Installation and Commissioning Instructions
for
GÄBLER-piston slide valves, especially for gaseous oxygen pipelines

1. General:

GÄBLER-piston slide valves are shut-off valves of a high standard that are produced with the most possible care and precision. In order to keep the safety and the reliability and in order to reduce the necessary maintenance to a minimum a few but important rules must be followed.
GÄBLER piston slide valves that are intended for the use in pipelines for oxygen are free of oil and grease and are marked correspondingly on the valve body. The valves have been tested for the behaviour in adiabatic pressure shocks at the German Federal Institute for the Testing and the Research of Materials (BAM) where they have been found suitable for the use in gaseous oxygen within an operating range of max. 100 bar pressure at max. 100°C – provided the strength of the valves acc. to their nom. pressure allows that high pressure. The European Industrial Gases Association EIGA recommends using valves that have been found reliable acc. to adiabatic pressure surge tests for an operation range of 30bar up.
The metallic materials chosen for the pressure bearing parts in contact with gaseous oxygen are exemt materials according to the EIGA document for oxygen pipelines 13/12/E. They are excluded from the limitation of flow velocity up to a pressure of 20.68 MPa.

Due to the soft seals made of FKM for gaseous oxygen the minimum temperature of either the ambient or the temperature of the flowing medium shall not be lower than -20°C. FKM seals are getting harder with dropping temperatures and their ability to tighten towards the ambient is getting lost in consequence. In order to keep the tightness even in areas where deep ambient temperatures could occur, the valve should be packed in an appropriate box which should be heated during the cold period.

Valves that are intended for the use in pipelines in the European Community and that are falling under the validity of the Pressure Equipment Directive 2014/68/EU can only be installed into new pipelines if the valves are marked with the required markings such as nominal bore, nominal pressure, manufaction no., direction of flow etc. and if the conformity with the PED 2014/68/EU is visibly confirmed by a CE-sign in combination with the number of the Notified Body.

If the protection caps and the lead seals are neither damaged nor missing and if the PE-foil is still wrapped around the valve we will guarantee for oil- and greaseless performance of the valves. Therefore the GÄBLER-piston slide valves should only be unsealed directly before the installation to avoid that dust or dirt comes into the valves.

1) Very important for the installation of GÄBLER-piston slide valves in pipes for oxygen is experience of the staff with valves for oxygen; the high demands concerning their handling must equally be taken as a matter of course as the freeness of oil and grease of hands, tools, and clothing.

2) Is is only allowed to operate the automatically operated valves with the right power supply which is shown in the data sheet as well as it is marked on the solenoid and on the limit switches.

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3) The GÄBLER-piston slide valve has to be installed in direction of flow according to the arrows on the valve body. This direction provides a comparatively low pressure drop. Further on the direction of the pressure difference over the closed valve is important for the tightness in the valve seat.

4) Especially for newly installed pipelines the pipes have to be cleaned and purged carefully with nitrogen gas or other inert gases of high flow velocity to ensure that all particles of dust, dirt, rust, oxid scale etc. are discharged out of the pipeline. Compressed air must oilfree if it has to be used for that purpose. Pigging is not recommened. Valves are to be installed after the purging and only if the removal of all particles is approved to avoid that the valves are damaged while the pipeline is purged clean. It has to be proved that the velocity of the gas is high enough to blow the partikels out because remaining particles can damage the sealing elements and the liners. Particles within oxygen pipelines are one main reason for an impingement leading to the combustion of the pipeline itself.

5) In some special cases the valve can be installed against the indicated direction of flow. Spring closing valves as well as handlever-operated valves may open by themselves, if the pressure on the outlet side of the valve is significantly higher (the pressure difference depends on the nominal bore) than on the inlet side of the valve. If this might be the case (at pressure vessel shut-off valves or within circle pipelines where the medium can flow in both directions) the company H. GÄBLER ARMATUREN GMBH & Co. KG should be contacted. In theses cases a closing cylinder is recommended for the valve to support the force of the closing spring in cases of an own medium operation or an operation with auxiliary medium instead of own medium might be the solution with an double acting actuator cylinder in order to grant tightness within the valve seat.

6) The shut-off valves should be arranged in the pipeline in a way that enables an easy access for maintenance purposes or for a repair of the valve without the necessity to remove the whole valve. It has to be drawn into account that from nominal diameters exceeding DN 150 lifting tools could be required to draw the piston so that there has to be enough space for cranes, a block and tackle etc. In all types of GÄBLER piston slide valves the piston has to be drawn out of the valve body towards the top based on the marking on the valve body.

