

FCC Valve Stuffing Box

from Design Best Practices to Field Troubleshooting

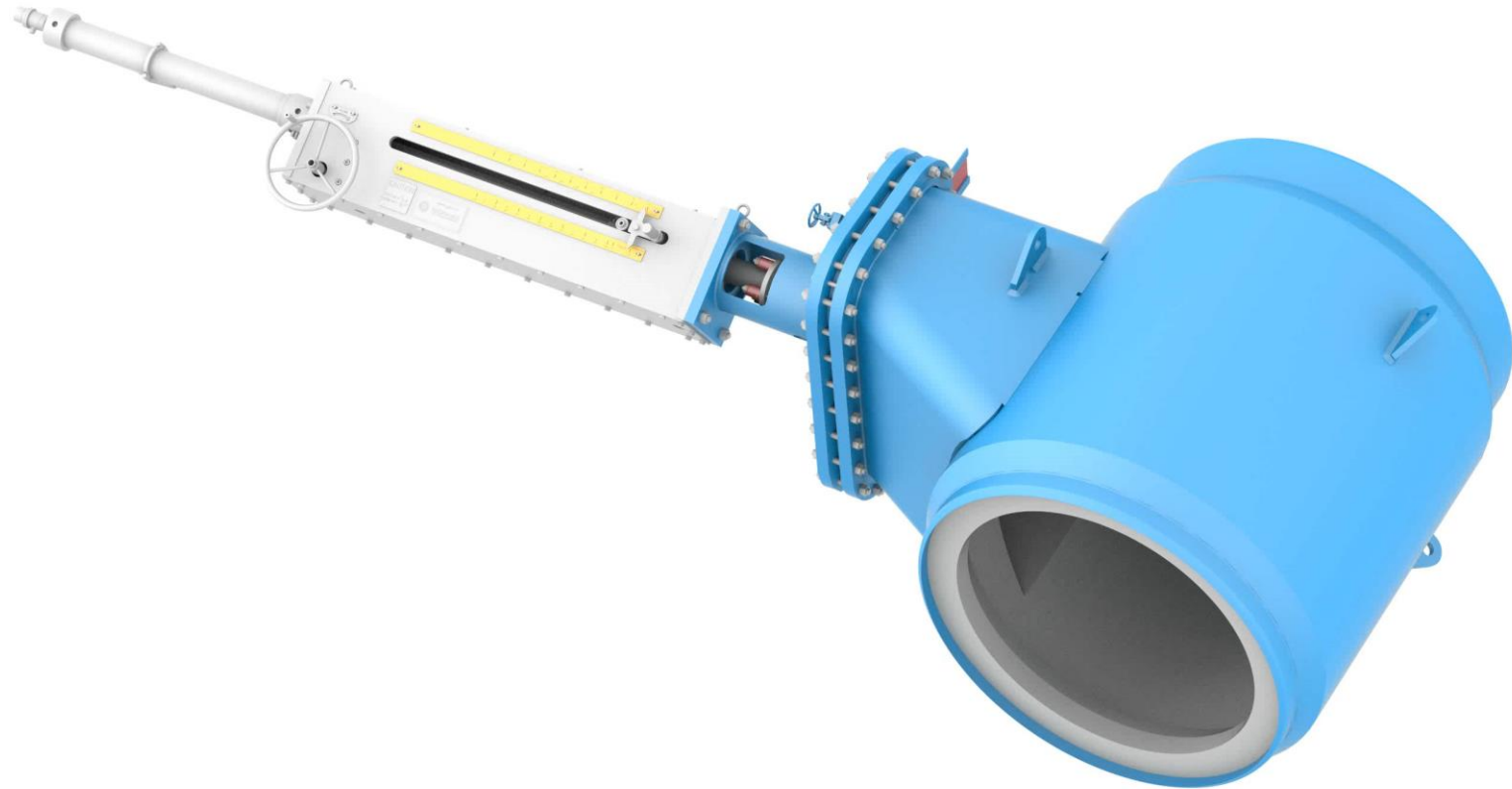
Engineering GREAT
the IMI Way ↘

Andrea Pusceddu
Technical Director
IMI Remosa - Italy



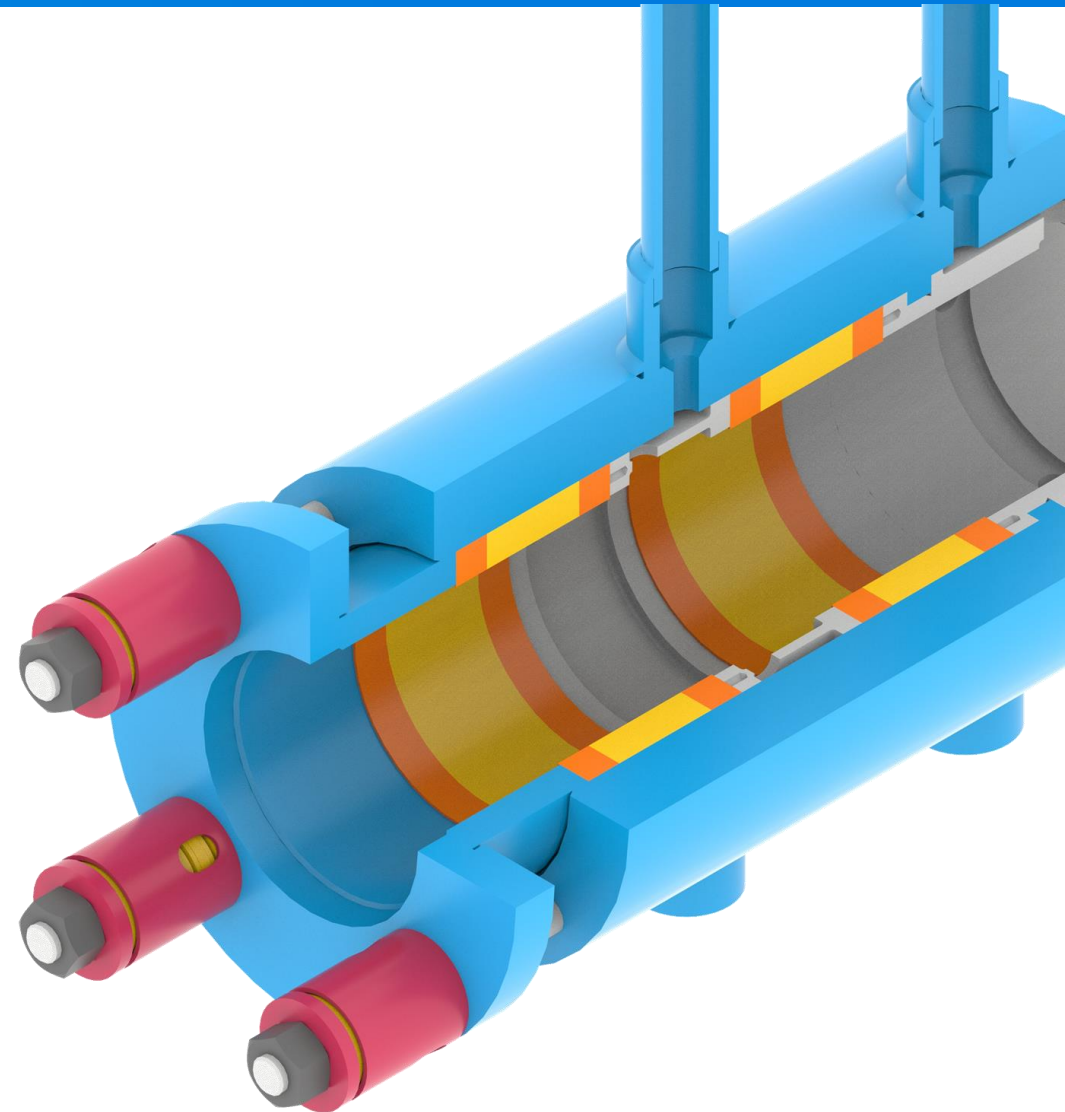
FCC Slide Valve

- ❑ FCC Slide Valve is a critical component for FCC Reliability.
- ❑ One of the most critical components of the SV is the stem stuffing box.
- ❑ Large Majority of emergency support from End Users is related to Stuffing Box issues.
- ❑ In virtually all cases, the root cause of the problem is in a improper lack of purging.

