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European Association for Ductile Iron Pipe Systems

Fachgemeinschaft Guss-Rohrsysteme

NEWSLETTER

05/2019

Dear Readers,

Gaskets have to meet different requirements. Basic requirements for gaskets with regard to the physical properties of the materials are regulated, for example, in EN 681-1 (or ISO 4633). Long-term behaviour is often only considered marginally. In the first article on seals, the service life of a TYTON® seal is determined on the basis of a test procedure in combination with a validated calculation procedure.

The title "Reduce the costs of pumping and the risk of damage" conceals the consideration of the positive influence of aeration and ventilation of pipe networks on their operating behaviour. The different applications are presented and the corresponding ventilation valves are presented as examples.

The replacement of PVC pipes by ductile cast iron pipes is the subject of the article "Robust cast iron pipes for Feldkirchen's drinking water network". The particular challenge during this renovation work was to ensure a trouble-free water supply for the city and the surrounding area during the construction period.

The article focuses on the safe operation of water networks by means of a new cover for existing and new above-ground hydrants as well as the retrofittability of manholes and covers. With a technology that accesses the freely available LORA data transmission network, unauthorised opening of the components or unauthorised water extraction can be monitored online.

Enjoy and inspire reading
Yours

Christoph Bennerscheidt

Always topical, always informed

The online Newsletter published periodically provides professionals in the field with up-to-date information about interesting European pipeline projects as well as the many and varied activities of EADIPS®/FGR®.

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Imprint

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The technical service life of gaskets

In the context of the requirements of the drinking water directive and the associated national and European hygiene requirements for organic materials in contact with drinking water, the **long-term behaviour of elastomer sealing materials** is discussed below.

According to standards EN 805 and EN 806-2, pipes and pipe joints for drinking water supply and installation are to be planned for a working life of at least 50 years. Based on the **working life of the pipe system and/or the pipe materials**, the joint system must function for at least as long as the pipes themselves. The **technical working life of the pipe joints**, i.e. also including that of the seals, is not taken into account in this consideration as a rule.

The sealing of the **push-in joints** as the heart of the piping system should achieve a working life of **more than 100 years**, corresponding to the service life of today's **ductile iron pipelines**. This is ensured among other things by appropriate physical material properties. In addition the seal must also meet all requirements and approvals as regards drinking water hygiene.

Requirements for elastomer for use in drinking water applications

Independently of the hygiene and certification aspects of an individual country, the **basic requirements for a seal** are covered in EN 681-1 (or ISO 4633) which addresses the physical properties of the materials.

Requirements for finished seals are defined in the relevant product and trade association standards as well as in client specifications. The performance of a pipeline seal or gasket is dependent on the material properties of the seal, its geometric form and the construction of the pipe joint.

The material of a seal, its design formulation as well as the seal itself are subject to the requirements of standards and specifications. As a rule they are certified and have all the necessary documentation and type examination certificates. However, the assessment of their behaviour over the **long term** is only marginal or even non-existent.

Long-term tests and measurement of the compression set

An essential criterion for a reliable statement on the durable tightness of a pipe joint is the **compression set**. It provides information about the viscoelastic properties of a sealing material and is measured according to the ISO 815-1 or ISO 815-2 test method.

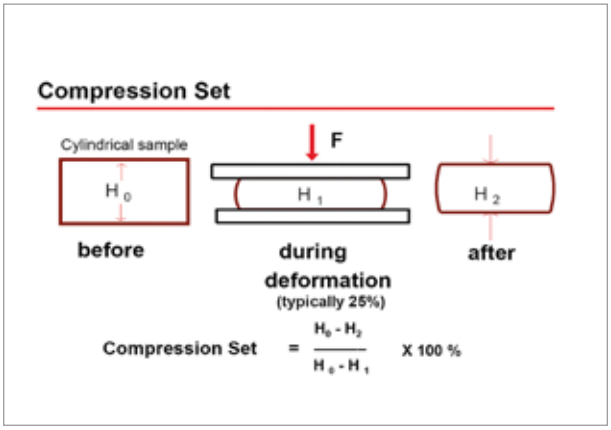
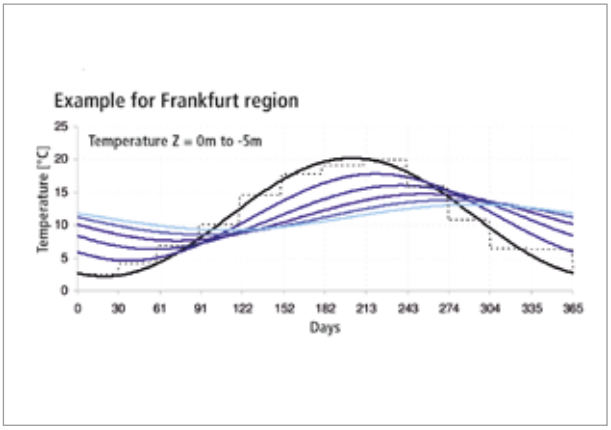


Illustration of compression set measurement to ISO 815-1 or ISO 815-2 and equation 1.



