresponding to the pipe dimensions should be followed.

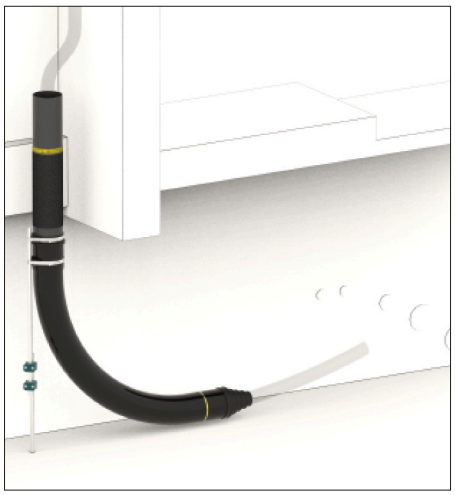
Construction types

Floor slab

For entering through floor slabs lines or conduits for lines have to be laid in the ground before the floor slab is established. In dry installation systems, appropriate wall sleeves in each case should be used; in the opposite case empty pipes are needed, which have a water and gas-proof connection to the wall sleeve. Alternatively the pipe can be outfitted with corresponding water barriers (for example, wall collars) and then poured directly into the floor slabs.



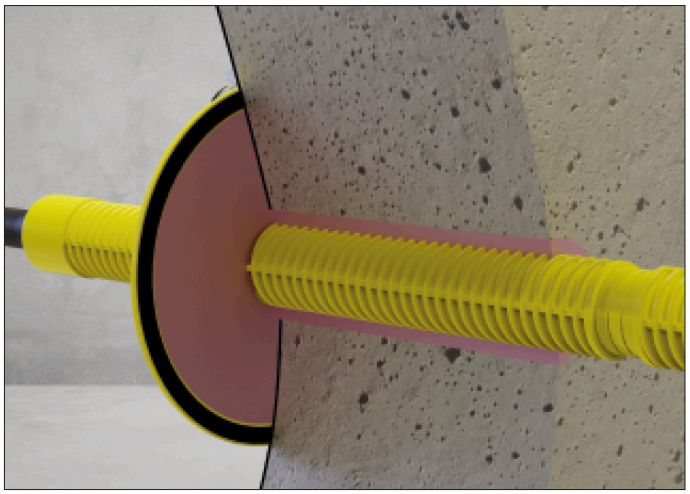
Floor entry with press seal



Floor entry with grouting mortar/ expansion resin

Floor entry with sealing rings

Basement wall



Wall entry with grouting mortar/expansion resin and sealing flange

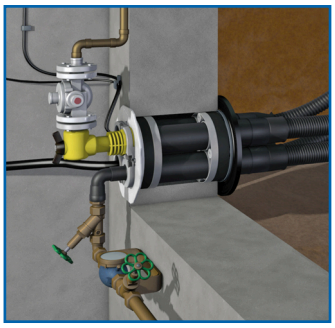
Wall entry with sealing rings

Construction types

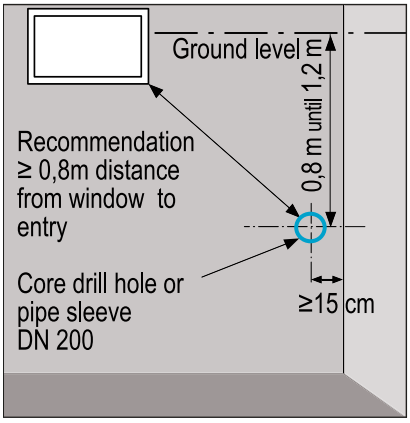
Building entry through the basement wall for dry installation

The following dimensions represent standard sizes. Other dimensions may also be possible depending on the system and manufacturer.

Multiple service building entry for
Gas
Water
Power supply
Telecommunication

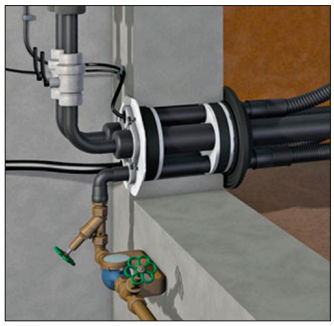


Recommended – minimum-distances* of wall entry to bordering components.

