

# STEM SEALING TO MEET INDUSTRIAL EMISSION REGULATIONS FOR NEW OR REFURBISHED VALVES

Currently many BREFS (Best Available Technology Reference Documents) are under review to conform to the Industrial Emissions Directive 2010/75/EU (IED). All industry sectors including chemical and process industry plants have to adhere to emission legislation when installing new valves or refurbishing existing valves during shut-downs. Besides the need for proper sealing solutions there are requirements with regard to the correct installation and condition of the equipment.

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## Packing requirements

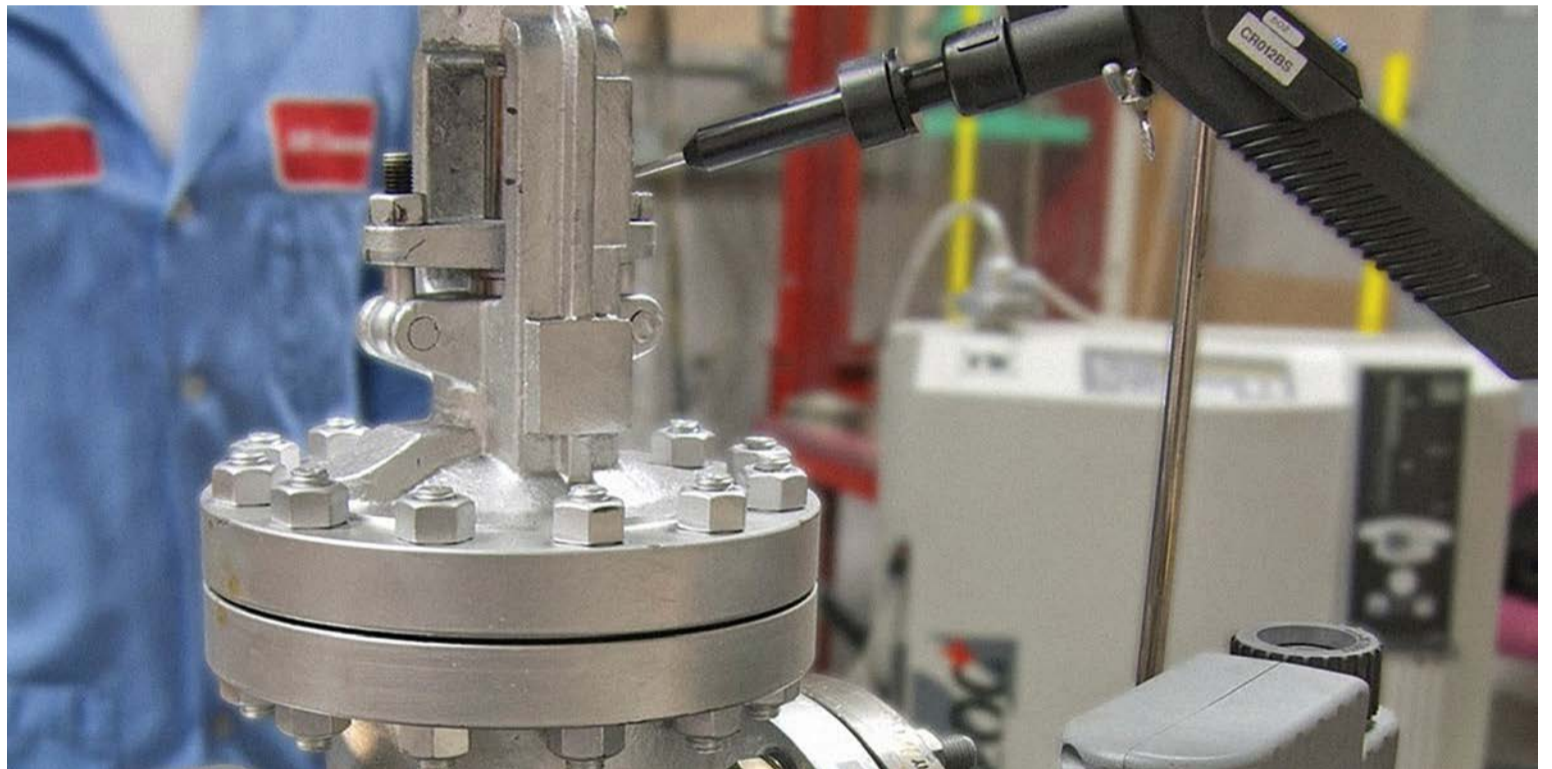
As well as the emission requirements there are a number of other factors to be considered when developing a packing for these duties. For each application the pressure and temperature capability, chemical compatibility, endurance in regard to required actuation cycles during service life. Additionally there are aspects of fire safety and corrosion resistance which must be taken into account.

For packings there is a specific test standard developed by the American Petroleum Institute API 622 Rev.2 which defines a number of different tests. Crucial here is the emission test which is performed by using a standardised test fixture. The testing can be done by independent test laboratories which will provide certification stating the measured emission levels.

