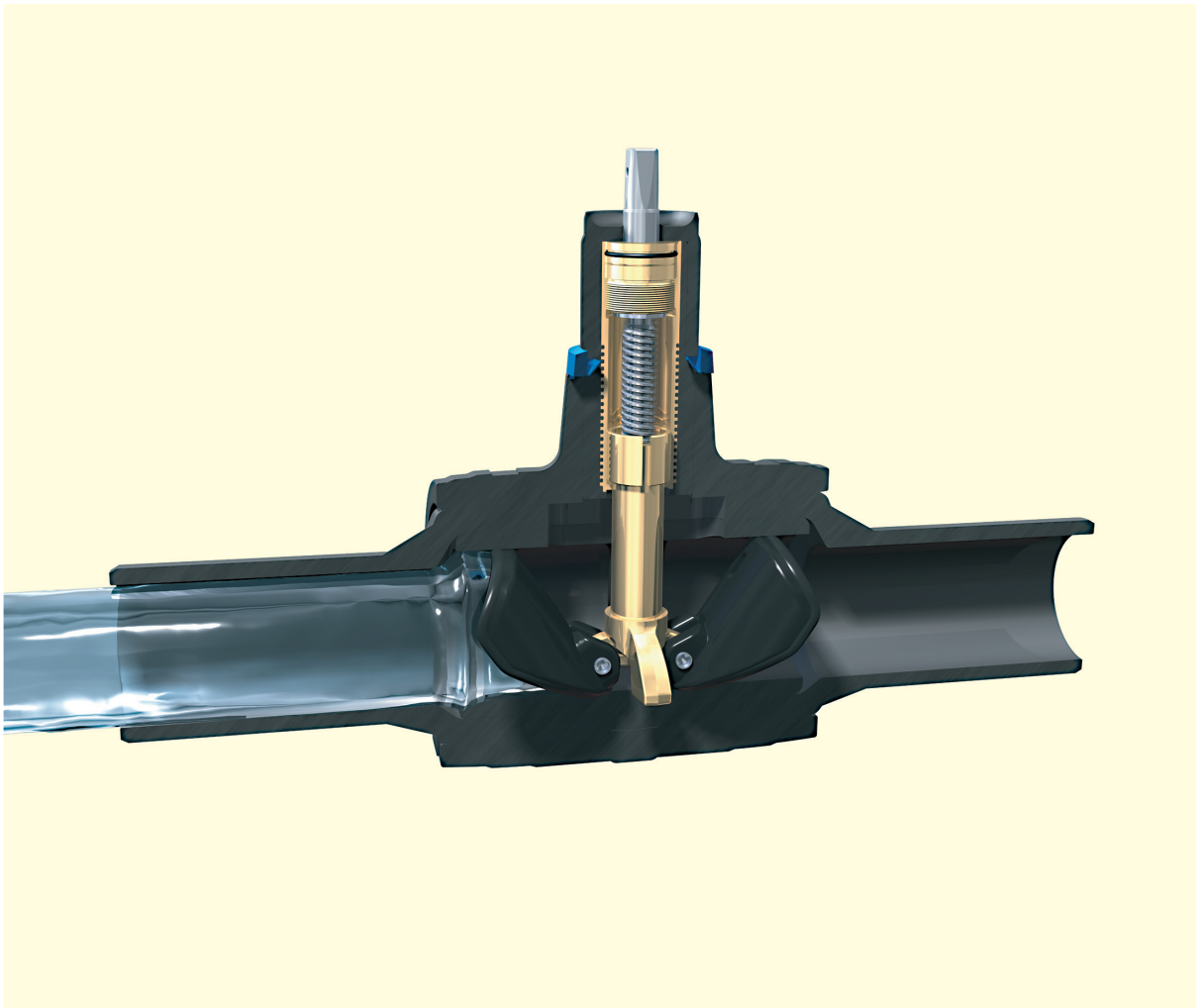
FRIALEN®

PE Shut-Off Valve **FRIALOC**

PE 100 / SDR 11
PFA/PN 16 bar
d 90, d 110, d 125, d 160, d 180

FAQ: Answers to frequently asked questions



FRIATEC

FAQ: Answers to frequently asked questions

Question 1: ***What are the advantages of a PE piping system compared to the use of traditional materials?***

An important advantage of PE piping systems is: no corrosion. Incrustations, deposits, which in the course of time can completely block pipings, are also not observed in PE piping systems thanks to the smooth interior pipe surfaces. Its high elasticity makes the material unsusceptible to subsidence formations of the piping zone. PE piping networks are even deemed earthquake-resistant. Of importance is the fusibility: Thanks to the simple and millionfold proven joining method, the electrofusion, the components used transform into a material-homogeneous piping network: non-detachably connected, resistant to being pulled out, permanently safe.

