

7.3 Packing and gaskets

The chemical industry has carried out cadastral surveys for many years. These surveys provide valuable information regarding environmental pollution which is usually related to leaking packings and gaskets. Packings are, in principle, gaskets too, they are, however, in addition exposed to dynamic strain. For the reliability of packings or gaskets there are primarily two factors authoritative:

- Suitable selection of type and material, and
- Regular maintenance, in order to avoid wear and tear and a compression of the sealing element.

The usual leakages for different sealing elements (literature figures) are shown in table 7.3.-1.

Sealing element	Typical Leakage ¹⁾
Standard flange at gases	0.02 g / h·m
Standard flange at liquids	0.2 g / h·m
Flange with metal gasket	0.01 g / h·m
Stuffing box of a control valve	2.8 g / h per valve
Slide ring packing of a pump	13 g / h per pump

¹⁾ Leakage in 10^{-3} kg per hour per meter gasket length or per device

Table 7.3.-1: Typical leakage of various sealing elements (state of art)

7.3.1. Stuffing boxes for control valves

It is actually astonishing that the principle of a valve packing or stuffing box has remained practically unchanged, **since the Englishman James Watt invented the steam engine in year 1765**. Today there is a variety of packing types with special forms and various materials available, but all of them have still the same weakness:

Wear and tear and plastic deformation of the valve packing causing, after a short period, unacceptable leakages which can only be avoided by the effort of regular maintenance and service. It is impossible to list the whole variety of different packing types in this book. Principle of a valve packing or stuffing box is shown in Figure 7.3.1.-1 to Figure 7.3.1.-2.

Packing cord or rings are usually produced by braiding, weaving, folding or other procedures. The cross-section is mostly square, but sometimes rectangular. The packing material consist today mostly of PTFE or PTFE derivatives, sometimes also of graphite or asbestos substitutes. The single fiber is frequently impregnated with special lubricating or sealing substances before the twisting or braiding process begins. To improve the elasticity, the packing sometimes contains a core of synthetic rubber.

Pre-formed packing rings are made of hard (sintered) and soft (not sintered) PTFE usually combined in the manner of a sandwich. The axial load of the packing deforms the rings radially to the inside and outside and it seals in this way. The same principle is achieved with rings of wrapped graphite foil, which require, however, precise dimensions of the packing rings as well as for the valve stem and bonnet bore.