In Europe the IED 2010/75/EU directive requires best available technologies be used, but for valves or packings there is no specific emission limit defined. The German TA-Luft legislation is more demanding and defines emission levels for two temperature classes. Testing is done according to VDI 2440 where packings or packing sets can be tested in a fixture or in a valve and certification is issued by the manufacturer or independent test laboratories.

## Valve requirements

New valves installed in a plant should have classification according to ISO 15848-1. This standard defines specific leakage classes for



the complete valve system including packings and gaskets as well as pressure, temperature and numbers of cycles. Valves are tested according to a defined test program and certification issued by the Valve OEM or independent test laboratories.

Existing valves should be surveyed and refurbished with appropriate low emission packing or sets.

## Reworking of valves

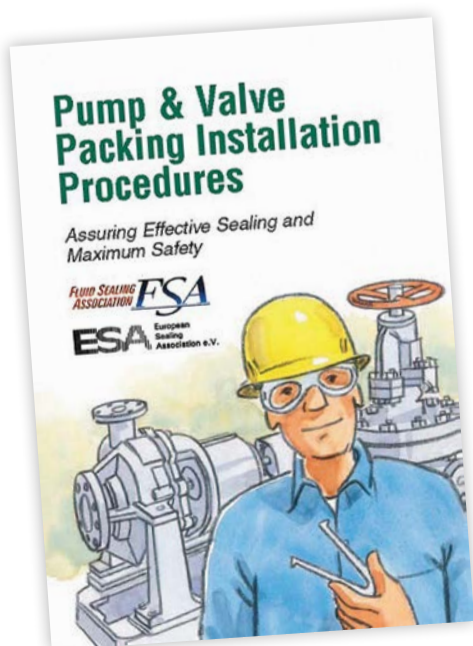
If a valve has to be reworked the principle component in most cases will be the spindle. Due to damage, the spindle may have to be replaced or machined slightly smaller. In the case of a smaller spindle the packing set should be able to adapt to the changed dimensions. If this is not possible new sets made from appropriate tooling have to be manufactured. It is also necessary to ensure that the permissible clearance dimensions are not exceeded after the rework. If they are appropriate metal disks should be used which can bridge the bigger clearances to reduce any possibility of extrusion. Similar measurements apply for the enlargement of the stuffing box bore due to corrosion problems. In addition bolts and nuts should be checked to make sure they are still in proper working condition.

## Spring loading of valve bolts

If the valve is to be fitted with disc springs on the gland bolts, all the dimensions for the spring assembly have to be measured. In some cases longer gland bolts are needed to accommodate the disc spring solution. The protection of the springs by an additional cover bushing is also recommended to guide the spring stack and to protect the springs against contamination. This solu-

tion is very user-friendly because it is virtually impossible to over or under tighten the set. Additionally there is a visual indication when the springs need to be re-tightened due to volume loss of the packing set.