Further advantages with regard to

Transport, handling, installation…

- low weight (HDPE/metal approx. 1/3)
- high flexibility
- good fusibility
- safe and proven joining method
- excellent notch impact strength
- simple handling

In use…

- low side friction losses
- no deposits and incrustations
- insensitive to electrochemical reactions
- simple later fitting mounting
- repair-friendly

In the long run…

- high resistance to chemicals
- corrosion-resistant in all kinds of soil
- good abrasion resistance
- life expectancy: 100 years

Question 2: ***What are the advantages of a PE plastics valve?***

(see also Question 1):

- no corrosion
- no incrustation
- No mechanical connections in the housing as compared to metal shut-off valves with PE fusion ends.
- Material-homogeneous integration into the PE piping network by fusion: no mechanical connections, no flange, no gasket
- low weight

Question 3: ***Which advantages does the new shut-off mechanism of the PE shut-off valve FRIALOC offer as compared to traditional gate valve shut-off?***

- Low actuation forces, smooth-running even given full differential pressure
- Low number of turns for actuation
- Excellent long-term operating characteristics thanks to low-wear drive, proven in dynamic fatigue test
- Fixed metal stops clearly indicate the reached end position in open/closed position
- High rigidity of the stops: > 5 x maximum actuation torque (breakaway torque, 80 Nm)
- Double shut-off valve with dynamic sealing behaviour, flexible valve fits perfectly into the existing internal contour
- Dead water-free design, no stagnation, no risk of microbial/bacterial contamination
- Minimised sealing surface reduces microbiological growth with regard to W 270, the valves are not fully rubberised but only equipped with the elastomer in the actual functional area

Question 4: ***How is the reliable function of the shutting-off of the PE shut-off valve FRIALOC taken into consideration with regard to a possible deformation of a PE component part given a technical service life of 50 years?***

This is achieved by the flexible design of the shut-off valve. In the position "closed", the sealing element across the full length and non-detachably connected to the valve is engaged at the internal contour of the housing. The valve has a concave shape. Because of the internal pressure, the flexible valve fits perfectly into the existing internal contour, as required. The function is progressive, i.e. the deformation of the valve and the pressing of the sealing element increase with the shut-off pressure.

Question 5: ***The shut-off valves of the PE shut-off valve FRIALOC are made of the material polyamide. Which experience exists for this material?***

Polyamide (PA) is also known as nylon and has proven itself – not only at ladies' legs – in numerous technical applications for decades. It is above all pressure vessels, gear wheels but also brake and fuel lines in the automobile industry which are made of polyamide. In the drinking water applications, PA is used as housing material for pressure vessels, e.g. for fittings or water meters.

Question 6: ***How do the sealing and shut-off valve interact during permanent operation of the PE shut-off valve FRIALOC?***

With regard to microbiological growth (W 270), the use of elastomer sealing materials is minimised. Thus, compared to traditional gate valves, the PA shut-off valves are not completely surrounded by the sealing material but they are only equipped with the elastomer in the actual functional area of the sealing. The connection between the materials is made undetachably by a specifically developed technique. This connection is made in the inter-molecular field. In all hitherto performed tests, this technique has proven to be extremely resistant, both with regard to the wear-resistance in dynamic tests and with regard to extreme slow-down and feeding of abrasive media in water.

Question 7: ***How does the PE shut-off valve FRIALOC behave, above all with regard to the shut-off behaviour under the influence of traffic loads and land subsidence?***

The valve was subjected to an extreme bending test which, going beyond the conditions in practice, simulated subsidence formation in the installation zone. In this respect, the valve was pressurised and actuated. No leaks – neither to the exterior nor with regard to the shutting-off – occurred. (for further information: see Question 1)

Question 8: ***The PE shut-off valve FRIALOC can be deformed because of the operating pressure. How does the shut-off mechanism behave with regard to the represented leak-tightness of the shutting-off during elongation of the material?***

This is achieved by the flexible design of the shut-off valve. In the position "closed", the sealing element across the full length and non-detachably connected to the valve is engaged at the internal contour of the housing. The valve has a concave shape. Because of the internal pressure, the flexible valve in addition fits perfectly into the existing internal contour, as required. The function is progressive, i.e. the deformation of the valve and the pressing of the sealing element increase with the shut-off pressure.