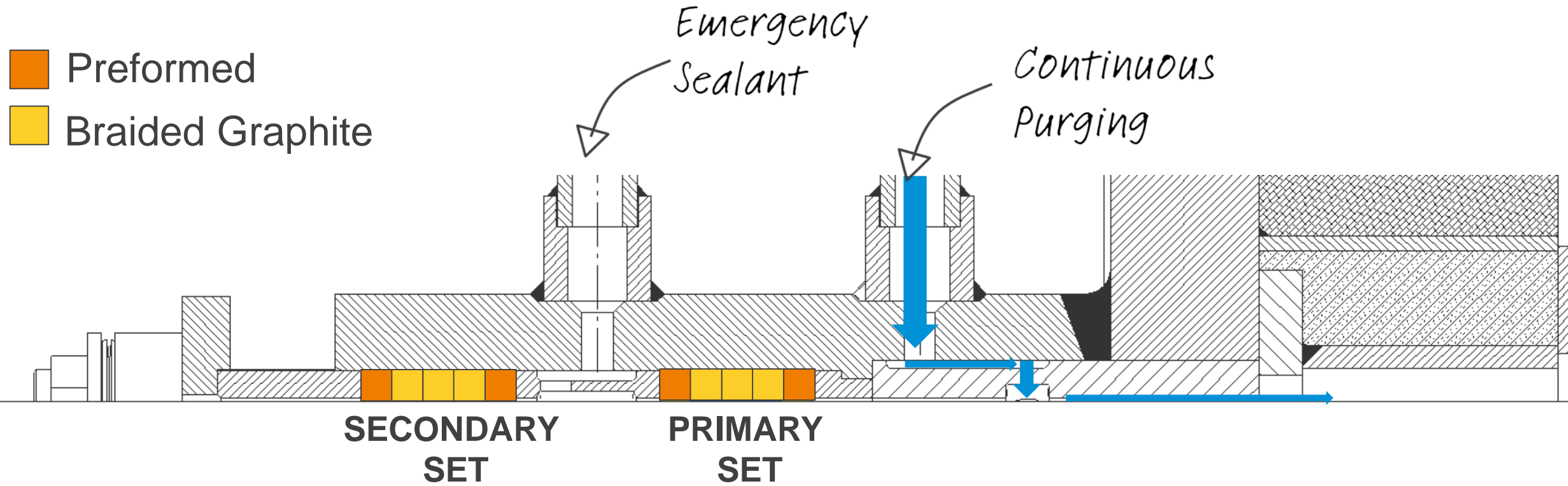


Stuffing Box Design

- Proper behavior of the Stuffing Box is ensured by a **continuous** purging (Steam, N2, Plant Air).
- The purging medium flowrate shall be **continuously** controlled.
- An excess of flow could damage the stem or the internals.
- Insufficient flow can lead to catalyst buildup, and backflow.
- A static Restriction Orifice (RO) is normally used to set-up the flow rate.