Transient soil temperature through the year. The 2nd curve from the top (at the beginning of the diagram) is the temperature measurement at a depth of 4 m. This allows the time-temperature collective to be deduced over one year.

In the context of predicting the long-term behaviour of seals, the Woco company has developed a **validated calculation method** and a **test method** in the context of a research project with the DVGW. This process has in fact been incorporated in DVGW test specification G 5406 since 2016 and has been included in the draft standard prEN 549. More far-reaching investigations show that the method is also basically suitable for elastomer seals in water applications and hence can also be used for **TYTON® seals** in order to carry out comparative measurements on competitive parts or to make calculated deductions about long-term behaviour.

The concrete results and the working life of a TYTON® seal/Woco seals-EPDM from Pipe System Components: The **time-temperature collective** is an essential basis for considering working life. An underground drinking water supply pipeline is allocated for the calculation of a temperature profile for one year. Drinking water supply pipelines typically lie at a depth of around 1.20 to 2 m, i.e. in the so-called near-surface area. The near-surface earth temperature is determined by the specific climate on the earth's surface, the composition of the soil (thermal conductivity) and the depth.

The **compression set of the TYTON® seal** has been measured at 60 °C, 80 °C and 100 °C, so that for each individual temperature a number of measurement values between a 20 % and 70 % compression set have been determined over a period of one year. Then the working life is able to be calculated using the Arrhenius process based on a limit compression set of only 55 %. As a rule, one reckons with about 70 % or indeed even higher limit values, which would then increase the working life positively again. An unfavourable value was also selected for the calculation. The limit compression set gives the value of elastic deformation or recovery which still remains after the calculated working life! Thus, after "x" years, a seal still has a small compression set, this reflects a high quality level for the seal and hence of the material as regards recovery.

In the operating temperature range selected, the TYTON® seal in the Woco-Seals/EPDM material has an expected working life of 164 years with a limit compression set of 55 %.

Author: Rüdiger Werner, Woco IPS GmbH

The article was slightly shortened by the editors. You can find the complete article with various illustrations as a PDF in the download area under Downloads Annual Issues EADIPS FGR.

Reduce the costs of pumping and the risk of damage

Air trapped in completely filled pipelines is basically undesirable. Even if air does not get into the pipeline during filling, small gas bubbles (air, carbon dioxide etc.) are also formed during operation. Little by little, these can then **merge to form larger bubbles and rise to the top. As a result, they then collect at high points in pipelines and form air cushions** there. The consequences can vary considerably:

- The interpretation of tightness tests before the commissioning of pipelines is made more difficult.
- The reduction of the free cross-section available for flow and the higher pressure losses in the pipeline associated with this can mean that the output of pumps is restricted; pumping costs increase.
- It can cause vibrations in pumps and valves.

Pressure surges are intensified and this can cause damage to pipelines.
For drinking water pipelines there are descriptions e.g. in DVGW data sheet W 334 of how accumulations of air can cause considerable **dynamic pressure changes** as a result of the different densities of the two media.

Pressure surge below admissible PMA

The **commissioning of a pipeline** represents a special case. Directly after construction, the whole system is filled with air and must first be filled up with a liquid. Attention must be paid to the following here: if, when filling pipelines, air is expelled via vent valves, the filling speed must be kept as low as possible. The **dreaded pressure surge** (Joukowsky surge), which occurs if the float of the vent valve closes the valve seat abruptly at the end of the filling process, must remain below the **admissible pressure load** (PMA = maximum pressure occurring temporarily, including pressure surges, which a part of a pipeline in operation can withstand) of the pipeline. As a rule, the admissible pressure surge is limited to 3 bars for safety reasons. The filling speed is limited to 0.25 m/s in accordance with DVGW data sheet W 334.

Counteract pressure fluctuations

In order to secure the pipeline against inadmissible pressure fluctuations for problem-free operation then, depending on the operating state, **ventilation or air release** is necessary for the pipeline components. The gas bubbles trapped in pipelines reduce the free cross-section available for flow, increase the pressure loss in the pipeline and in some cases cause undesirable pressure surges. The size and number of vent valves is to be determined according to the nominal size of the pipeline, the filling volume, the topography and the maximum permissible air speed in the narrowest cross-section of the vent valve (main venting).