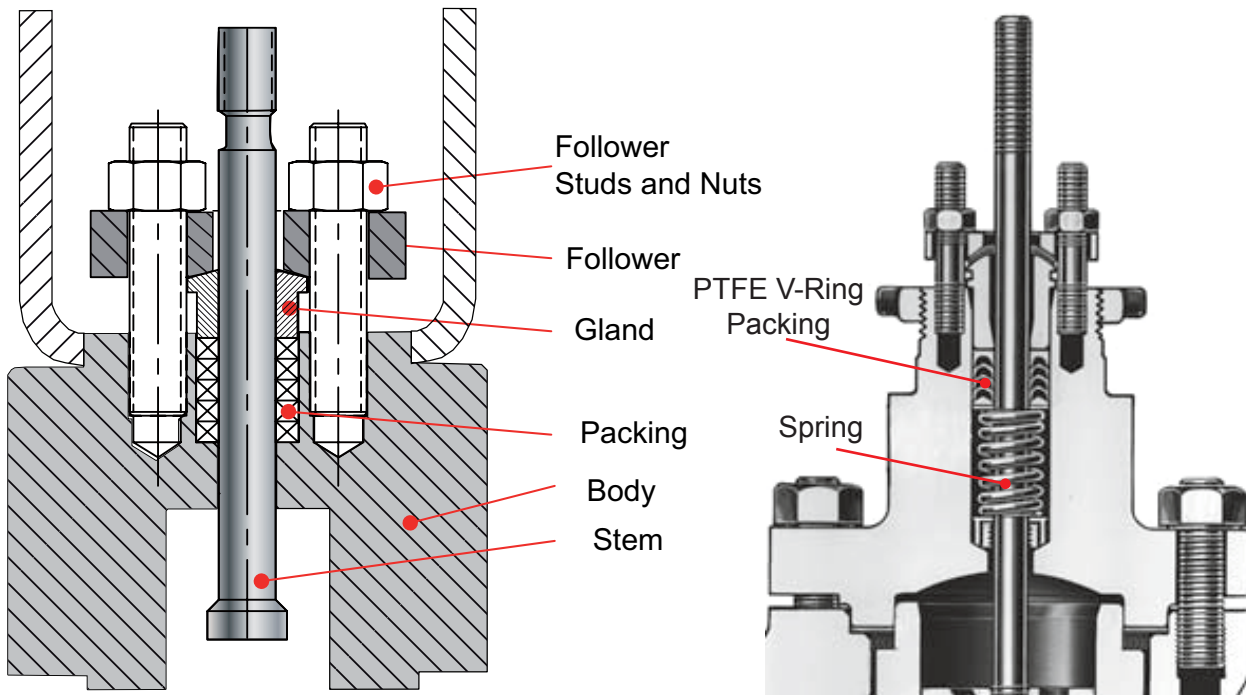


Figure 7.3.1.-1: Design with packing flange (gland flange) and external bolting

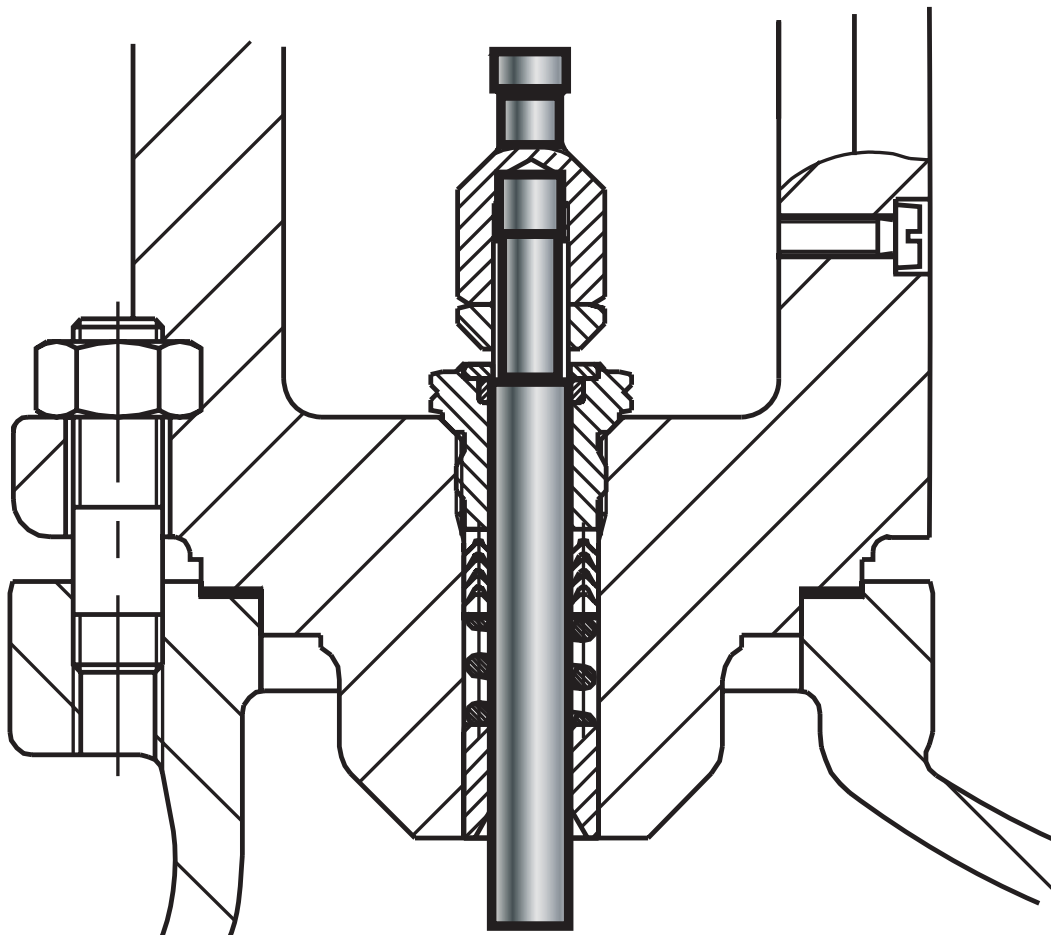


Figure 7.3.1.-2: Single or double packing sets available, also available with live-loading systems