7) Up to nominal diameters of DN 100 the valves can be arranged in all positions, bigger valves should be mounted in a way that the piston moves vertically and the pipeline goes horizontally to avoid the sealing rings being damaged by the weight of the piston.

8) For GÄBLER-piston slide valves exceeding DN 150 the valves must be supported at the flanges or at least the pipeline itself should be supported directly next to the valve in order to reduce the stress to the flanges of the valves and to the counterflanges. If the pipeline is buried into the ground it has to be avoided that tensions arise due to sinks of the earth. Further on tensions due to thermal expansion are not acceptable for the valve.

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9) Especially the GÄBLER-piston slide valves that are shut or opened pneumatically should be arranged at a place where no direct rain, spray water or deep sea may flow through the venting hole (covered by a sinterbronze filter) into the inner space of the piston. A shelter is recommended which is including electrical equipment like solenoid valves or limit switches. A shelter in order to prevent water getting into the valve is especially important in areas where ambient temperatures below 0°C may occur.

10) To increase the reliability of the valve and to avoid impingement it is necessary to use suitable dirt traps in the pipeline in order to keep away abrasive particles from the piston slide valve. The filter mesh size should not exceed 100µm. As described very detailed in the EIGA doc. 13/12/E and as mentioned in point 2) oxidisable particles like rust, welding beads, chips etc. are one main reason for oxygen fires. Therefore despite the tightness and reliability of the valve it is important for the whole pipeline itself to remove the particles out of the pipeline.

11) For the choice of the gaskets and the pipeline material the safety rules as well as governmental restrictions have to be followed according to the media the pipeline is intended for. The maximum forces for the screws should not be exceeded. For oxygen pipelines for pressures up to 100 bar we do strongly recommend spherical comb profile gaskets with a graphite layer, ordered free of oil and grease, properly and individually packed with approval of suitability for gaseous oxygen for the graphite seal as well as for the fixing agent which is connecting the graphite to the stainless steel body.
If you use other gaskets, even if they are approved for oxygen use (or in other media if they do have a DVGW-approval or equivalent), these gaskets might require too high contact pressure to reach reliable tightness. If the bolt forces at the flanges are too high the bronze flanges of the valves might get damaged.

12) The staff which is installing the valve and which is connecting the flanges should be qualified acc. prEN 1591. For the enduring and reliable tightness of the flange it is important that the axle of pipe and valve do align and the flanges are parallel to each other. Of course the valve can only be installed if the flanges of the valve correspond with the counterflanges. Each hole in the flange must be filled up with a screw. We recommend stainless steel screws and stainless steel nuts of the strength calls A2.70. Hardened washers with a hardness of at least HV200 should be used. A little bit oxygen-suitable grease on the thread is necessary to avoid a seizing of the thread. As an alternative galvanic coatings like silver coating might serve the same purpose. The correct bolt sizes according to the flange norms have to be used in order to centre the gasket. If stud bolts acc. to DIN 2510 pt. 8 type L (with reduced shaft diameter) are used we recommend using special centring bolts to centre the gasket to the face of the flange.

13) The bolts have to be tightened in several steps in a crisscross manner. We recommend initially tightening four bolts with 20 % of the specified bolt force, followed by a tightening of these four screws with 60 % of the bolt force indicated. Finally these screws have to be tightened with 110% of the given forces of the attached tolerable bolt force sheet.

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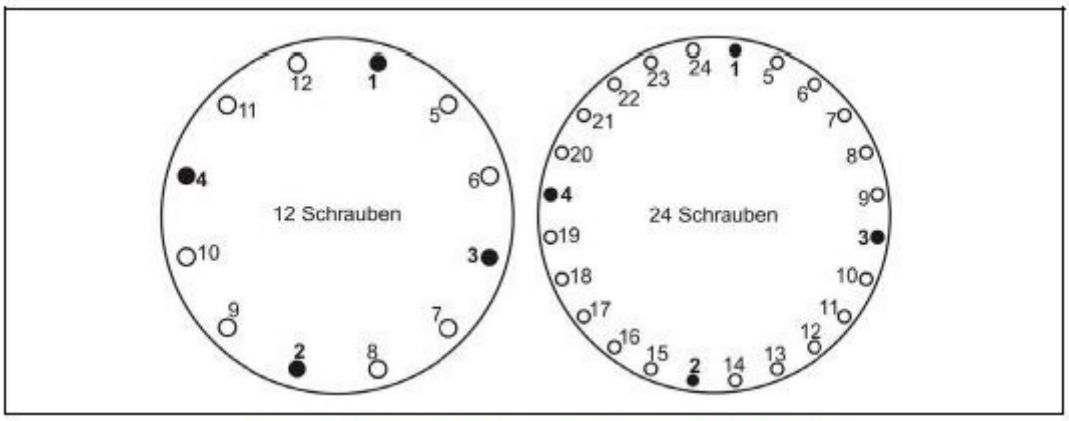
After tightening these four screws (if the flange connection has more than four bolts) the remaining bolts have to be tightened in a rotating manner also with 110 % of the bolt force, followed by a final tightening of all screws in a rotating way applying the same force.