Ventilation and air release valves are generally installed in shafts or buildings. They can also be arranged on pipelines which run above ground. However, there are also designs of **ventilation and aeration fittings** which are suitable for installation underground.

Ventilation and air release

Ventilation by automatic vent valves is necessary in the following cases:

- draining sections of the pipeline
- in case of underpressure occurring, to protect the pipeline (for example behind pipe break protection devices)

Air release is not necessary in normal network operation. Even with long-distance pipelines, no forced air release is necessary if the speed of flow is sufficient, even when the pipeline is on a downward gradient, to **carry the air bubbles with** it. In cases where disruptive accumulations of air can form, **automatically acting air release valves** are to be provided. Air in water pipelines is mainly to be expected in places where certain conditions arise such as pressure reductions and temperature increases.

Choice of different aeration and air release devices

Most designs are based on the float principle, with and without lever reinforcement.

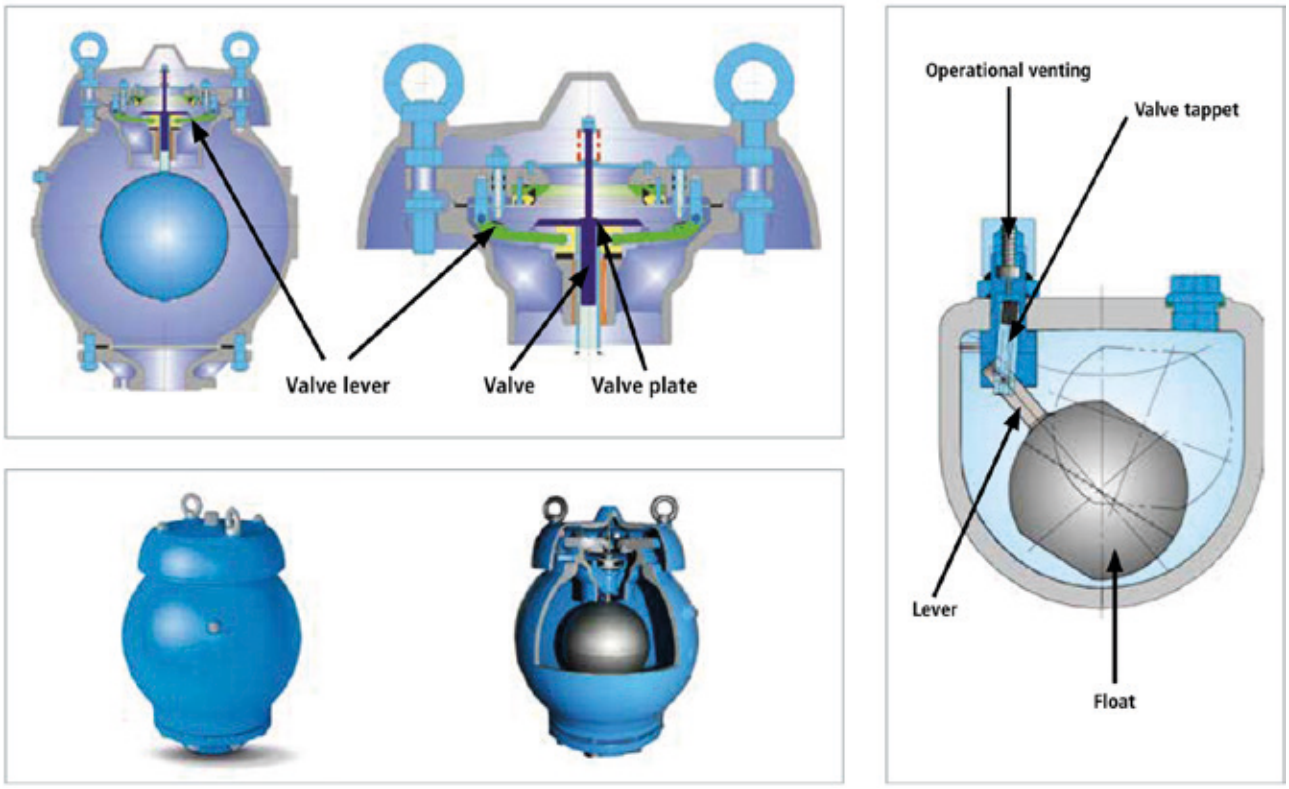
Float principle

Ventilation and air release valves using the **float principle** are designed with a main vent section with a large aeration and air release cross-section and an operational vent section with a smaller aeration and air release cross-section. The **main aeration and air release** is there to remove or drive large volumes of air from the pipeline. This is the case if pipelines are being filled or emptied.