Reliability as the main goal for the packing set

- Risk analysis together with an international oil and gas company
 - ◇ (FMEA, Failure Mode and Effects Analysis)
 - ◇ A to C : Probability
 - ◇ I to IV : Consequence
 - ◇ 1 to 4 : Risk level

	A	B	C	D	E
I	1	1	1	2	3
II	1	1	2	3	4
III	2	2	3	4	4
IV	3	4	4	4	-

Table 7.3.1.-3: Risk matrix

Special problems for the design with packing flange and external bolting system:

- Corrosion (material quality) of the external bolts, springs etc.
- 2 screws have to be operated, possible uneven adjustment
- Rating of the springs
- Packing is moving under process conditions

Detailed information see Chapter - 17 → 17.6.8 Packing.

Correctly mounted control valve packings require a certain compression, which is usually adjusted by careful positioning of gland and packing follower. The compression of the whole packing is however not homogeneous like in a liquid, but is higher in the upper rings. To obtain an equal compression of the packing rings, the lower rings must be compressed more strongly than the upper ones. If many packing rings are compressed as a whole, the upper rings become - due the wall friction - tight, but the lower rings are compressed to a lower degree, which results in an unfavorable drop of the pressure differential and early leakage is the consequence. The success due to optimal packing compression requires experience and feeling to avoid either early leakage or an unacceptable high hysteresis.

There isn't any completely tight packing box with the exception of metal bellows seals. Satisfactory results are nowadays obtained on rotary valves (Figure 7.3.1.-4). Control valves with linear stem motion, however, have usually only a limited seal ability which depends on many parameters. Adjustable packings have at least the advantage that, in such cases, a temporary improvement by a regular service can be attained.

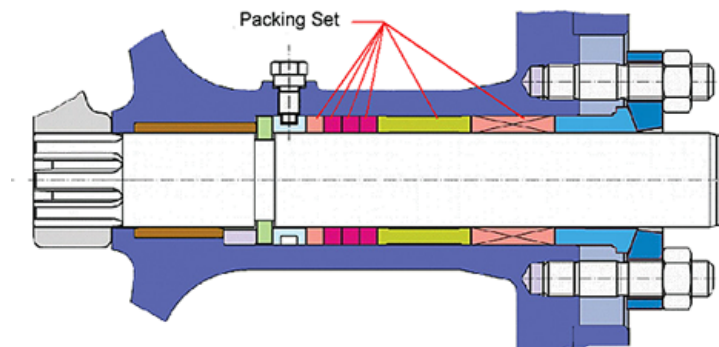


Figure 7.3.1.-4: Long bonnet design for rotary valves, standard packing (VETEC)

7.3.2. SAMSON standard packing

Temperature range -10 to $+220$ °C Self-adjusting, spring-loaded V-ring packing made of PTFE-carbon for nominal sizes DN 15 to DN 150.

Self-adjusting PTFE-carbon/PTFE-silk packing for nominal sizes DN 200 to DN 500.

Suitable for all applications that require a high level of sealing performance, yet requiring hardly any maintenance.

Other packings can be installed for special applications.

What makes a Type 3241 unique?