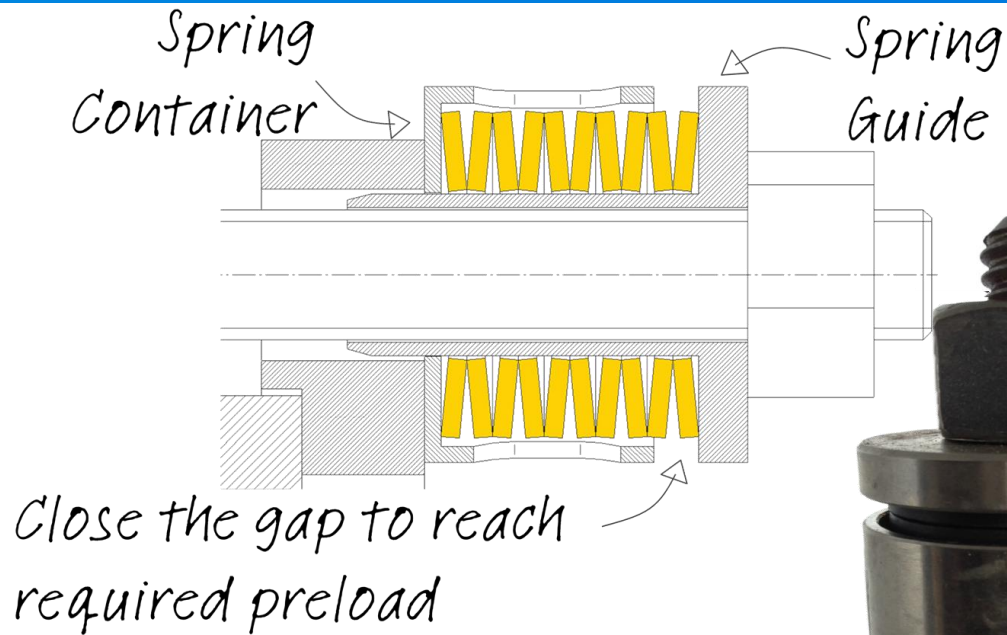


Stuffing Box Design



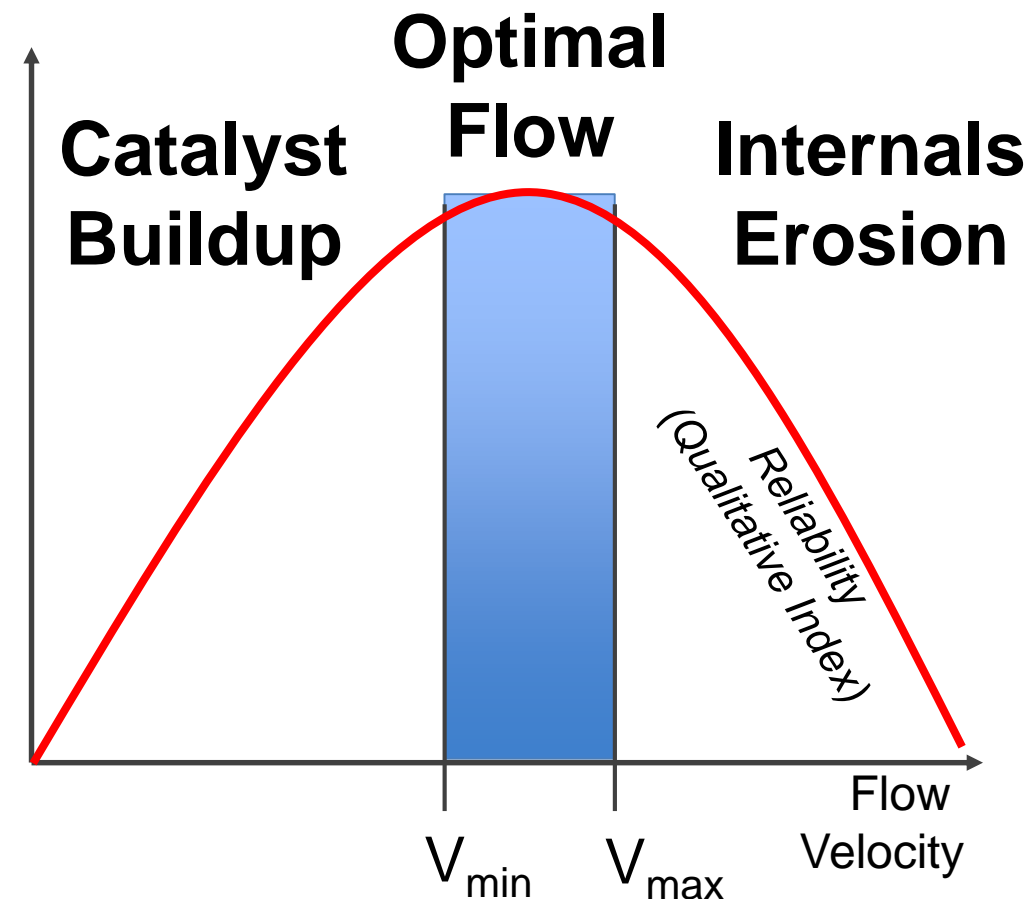
Live Loading

- Live Load is achieved with a set of flat springs washers.
- Springs are contained in a two pieces housing that:
 - *ensures a perfect sealing on the stuffing box.*
 - *provides an easy and failproof way to apply required preload.*
 - *visually shows if the packing needs to be retightened.*



Optimal Flow Velocity

- Main Purpose of the purging is to create a dynamic barrier against catalyst backflow.
- If trapped between the packing and the stem, catalyst may degrade surface finish and start a leak path, or build up a catalyst block.
- On the other hand, an excess of velocity will accelerate catalyst particles in the stem premises, creating eroding jets that may damage internal components.
- In order to avoid both side effects in the same time it's paramount to have a fine control of flow velocity!



What if Purging goes wrong? (insufficient flow)



...and what about if I have *too much* flow?



01/03/2013

Purging Media

Medium

Pros

Cons

Nitrogen

It's the most stable chemical element, does not react or oxidize.

Normally it's an expensive solution for the End User.

Superheated Steam

Cheap supply, no oxidation issues for graphite packing.

Steam shall always be superheated and dry, condensation is a big issue, e.g. due to poor pipes insulation.

Dry Air

Easily available.

May trigger combustion (e.g. partial burn process) and accelerate graphite packing volume loss (oxidation).