14) Integral part of these installation instructions is the attached sheet with the maximum bolt forces that are specified individually for the nominal size, nominal pressure and the bolt size of the valve delivered provided the recommended spherical comb profile gaskets are used. The indicated bolt forces must not be exceeded. Overbolting might damage the bronze flanges of the valve.

15) If the actual force in the bolts can't be measured (for example by gauging the increase in length of the bolts) during the tightening of the flange connection, the required torque to be applied has to be estimated. The required torque depends on many factors like the friction between the bolt and the nut, the friction between the nut and the counter surface, the quantity of interstices to be connected, the mode of applying the torque (slowly or abruptly), the tool which is used for the tightening and whether the pressure and temperature within the pipeline is changing slowly or quickly.
Based on nearly constant (or only slowly changing) pressures and temperatures at operation conditions, greased bolts and nuts and the tightening of the bolts with a torque wrench with a monitoring of the pre-set torque and a moderate rise of the torque applied, the required torques can be estimated with the following factors to be multiplied with the forces indicated in the attached "Maximum bolt forces" sheet.

nominal bolt size	Factor	nominal bolt size	Factor
M12	8,3 mm	M27	18,3 mm
M16	10,9 mm	M30	20,3 mm
M20	13,5 mm	M33	22,2 mm
M24	16,2 mm	M36	24,2 mm

16) To protect the seat seal of the GAEBLER-piston slide valve the valve should be opened quickly but smooth, equalized pressure provided. The valves that are piloted pneumatically by own or auxiliary media should have a pressure regulator or a filter pressure reducer in order to adjust the pressure and the corresponding opening or closing speed.

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17) If the pipelines are installed for the first time it is recommended to install the pipe sections in the line of flow one after the other. Prior to the cleaning or purging of the pipelines the valves should be replaced by fitting adapters to close the gap before the pipeline is cleaned and purged free of oil, grease, welding beads, chips and other particles. The length of the valve including the gaskets has to be considered for the gap for the valve. The weight of the valves has to be supported if the valves are connected to one flange first.

18) At higher diameters and high pressures in the pipeline the installation of a bypass-valve is strongly recommended to get a smoother pressure equalisation and to avoid the pipesections downstream being damaged by a sudden pressure surge. For diameters DN 200 up this is strongly recommended in the accident prevention rules BGR 500 Chapter 2.32 for the operation of oxygen systems, too. Further on adiabatic pressure shocks are dangerous due to their risk of an ignition of non-metallic pipeline materials like gaskets or valve seals.

19) To check the operational availability of the GÄBLER-piston slide valve the piston should be operated regularly, at least once a month. By moving the piston the smoothness of the sealings is improved thus extending the life of the sealing rings as well as the tightness of the valve towards the atmosphere and within the valve seat.

20) After longer storage the sealing rings might have settled down in the liners a bit and the valve might leak after the first operation. On the ground the seals are quite elastic this process is reversible by moving the piston with operation pressure several times so that it can be secured that the valve shuts tight again.

21) If the valve is auxiliary medium operated the GÄBLER piston slide valve itself must be equipped with an additional actuation cylinder to separate the flowing medium within the pipeline and the actuation medium in case of a leakage. The actuator cylinder must not be operated with oxygen unwise this has been ordered explicitly. In this case FKM seals are used instead of the standard NBR sealings for the actuator cylinder. Nontheless the parts of the actuator cylinder are degreased.
The auxiliary medium pressure is limited to 10 bar(g). The auxiliary medium pressure should be disconnectable through a small piston valve, for example a GÄBLER GKS 200.

If the instructions mentioned above are followed, the GÄBLER-piston slide valve has almost no considerable wear and provides a long life of operational reliability, which has been proved in a huge number of cases of use in plants all over the world.

Provided the valve is installed according to the above instructions and if the valve is operated regularly we recommend maintaining the valve every five years or after one million operations.

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Peine, July 2016

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