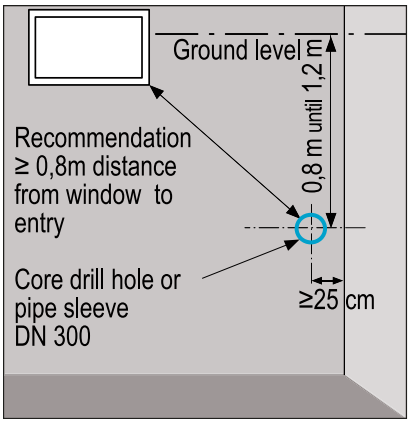


Dimension of core drill hole or pipe sleeve: **DN 200**

Multiple service building entry for
district heating or
thermal heating
pump for
Water
Power supply
Telecommunication

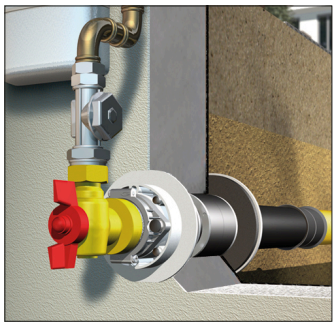


Recommended – minimum-distances* of wall entry to bordering components.

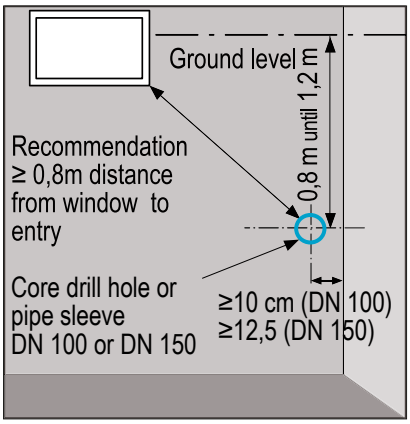


Dimension of core drill hole or pipe sleeve: **DN 300**

Single building entry for
Gas or
Water or
Power supply or
Telecommunication



Recommended – minimum-distances* of wall entry to bordering components.