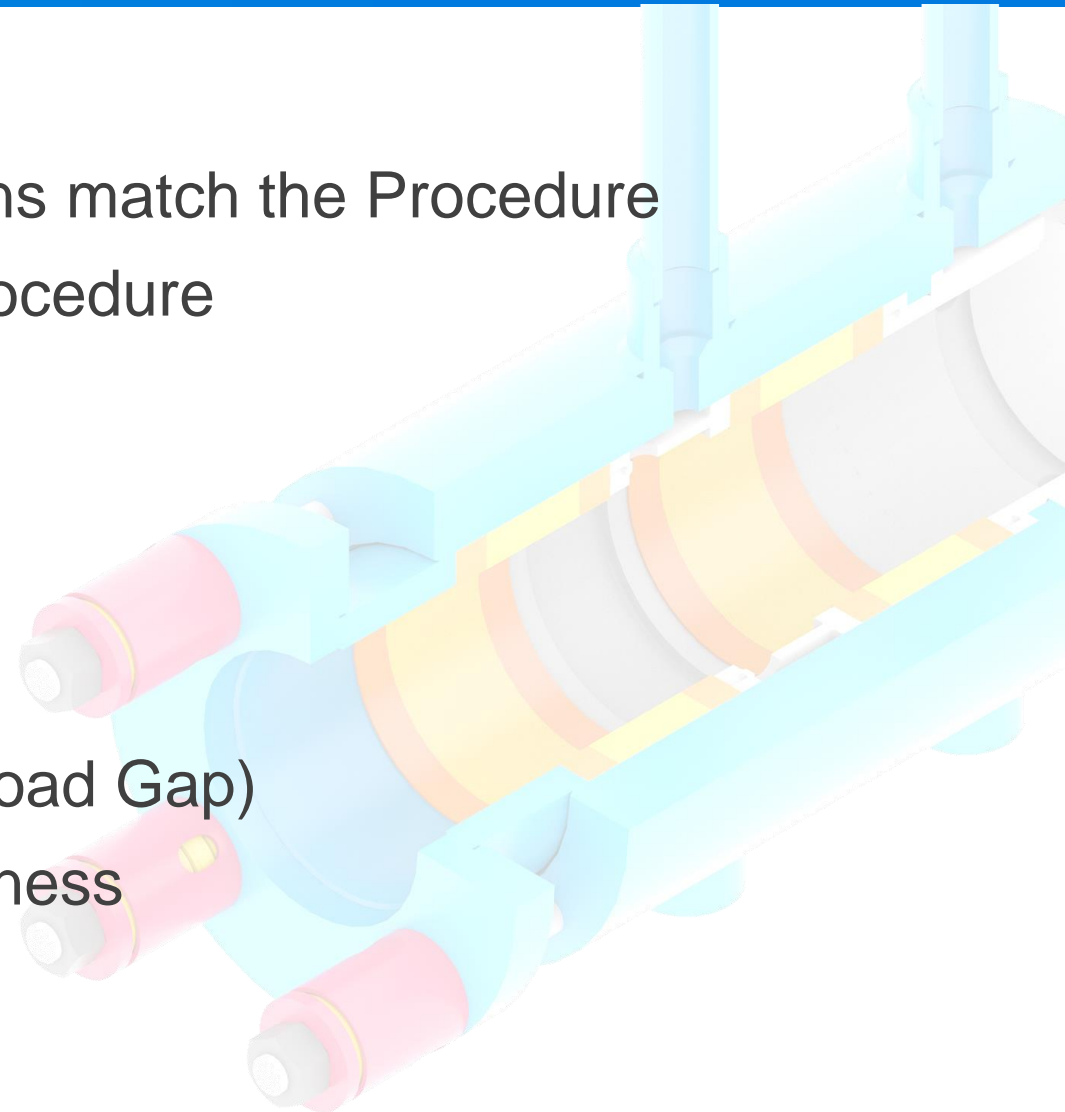
Checklist

Before Startup

- ☐ Verify that Purging Medium type and conditions match the Procedure
- ☐ Verify Restriction Orifice Size matches the Procedure
- ☐ Verify all valves along the pipe routing
- ☐ Verify Packing Preload (Live Load Gap)

During Operation

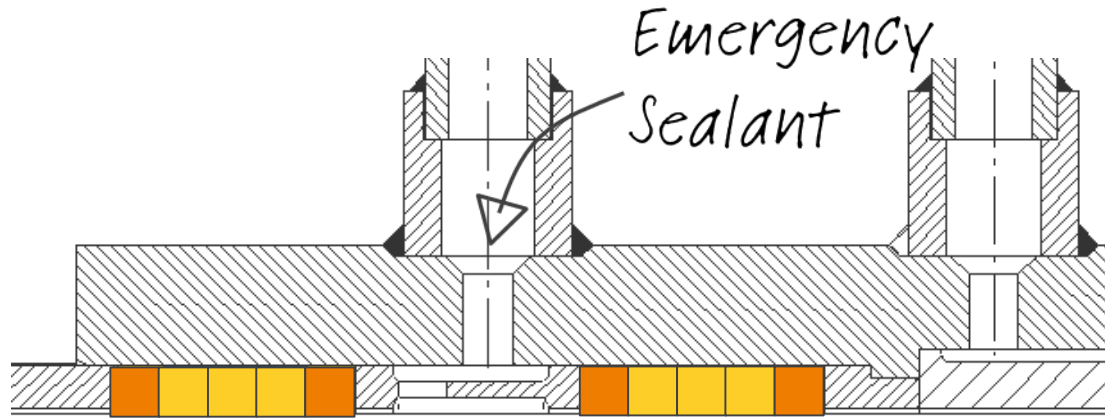
- ☐ Daily Check the Purging parameters
- ☐ Weekly Check of the Packing Preload (Live Load Gap)
- ☐ Weekly Inspection of the stem surface cleanliness