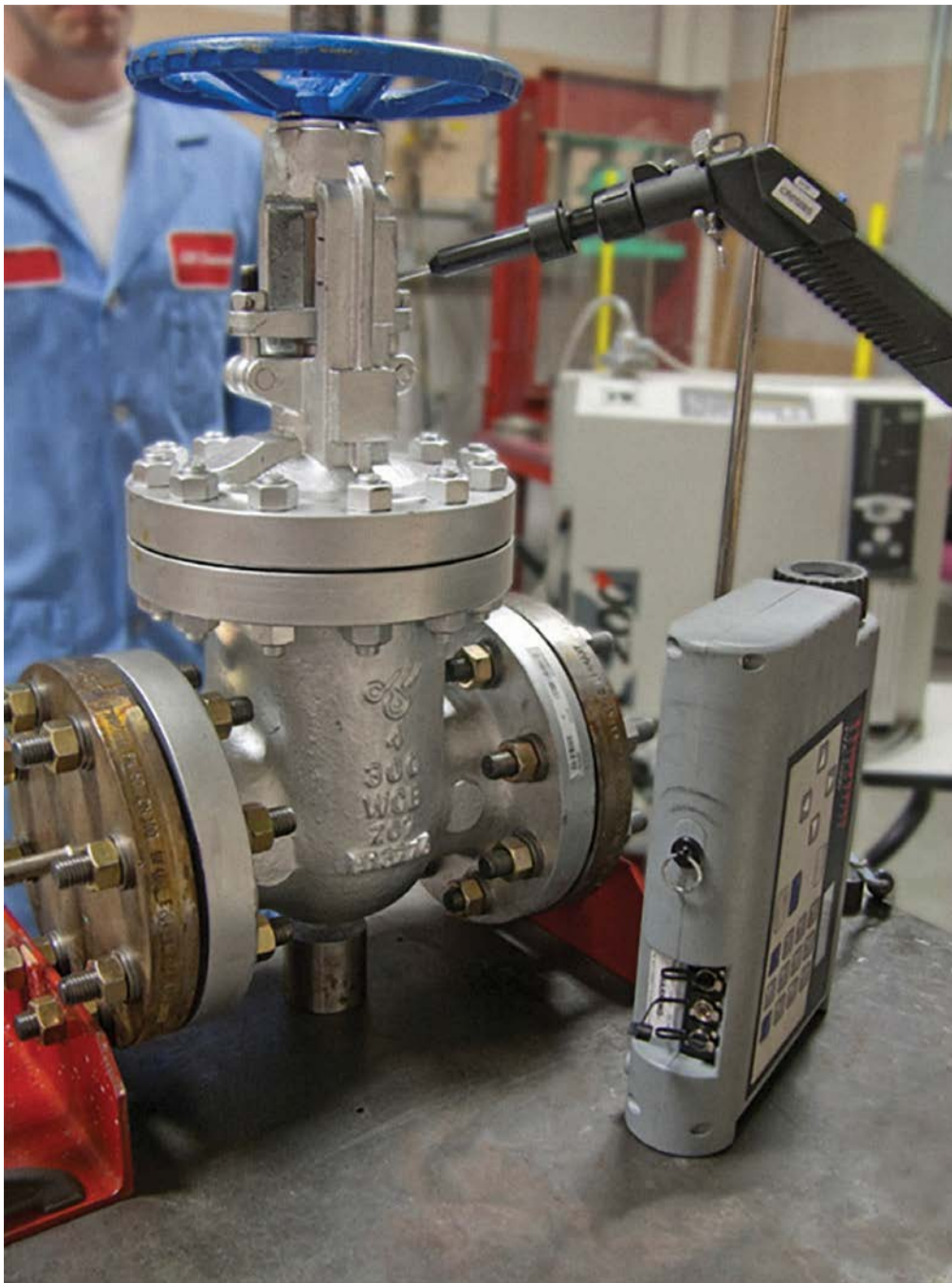
There should always be a cost evaluation to see if spring loading is necessary. It is recommended if the valve is hard to access for re-tightening or if long maintenance free periods are expected. Also if there are a high



ESA Pocket fitting guide



Valve testing to ISO 15848. Image courtesy of the Fluid Sealing Association



Valve testing to ISO 15848. Image courtesy of the Fluid Sealing Association

number of spindle movements or larger temperature fluctuations during operation, a spring-energised system can guarantee more sustained and consistent axial force retention and sealing performance.

#### Installation of sealing sets maintenance plan

The supply of detailed installation information and maintenance plans with all packings or sealing sets is very important to ensure low emissions. All installation forces have to be specified to achieve the best sealing performance. If torque measurement is not possible, a specific dimension diagram for the compression-related tightening will be supplied. This information will often be incorporated into customer standards. Our experience shows that the maintenance information needs to be easy to understand. Diagrams are more informative than formulae or tables. If the instructions are too complicated they will not be followed and errors can occur, resulting in poor seal performance.

#### Training of maintenance personnel

In situations where there are problems or dimensional deviations the experience and skill of the maintenance personnel is crucial. In addition to the specific maintenance and installation instructions seal suppliers will provide training seminars for end users or refurbishment companies. Thorough theoretical and practical training is given which ensures that not only standard situations but also potential problems are covered. The ESA produces a handy pocket guide on installa-

tion procedures as an 'aide memoir' to the trained operator.

#### Re-work or new valve

In many instances it is questionable if an old and worn valve should be reworked or replaced by a new one. Experience has shown that most valves can be upgraded to fugitive emission requirements if the work is carefully done. But for smaller valve sizes there is always an economic decision which has to be made. Experience at bigger plants has led to a general rule being adopted: stainless steel valves smaller than DN 50 and carbon steel valves smaller than DN 80 for use in fugitive emission applications should be replaced by new valves. In general, replacement proved to be more economic than refurbishment.



Typical fugitive emissions packing set

#### Conclusion

The use of suitable packing rings or packing sets is important to guarantee problem-free operation according to fugitive emission legislation during the lifetime of the valve. The seals should be approved to a recognised standard like VDI 2440 or API 622. New valves should be classified according to ISO 15848-1. Also, the proper preparation of the valve as well as the right installation is just as

important. Additional measures, like spring loading of the gland, provide prolonged and trouble free performance. Despite the initial increased maintenance costs to fulfil the legal requirements there will be significant cost reductions due to longer service life and increased maintenance intervals. Additionally, reduction of product losses will give benefits in regard to increased efficiency of the plant.

#### ABOUT THE AUTHORS



David Edwin-Scott graduated with a BSc (Hons) in Chemical Engineering from Queen's University, Belfast in 1973. He has gained extensive experience in the sealing industry throughout the years and currently serves as a consultant to the ESA as a Technical Director, in the fields of compression packings and elastomeric sealing technology.



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