Smaller volumes of air which can occur during normal operation are taken away via the operational vent section.

Valve lever function

With **aeration and air release valves with a lever function**, valves are opened and closed by a lever in the components; depending on the application, different construction forms are used.



Different construction forms of aeration and air release valves with lever function. Top left: sectional view of a single-chamber valve with valve lever for small and large volumes of air; bottom left: aeration and air release valve with lever function for wastewater pressure pipelines; right: The illustration shows operational air release. The float is attached to a lever. A valve tappet on the lever closes the air release port under positive pressure. With negative pressure, the float drops and the port is opened. Air can escape.

Particular construction forms

In addition to the construction forms described above, particular types of design have been developed for operational reasons. **Dynamic pressure brakes** are used in order to protect aeration and air release valves from pressure surges. There is a **shut-off body** mounted in the valve housing which can be moved by the flow. When a certain flow speed is exceeded the medium pushes the shut-off body into the valve seating. Only a reduced cross-section remains free.

So that the aeration and air release valve can be isolated from the pipeline for overhaul purposes, a **gate valve** is often installed before the aeration and air release valve. This means that the aeration and air release valve can be dismantled or cleaned while the main pipeline is stull operational. A soft-seated valve is best suited to this function as it allows a free passage. In order to prevent aeration with small aeration and air release valves and only ensure an air release function, aeration and air release valves with **suppressed air inflow** are often used. These valves have their main application in suction pipelines for mechanically purified water or in the area drinking water.

Authors: Jürgen Rammelsberg und Christoph Bennerscheidt, EADIPS FGR

The article was slightly shortened by the editors. You can find the complete article with various illustrations as a PDF in the download area under Downloads Annual Issues EADIPS FGR.

Robust cast iron pipes for the Feldkirchen drinking water network

Regular servicing and maintenance of a drinking water network pays off. This is also one of the reasons why the urban area of Feldkirchen in the Federal State of Carinthia is particularly anxious to replace their ageing pipes or pipelines whose dimensions no longer correspond to current requirements. Therefore the municipality is responding to a recommendation by the Austrian audit office which advises communities that they should renew around 2 to 3% of their network of drinking water pipelines each year. This is because the funding authorities have also responded to this recommendation and suuport those communities with a **higher rate of funding** that maintain their pipeline network constantly.

Ratio of resident number to supply area

The lasting financial advantage is only one aspect of the reason why the urban community checks the performance of their water supply network regularly; the topography of Feldkirchen is another one. The community counts barely 15,000 residents spread over an area of around 77 km^2, which equates to a considerable **spread in relation to population numbers**.

Feldkirchen has a large arsenal of supply sources available to it – with 17 pumping stations, ten wells and one deep well plus 15 elevated tanks with a volume of 3,500 m^3, 4,000 domestic connections across a 230 km long network of pipelines are supplied. The piping network is being recalculated for the planning of a new housing project.

Calculation of pressures and volumes

What volumes of water are required at peak times, whether these can be transported by the existing piping network or whether adaptations are necessary were the results of the **hydraulic pipe network calculation**. For example, a need for adaptation in the form of an **enlargement of the pipeline cross-section** was identified in one area of the main supply pipeline in the network.

In order to guarantee the security of supply of drinking water and water for other purposes, both for the town and for the newly developed land around it, it was decided to extend the existing system and the **constantly ongoing extensions** for new-builds and new developments.

Uninterrupted water supply

The particular challenge for the renovation work completed to date was guaranteeing the water supply for the town and the surrounding area even during the construction work. So the first construction stage to be completed was the one which ensured the supply of the urban community from the deep well; those in the outlying settlements of the urban community of Feldkirchen were supplied from the small wells.

The particular challenge for the renewal work was guaranteeing the water supply for the town and the surrounding area even during the construction work. Various different alternatives were considered for this, which also carefully scrutinised the scheduling of construction stages so as not to disrupt the traffic too much.

Installation of various valves and hydrants in the piping network.

Crossing the railway was the greatest challenge

The contractor CCE-Ziviltechniker GmbH, together with the urban community, decided to use ductile iron pipes from Tiroler Rohre GmbH in nominal sizes DN 100, DN 125, DN 150 and DN 200. There was one construction phase, where DN 200 pipes were installed, which proved a particularly tricky task for those in charge: **Crossing the railway line**, where it was not clear whether it would work, because there was only use of an abandoned rainwater drainage channel, that **didn't run straight but slightly curved**.