Troubleshooting & Tips

- During Commissioning and first months of usage it's normal to experience a reopening of the Live Load Gap. Simply **re-tighten the gaps**, no special tools are required.
- Do not underestimate the importance of a **continuous** purging. In some cases even a short period without the correct flow may jeopardize valve reliability.
- Remember that catalyst leakages are **non reversable** and self increasing process. Once a leakage is detected something it may be possible to stop it by increasing the Packing Preload, but this would not reverse any internal damage.
- Remember that once a leakage is visible, the catalyst already traveled across Primary and Secondary Packing! Prepare for an **Emergency Sealing** Attempt.

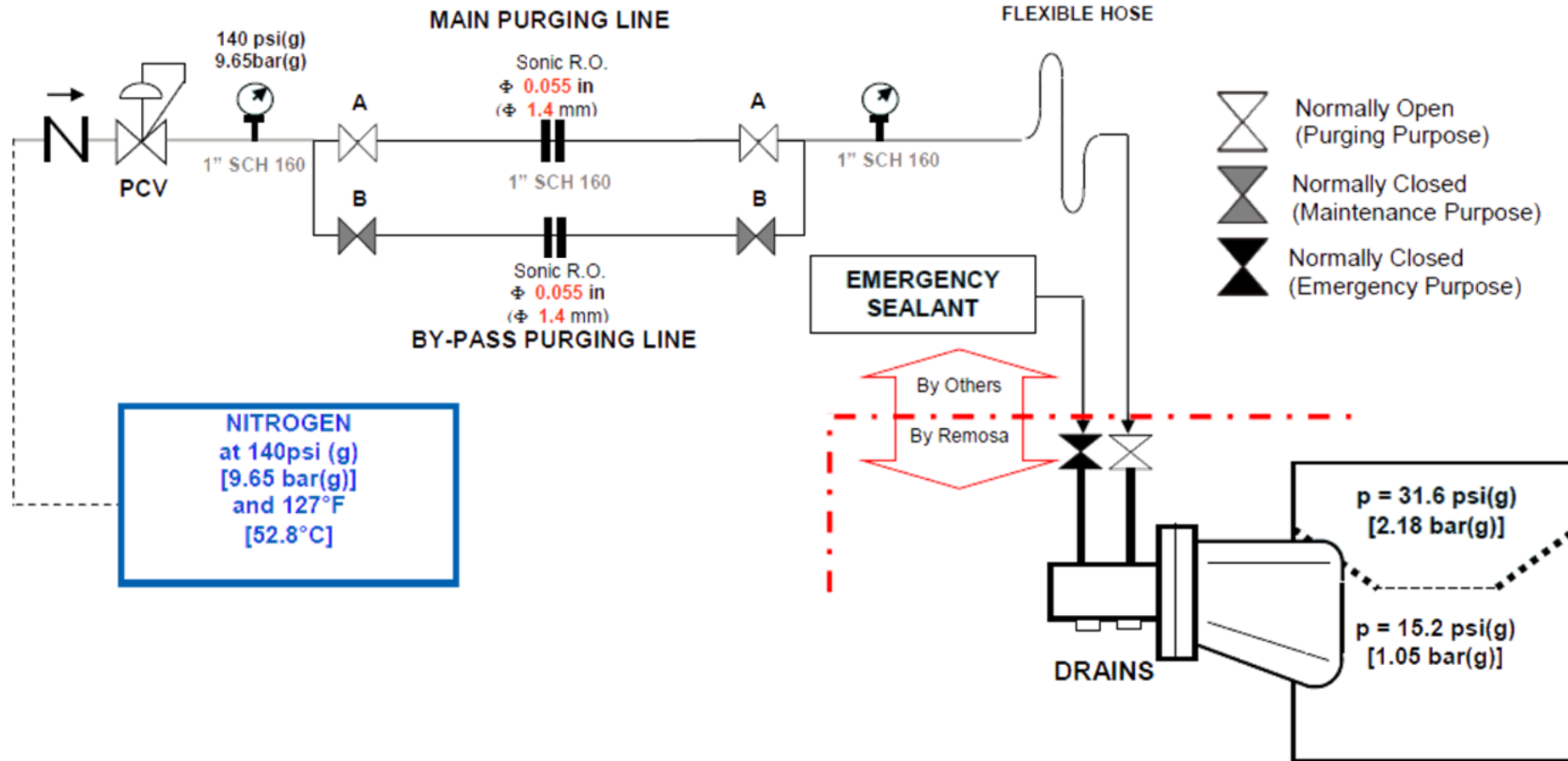
Emergency Sealant Kit



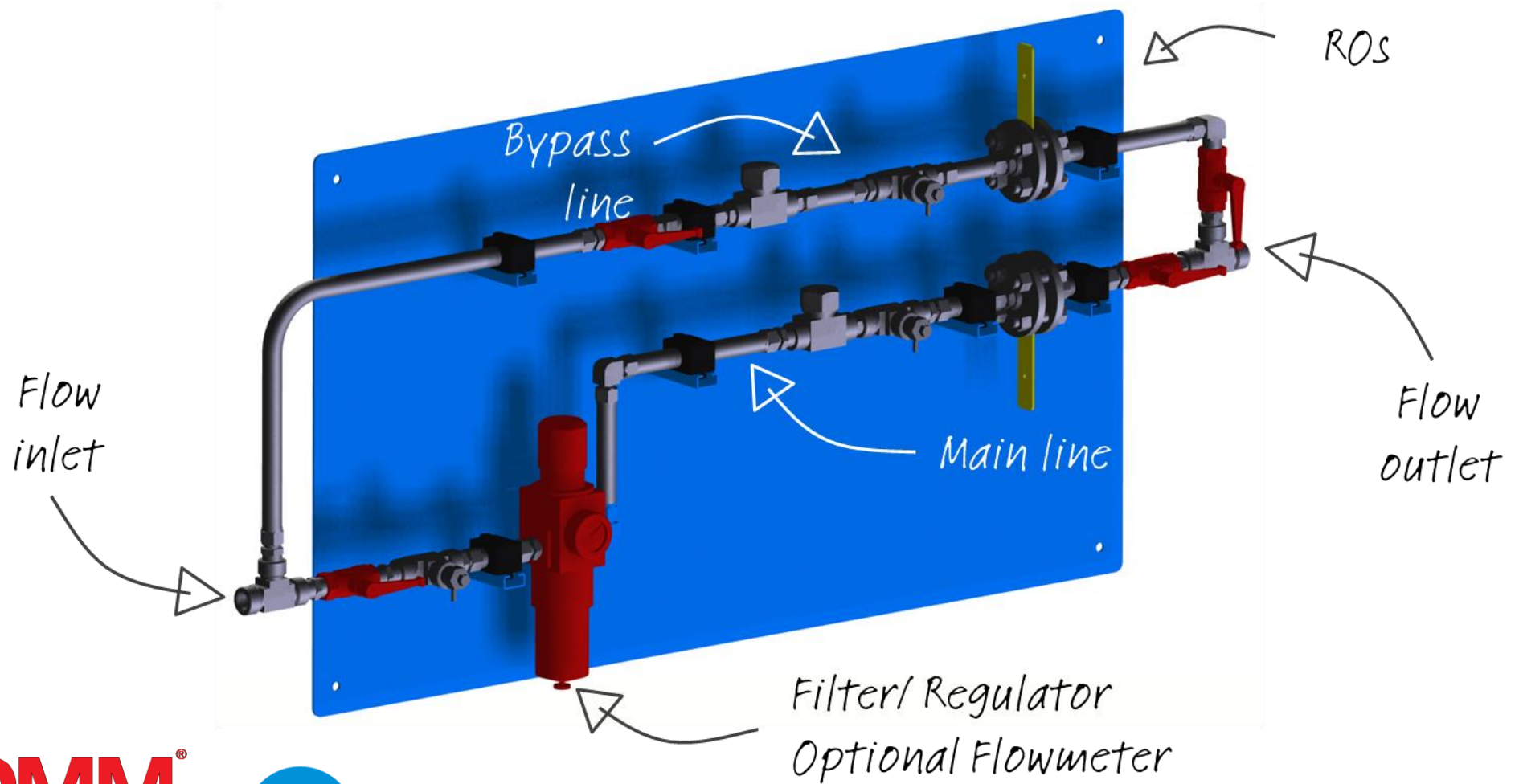
A graphite based special compound can be injected in the Emergency Sealant Port using an high pressure hand pump, in order to stop or decrease the leakage in case of safety concern.