- Standard stuffing box design
- V-Ring design PTFE-carbon compound
- Spring loaded
- Min. Maintenance
- Low-emission (10^{-5} mbar l/sec)
- Temperatures up to 220 °C
- Over-tightening of the packing is not possible

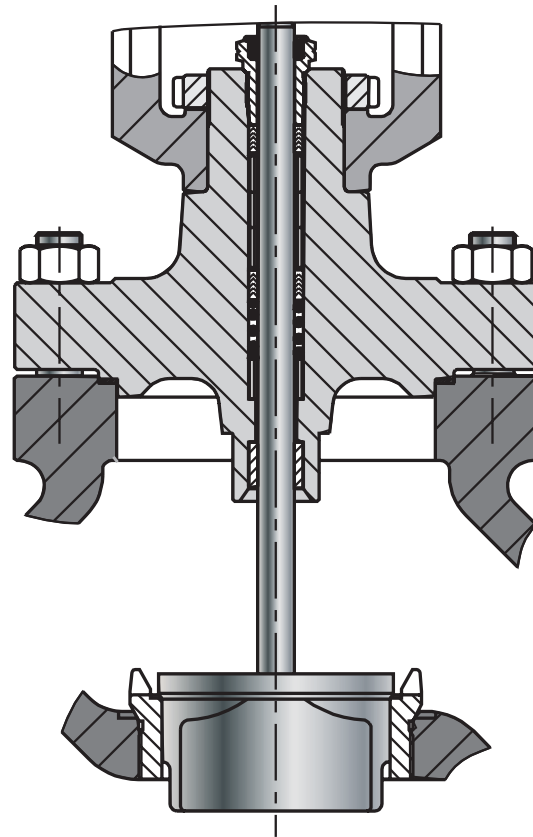


Figure 7.3.2.-1: Valve bonnet for Series 3250 Valves

7.3.2.1 SAMSON self-adjusting packing

SAMSON's Standard packing is self-adjusting, spring-loaded PTFE/Carbon V-ring. When the packing nut is tightened all the way, the spring compresses the packing against the plug stem with just the optimal sealing force. As the packing wears over time, the spring compresses the packing further to take up any stack. As such, the valve can operate for many years without maintenance on the packing. Over-tightening is not possible. SAMSON packing system is not of bolted gland type a typically packing follower system of most valve manufacturers "swimming fix point".

SAMSON has developed packings for its valve lines to incorporate all the features required for demanding applications. The maintenance-free, spring-loaded V-ring PTFE and carbon compound packing with a special lubricant is suitable for practically all process media at temperatures ranging from -200 °C to $+450$ °C. The adjustable, cavity-free packing is designed especially for liquids that crystallize or polymerize by inserting PTFE silk cord rings in front of the V-rings.

Packings for high temperature ranges incorporate rings made of pure graphite and carbon, which are arranged in alternating order.

Optionally, a leak-off connection can be fitted in the space between two packings to detect fugitive emissions.

SAMSON uniform packing design operate with all sizes up to DN 20 inch and PN up to class 2500 since 5 decades.