5,750 m cast iron pipes from Tiroler Rohre GmbH have been installed in the last three years. They replace the ageing PVC pipes.

The robust DN 200 ductile iron pipe can be deflected up to 4 degrees. Thanks to this **flexibility of the joint**, the pipes could follow the curved course of the rainwater channel. Feldkirchen saved money here was there was no need to use fittings and the work could progress more quickly.

From PVC pipes to ductile iron pipes from TRM

In the nineteen sixties and seventies, a great deal of housing development occurred in the whole of Austria. In the course of this, in Feldkirchen too, a network of pipelines came into being, for the most part in PVC pipes. In the last two decades these PVC pipes have come to the end of their useful life and have gradually been **replaced by ductile iron pipes. Quality material, a long working life and the good hygiene properties** for drinking water all speak in favour of the cast iron pipe system. "Quality counts", says water engineer Werner Drolle with satisfaction, and also the service and the reliability of Tiroler Rohre GmbH were convincing.

Products from the home market preferred

Whenever possible, the municipality goes for home-produced products and when selecting products, it is not just a question of the cheapest price but of the quality. "The price-performance ratio must fit," explains Feldkirchen's deputy mayor Siegfried Huber. Added to this is the fact that with good support by experienced sales representatives, smooth progress of work is guaranteed. Until now **5,750 m of TRM cast iron pipes** has been laid in the Feldkirchen network of pipelines.

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KLAPPE with ALERT –
Paving the way for smart mains-operation

Manholes and covers of water supply networks are designed so that they can be easily opened by the water supplier's operating personnel, for example to operate gate valves, hydrants and other fittings. Underground or above-ground hydrants can be used to extract water from the water network by the network operator, the fire brigade or instructed personnel.

Monitoring the widely branched networks is an important task of network operation. Even with a constant presence in the network area, the **unauthorised opening of manholes and covers** or the **unauthorised removal of water** is only detected if the operating personnel is at the right place at the right time. With the **digitalisation of water management**, this no longer has to be the case. With ALERT sensor technology, operating personnel can be relieved and network security increased.

Sensor technology ALERT

Hydrants, gate valves, manholes and covers equipped with **ALERT sensor technology** report – silently for the person responsible – when they are opened. How does it work? Sensor technology ALERT uses data transmission via the **Lo**ng **R**ange Wide **A**rea Network (LORA), a data transmission standard that is already integrated into ORTOMAT technology. **LORA** uses a smart chipset and a data transmission standard that allows sensors to operate for a very long time with low power consumption, eliminating the need to build and operate expensive and error-prone parallel networks.

The network operator has the free choice of whether a special operation site (e.g. the operating centre of the network operator) or the VONROLL-HYDROSERVICE is informed if unauthorised access to the network occurs. In this way, the right measures can be taken quickly to **effectively prevent water theft and unauthorised manipulation**. ALERT turns any network into a smart infrastructure.

ALERT sensor technology is part of the **ZERO WATERLOSS strategy**. It can be easily retrofitted (also to other manufacturers' products) and can be displayed via HYDROPORT in the **INTERNET OF THE WATER**.

KLAPPE with ALERT

The **rotating lid** of the often copied but never reached above-ground hydrant of vonRoll CLASSIC has been replaced by **KLAPPE** as standard since 2019. The name says it all: a hinged lid that combines superior user-friendliness with functional reliability and, thanks to ALERT, can send a message to HYDROPORT or another defined location when opened. Of course, both the rotating lids of the vonRoll CLASSIC and the lids on the 7502, 5000 and Hinni 6000 above-ground hydrants can be replaced by KLAPPE, thus paving the way for **smart network operation** even in existing networks.

Of course, the powerful and technologically leading **leak detection system ORTOMAT MTC** can be retrofitted into KLAPPE.

The KLAPPE
- is reliable: no faulty operation possible.
- can be retrofitted to the 7502, 5000, CLASSIC and Hinni 6000 above-ground hydrants.
- communicates via LORA or mobile phone networks and does not require expensive and error-prone parallel networks.
- monitors manipulations and unauthorized water withdrawals in real time.
- supports network operation and increases supply and functional reliability.
- is prepared for the installation of the leading leak detection system ORTOMAT MTC.
- can be mapped via HYDROPORT in the INTERNET OF THE WATER.

Above-ground hydrant from vonRoll CLASSIC with hinged cover KLAPPE and integrated ALERT sensor.

KLAPPE reports manipulations and unauthorized water withdrawals in real time.

Author: Roger Saner, vonRoll hydro (suisse) ag