Base Purging Layout



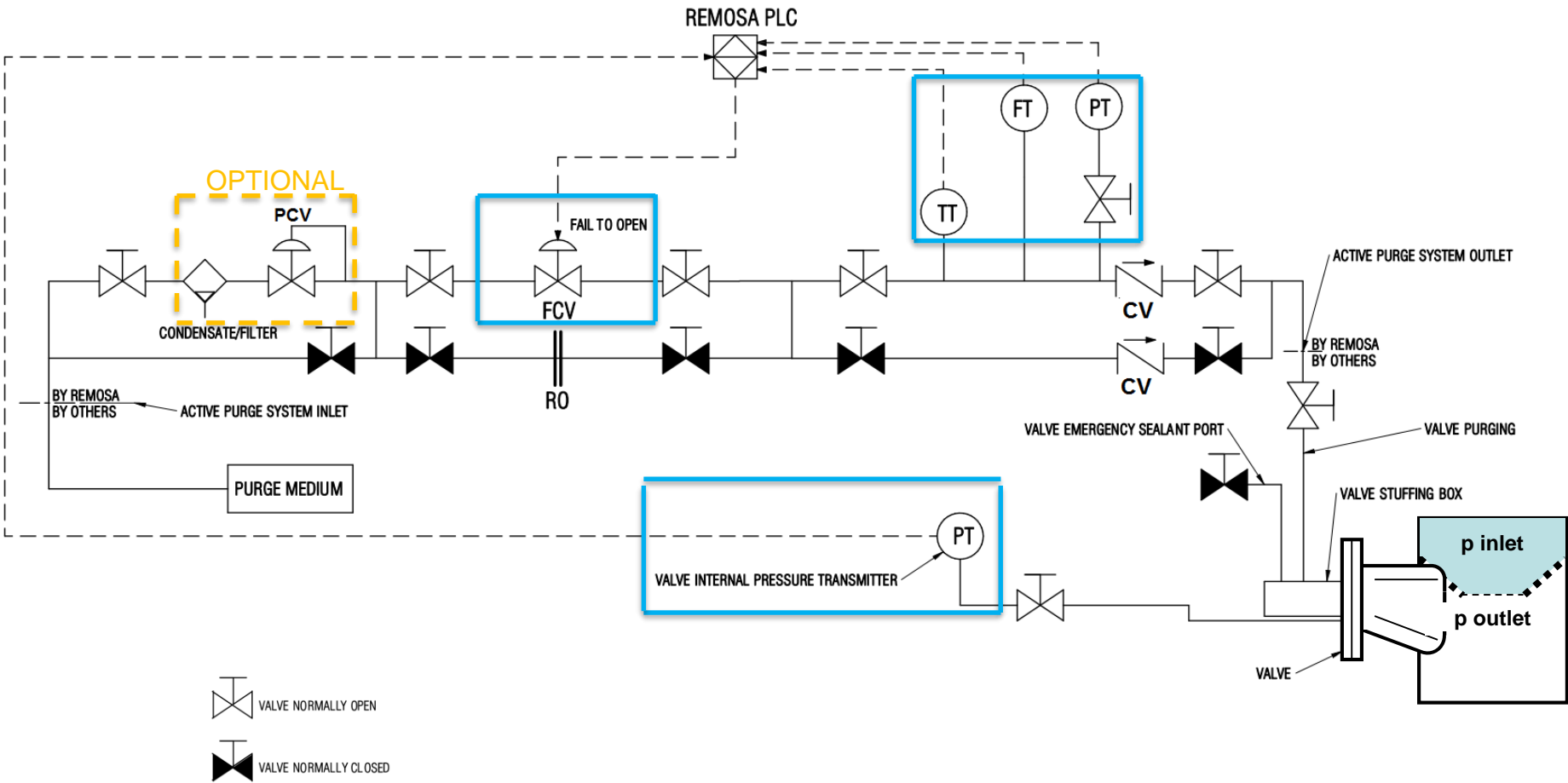
Basic Purging Panel



Limitations of Static Purging Systems

- ❑ Static purging systems work as long as the purging medium and the process fluid matches the expected/nominal conditions (temperature, pressure). Outside this scenario the system loses its set-up: too much flow or insufficient flow.
- ❑ Malfunctioning can be detected only by human operators, depending on visual indicators installed in the purging systems (flowmeters, pressure gauges).

Active Purging System Layout



Active Purging System



Conclusions

- ❑ Stuffing Box is one of the most critical components of an FCC Valve.
- ❑ Stuffing Box failures are hardly recoverable during service, but can be prevented with simple and easy checks.
- ❑ Active Purge System is the latest technology development in this field, and will bring an unprecedented layer of additional safety and reliability to your Process.

Thank You!