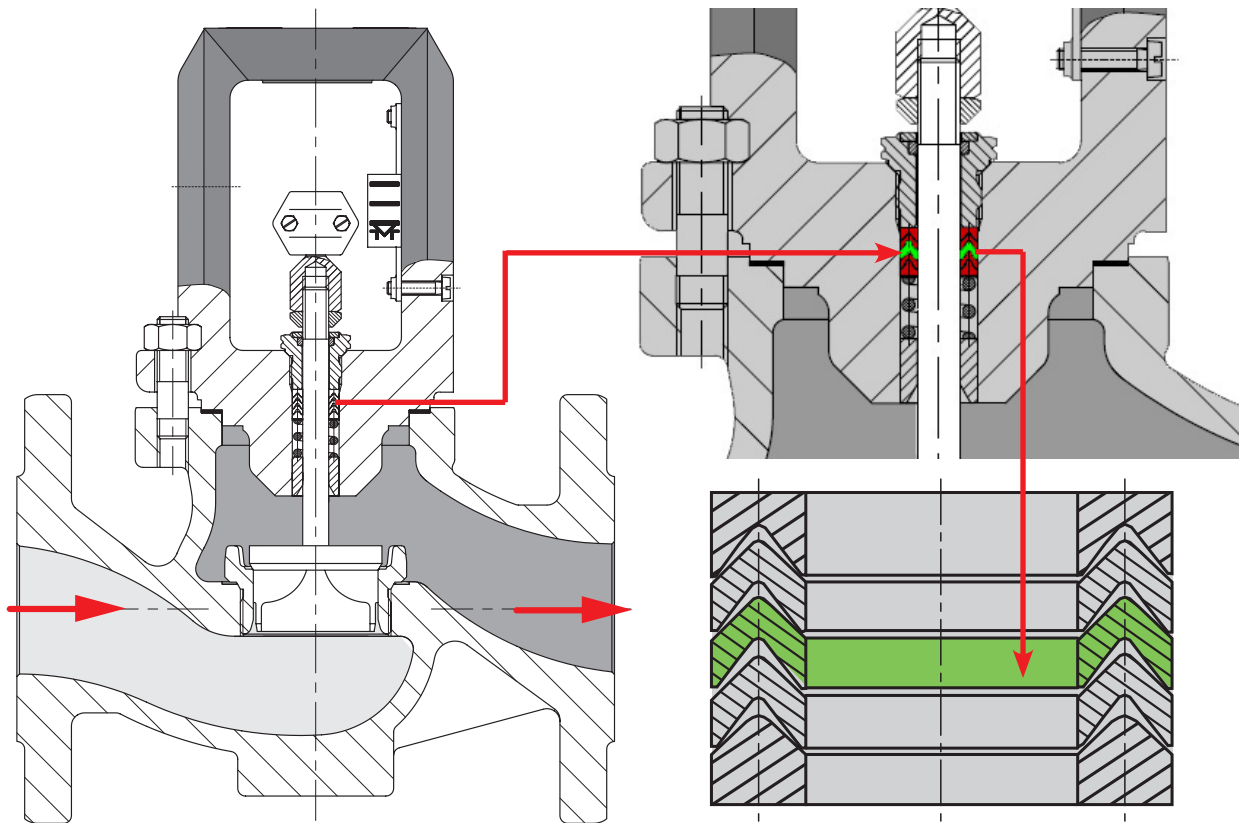


Figure 7.3.2.1.-1: Stuffing box for control valve Type 3241

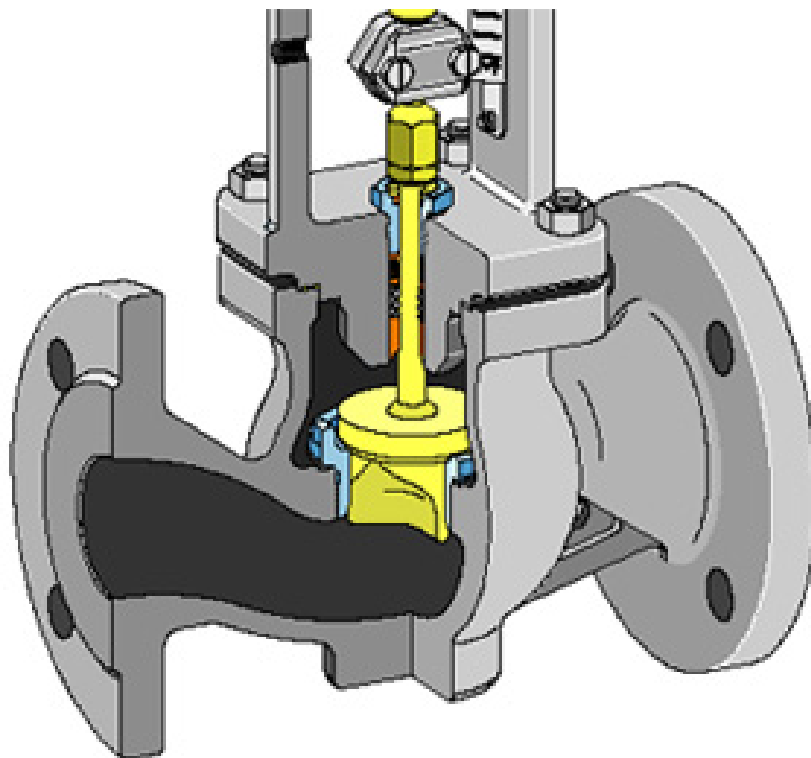


Figure 7.3.2.1.-2: Control valve Type 3241