Dimension of core drill hole or pipe sleeve: **DN 100** or **DN 150**

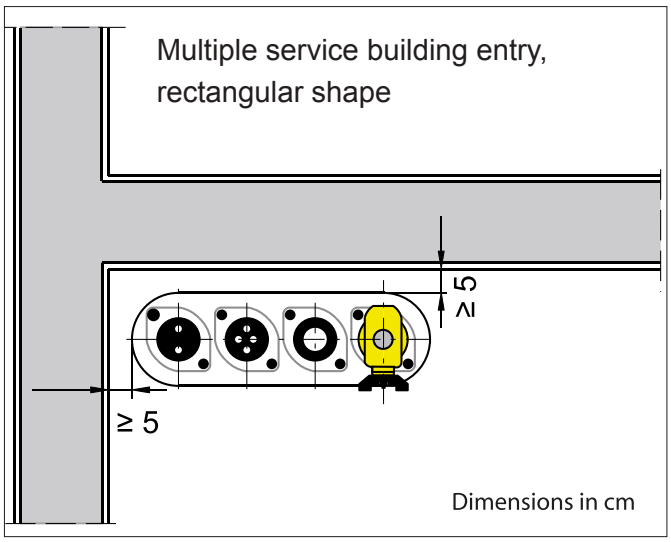
*** To avoid problems:**

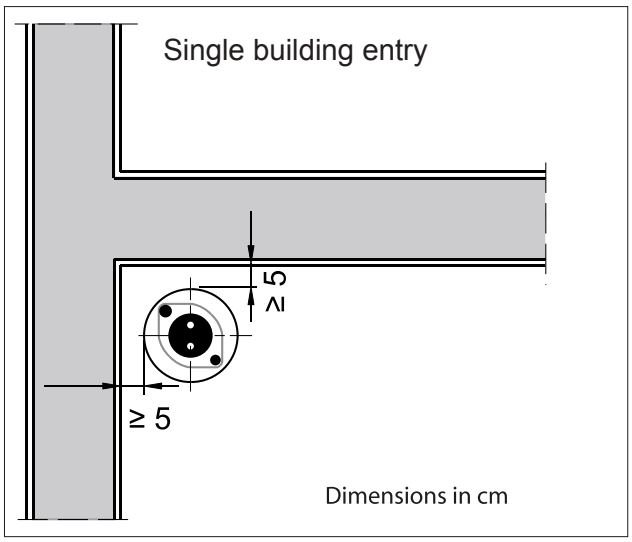
- Please coordinate the dimensions (position, adjustment, wall distance, etc.) with your local utility company and the information of the manufacturer (please pay attention to the size of the armatures).
- Inspection shafts, drainage systems or other lines may not be placed in the range of the house connection route.
- The connection of service lines is in the responsibility of the network operators.
- During installation pay attention to the assembly instructions of the manufacturer.

Distances of building entry through floor slab for dry installation

The following dimensions represent standard sizes. Other dimensions may also be possible depending on the system and manufacturer.

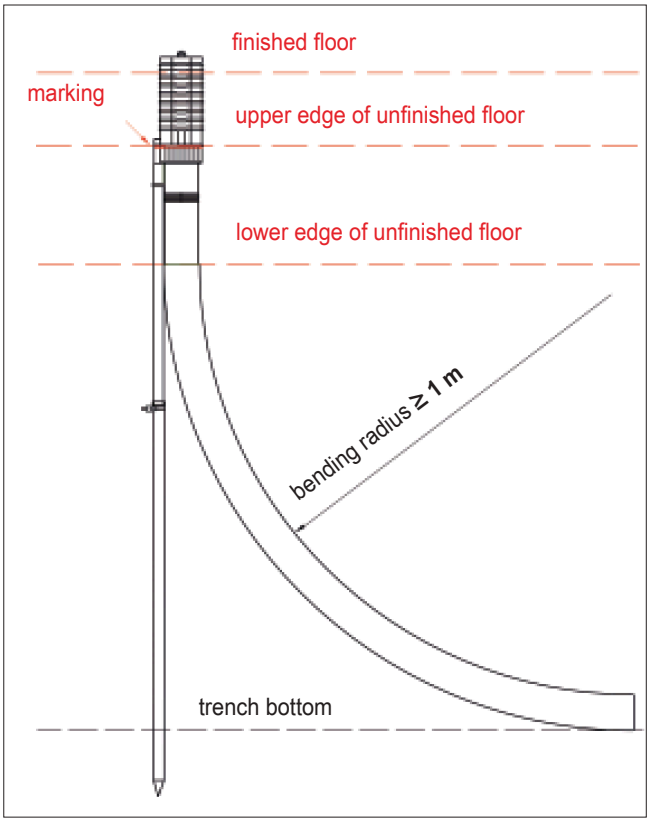
Recommended minimum distance* to adjoining walls including wall surface (plaster).