Question 9: ***When opening and closing the PE shut-off valve FRIALOC, considerable torques may be required – above all given high operating pressures. How are these absorbed by the shut-off valve?***

Due to the design of the FRIALOC, the shear forces occurring in traditional gate valves, which as a consequence of the operating pressure act on the spindle drive, are reduced. This is, on the one hand, a result of the valve shape:
The design of the valve reduces the force application surface available. On the other hand, the reaction forces are absorbed by the guide of the transverse yoke in the housing. This, in turn, results in lower actuation forces when opening and closing the valve.

The actuation forces are also reduced by a further design particularity: The double design of the shut-off valve results in a dampening of the pressure difference in the clearance. The dynamic flow pressure of the medium when closing the valve and the back pressure when opening, resp., are buffered by the clearance of the double valve. The required peak torques in the area of the end position of the shut-off body are significantly lower.
As shown in permanent dynamic tests, the lower force action at the same time also reduces mechanical wear. This results in a higher service life of the drive mechanism.
Thanks to the low number of turns (d90-d125: 9 turns) and the design of the shut-off mechanism, the valve can be comfortably operated even under maximum operating pressure.

Question 10: ***How does the PE shut-off valve FRIALOC behave during operation? Which stop torques may occur in the open or closed position?***

The design of the valve reduces the force application surface available, reaction forces caused by the operating pressure are absorbed by the guide of the transverse yoke in the housing. The actuation forces during opening and closing of the valves are thus reduced.
In addition, the flexible valve fits perfectly into the sealing seat. The function is progressive, i.e. the deformation of the valve and the pressing of the sealing element increase with the shut-off pressure.
When operating the valve, the spindle drive runs against a fixed metal stop, both in the position “open” and “closed”. By the sudden blocking of the drive, the operator is clearly informed about the relevant end position. The strength of the stop exceeds the maximum occurring actuation torque (breakaway torque 80 Nm) by approx. the factor 5.

Question 11: ***After longer periods of operation, often enormous efforts are required to operate metal valves. Are there any experiences with regard to the actuation behaviour of the PE shut-off valve FRIALOC?***

In order to examine the influence of sediments with regard to incrustation and deposits, a shut-off valve was installed in the company’s pump room. The raw water pumped there has an extremely high percentage of solid matter. The function and operability have been regularly checked since the installation in mid-2006. Because the material polyethylene in general does not favour any incrustation and deposits and thanks to the contamination-resistant design of the drive, no effects on the shut-off valve were observed.

The shut-off valve has been reliably functioning until today and the actuation torques remained at the original level of the new shut-off valve. At the beginning, it was expected that the FRIALOC prototype would have to be removed in the short term for control purposes. Thus, metal valves were installed simultaneously upstream and downstream of the plastics valve. Contrary to the initial expectations, these could, however, no longer be operated after a very short period of time.

Question 12: ***Shut-off valves only know the operating modes open or closed. But an intermediate position cannot be ruled out in practice. What is the expected behaviour of the PE shut-off valve FRIALOC?***

The double design of the shut-off valve results in a dampening of the pressure difference in the clearance. The dynamic flow pressure of the medium when closing the valve and the back pressure when opening, resp., are buffered by the clearance of the double valve, the occurring flow rate is reduced. Thus, there only exists a minimal risk of damages caused by flow rate control.
Practical experience was gained within the scope of field tests at the company of Gelsenwasser AG: The shut-off valve was intentionally loaded with an operating pressure of approx. 8 bar for more than three weeks in partially opened position with an opening gap of 1cm. The medium was discharged to the free atmosphere into a seepage reservoir. After stopping the water flow, no irregularities could be observed under visual inspection. Neither the valves nor the sealing, housing nor the drive had been damaged. The subsequently performed tightness and function tests showed positive results. The actuation torque for opening and closing was unchanged with only 19Nm as compared to the original value, measured at the new valve.

Question 13: ***How does the PE shut-off valve FRIALOC behave during long-term permanent shutting-off with regard to loads exerted by the existing operating pressure?***

The flexible valve fits perfectly into the provided sealing seat. The function is progressive, i.e. the deformation of the valve and the pressing of the sealing element increase with the shut-off pressure.