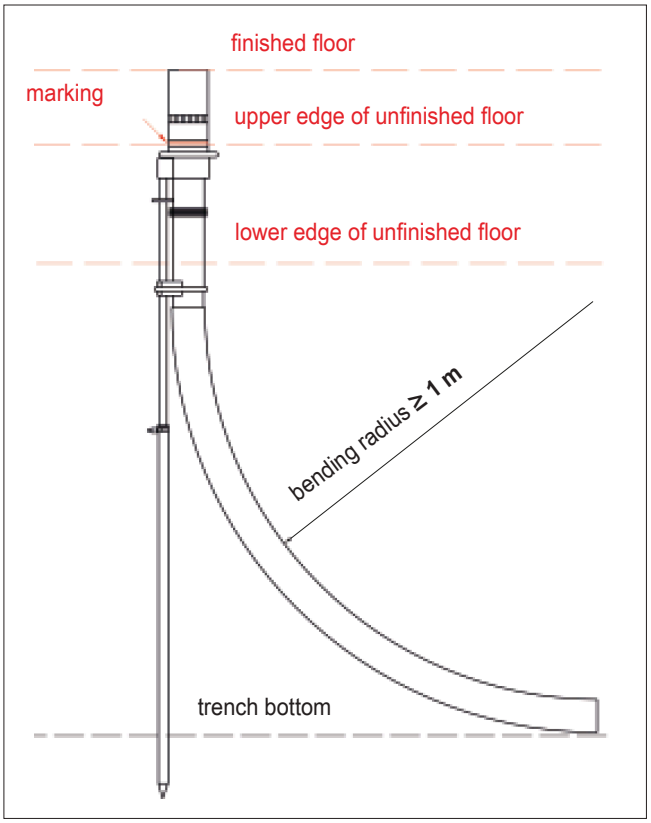


Installation in the floor slab

Reference point for the installation of the service building entries in the floor slab is the upper edge of the unfinished floor.



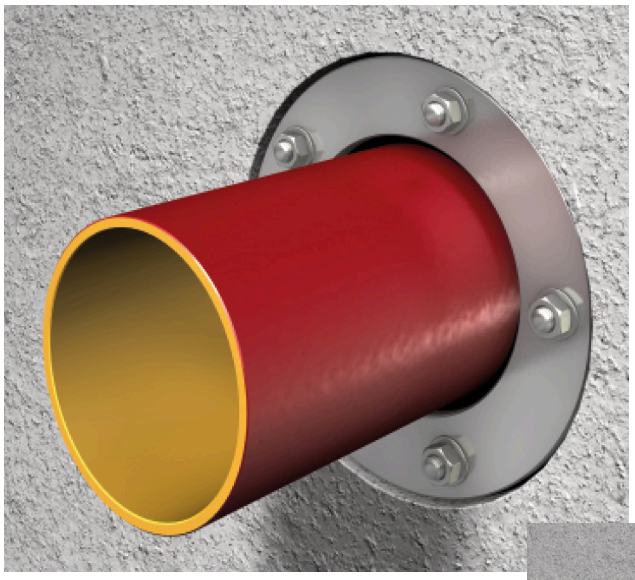
Multiple service building entry



Single building entry

Important note: No connecting sleeves are permitted in built-up areas. The length of the empty conduit must therefore be selected accordingly.

Tested sealing systems...



… to keep the house dry

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get your tender text easily

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www.fhrk.de

FHRK
Fachverband Hauseinführungen
Rohre und Kabel

FHRK e.V.
Ravensburger Straße 29
D-89522 Heidenheim
Tel. +49 7321 5306810
E-Mail: info@fhrk.de | www.fhrk.de

Every house needs supply - and disposal lines which are entering buildings from the outside through basement wall or floor slab. Industrial produced and tested sealing systems guarantee a permanent gas- and water-tight sealing of all cables and pipes (waste water, water, power, gas, telecommunication, rainwater, ventilation lines, etc.).

CHECK LIST

That your house building runs smoothly:

Planning and register	Date	done
Registration of power consumed on site		☐
Registration of water for site		☐
Determine entry points of sealing systems in coordination with the utility company		☐
Registration for connection:		
Gas network		☐
Power grid		☐
Water network		☐
District heating network		☐
Submit applications for:		
Phone		☐
Cable television		☐
Connection to canalization		☐
Determine entry points and include them in the architectural plan:		
Waste water		☐
Rainwater harvesting		☐
Heat pump		☐
Controlled ventilation (inlet and exhaust)		☐
Power supply property		☐
Exteriour lighting/garden area		☐
Charging infrastructure		☐
External parts of buildings (e.g. garage)		☐
Determine selection criteria for press seal:		
Design groundwater level		☐
Sort of wall		☐
Sealing system for the building		☐
Version of sealing system		☐

For technical support and planning advisory the FHRK member companies are at your service.