Question 14: ***Compared to metal materials, plastics possess a significantly lower strength. How are the forces acting during installation and operation absorbed by the PE shut-off valve FRIALOC?***

The force transmission into the shut-off mechanism is limited by a fixed metal stop in both end positions open/closed. The strength of the stop exceeds the maximum occurring actuation torque (breakaway torque 80 Nm) by approx. the factor 5. The maximum acting torques are safely absorbed by the sleeve integrated in the PE dome.

Question 15: ***Can the PE shut-off valve FRIALOC be repaired?***

The valve is designed for a long service life and a maintenance-free operation. A repair is not planned, also with regard to the low extra costs in case of any possibly required replacement.

Question 16: ***When installing the valve into an existing piping network, often residual water occurs. Which processes are employed with regard to the electrofusion to homogeneously integrate the PE shut-off valve FRIALOC?***

With regard to the problem of subsequently flowing residual water and the simultaneous need for a dry and clean fusion area, we intensively looked for a manageable and practicable solution. We will soon present a new procedure which facilitates a safe use of the electrofusion even under these adverse conditions.

Question 17: Can the PE shut-off valve FRIALOC also be installed in piping networks made of other materials?

Yes! First experiences have already been gained based on field installations accompanying the development. 2 FRIALOC shut-off valves were installed in a cast iron piping network with heavy incrustations using EFL flange joints. PE – as pipe-, or as housing material of FRIALOC – is a corrosion-resistant material which shows no tendencies to form incrustations thanks to its smooth surface. The function with regard to actuation and shutting-off shows no deviations from the installation condition.

Question 18: The length of the pipe spigots at the PE shut-off valve FRIALOC facilitates a twofold fusion. Is a shortening for compact installation possible?

Yes, shortening is possible without any problems. The pipe spigots have a constant dimension of SDR11.

Question 19: Which dimensions of the PE shut-off valve FRIALOC are available? For which operating pressure is the valve designed?

FRIALOC will be available in the dimensions d90, d110, and d125 from January 2008. The dimensions d160 and d180 will be available mid-2008. The free passage in the valve is a full-port passage corresponding to the relevant pipe dimension SDR11. The maximum operating pressure is PFA 16 bar.

Question 20: Which operational experience exists for the PE shut-off valve FRIALOC up to date?

Internal field tests on the company's premises

- Pump room
  In order to examine the influence of sediments with regard to incrustation and deposits, a shut-off valve was installed in the company's pump room. The raw water pumped there has an extremely high percentage of solid matter. The function and operability have been regularly checked since the installation in mid-2006. Because the material polyethylene in general does not favour any incrustation and deposits and thanks to the contamination-resistant design of the drive, no effects on the shut-off valve were observed. The shut-off valve has been reliably functioning until today and the actuation torques remained at the original level of the new shut-off valve. At the beginning, it was expected that the FRIALOC prototype would have to be removed in the short term for control purposes. Thus, metal valves were installed simultaneously upstream and downstream of the plastics valve. Contrary to the initial expectations, these could, however, no longer be operated after a very short period of time.

- In-house water supply
  Additional shut-off valves were installed in the in-house drinking water supply, a mixed network of cast iron and PE pipes. Up to now, no irregularities were observed. There have been no complaints about operation and function.

External field tests

With field tests at major water supply providers, first proofs of the fitness for purpose of the PE shut-off valve FRIALOC under realistic network conditions were obtained.

- At the Hanover municipal utilities – Enercity -, the PE shut-off valve FRIALOC was integrated into an existing old cast-iron piping network using FRIALEN fusion flanges EFL. It was specifically for this installation situation into existing cast-iron piping networks that the suitability of the plastics valve with regard to effects of incrustation and other solid matters was to be proven across a longer period of operation. The actuation forces were determined after four months of operation.

The actuation was performed manually. The torque measurement showed no result: The torque wrench only shows torques from 30Nm. At an exposed position, the valve can be operated in regular intervals and thus conclusions can be drawn with regard to the long-term behaviour.

- At HSE in Darmstadt, two FRIALOC shut-off valves were installed in PE pipings. The installation locations were documented such that the valves can be specifically tested for their function and leak-tightness.

- Particularly harsh operating conditions were simulated at the company of Gelsenwasser AG in the Haltern waterworks. Before the testing, the FRIALOC shut-off valves were subjected in the laboratory to various strength and tightness tests.
  After the positive evaluation, an operating test of a special kind was performed: Shut-off valves are designed for the operating modes “open” or “closed”. The shut-off valves are by definition not designed for intermediate positions. In practice it can, however, not be excluded that the valve is “abused” for controlling purposes. The shut-off valve was intentionally loaded with an operating pressure of approx. 8 bar for more than three weeks in partially opened position with an opening gap of 1cm. The medium was discharged to the free atmosphere into a seepage reservoir. The enormous forces occurring in this operating situation result in impressive vibrations in the surrounding ground. After stopping the water flow, no irregularities could be observed under visual inspection. Neither the valves nor the sealing, housing nor the drive had been damaged. Both the tightness test performed a second time in the laboratory and the strength test (30 bar/15 min) showed positive results. The measurements of the actuation torques at the "maltreated" valves showed another surprising result: The original value for closing and opening the valve remained unchanged with only 19 Nm.

Question 21: Which tests, going beyond the standard requirements, guarantee the wear-resistance and function of the PE shut-off valve FRIALOC?

An important element of the test series was the testing of the drive and the actuation. The standard requirements define the proof of 250 actuations for ground-installed shut-off valves, with regard to customer specifications, a proof of 2,500 turns is required, analogue to valves for plant construction. In principle, the test is made against a pressure of 16 bar, however, statically, i.e. valve closed – pressurisation – open. These requirements were met by the PE shut-off valve FRIALOC without showing any irregularities.

In practice, however, this load will rather not occur in this way. We thus simulated this test under the hardest conceivable operational conditions using a valve test bench specifically set up for this purpose and equipped with five high-performance pumps.
- Maximum operating pressure 16 bar
- Maximum flow volume up to 250 m3/h
- Actuation of the valve under these near-service conditions
- 2,500 actuation cycles
- Requirement: no functional limitations of the drive and shutting-off after test

This requirement was met and confirmed by the positive test results.

Question 22: According to which test basis are the PE shut-off valves tested, which requirements are made?

The basis for the approval is the DVGW (DVGW German Technical and Scientific Association for Gas and Water) test requirement VP647: “Shut-off valves made of polyethylene (PE 80 and PE 100) for drinking water supply systems – requirements and tests” which was only published in 2007 on the basis of the present national and international standard requirements.

This took into consideration both the specific test requirements for plastics valves pursuant to DIN EN 12201-4: “Plastics piping systems for water supply - Polyethylene (PE) – Part 4: Valves” and the relevant requirements pursuant to DIN EN 1074-1, -2: “Valves for water supply - Fitness for purpose requirements and appropriate verification tests”.
Despite the orientation of the requirements in DIN EN 1074 to typical metal valves, the tests must, of course, also be met in any respect by plastics valves. This poses a very high obstacle for the design and the material PE. The typical strength tests of the housing, the long-term behaviour of the shutting-off function and the wear-resistance of the drive as well as, of course, the sealing in permanent operation have become more stringent in DIN EN 1074 as compared to DIN EN 12201.
Apart from the design requirements, e.g. internal pressure creep test, strength test of the housing and activation are performed, internal and external leak-tightness, fitness for permanent use, and the performance of the hygienic requirements are tested.

The DVGW approval was applied for the PE shut-off valve FRIALOC. All required tests have already been completed with positive results such that the DVGW registration will be granted shortly (as of 10/07).

Question 23: ***How are the requirements on hygiene, in particular with regard to the DVGW leaflet W 270, met by the PE shut-off valve FRIALOC?***

The PE shut-off valve FRIALOC including the sealing materials, of course, met the requirements of the DVGW leaflet W 270. In addition, the minimised use of elastomer sealing materials was specifically considered. Less sealing surface also ensures less growth. In this sense, the shut-off valves were only equipped with a circumferential sealing: Only at places where it is needed, where it is engaged in the valve housing. In contrast to traditional, fully-rubberised gate valves, the elastomer surface of the PE shut-off valve FRIALOC accounts for only a very small percentage of the total surface. Despite of the improved sealing materials with regard to microbiological growth, the amount of growth is thus significantly reduced.

In order to exclude the risk of microbial/bacterial contamination, the design of the drive and the wetted internal contours is such that there are no dead water zones and no stagnation of the drinking water under normal operating conditions.

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