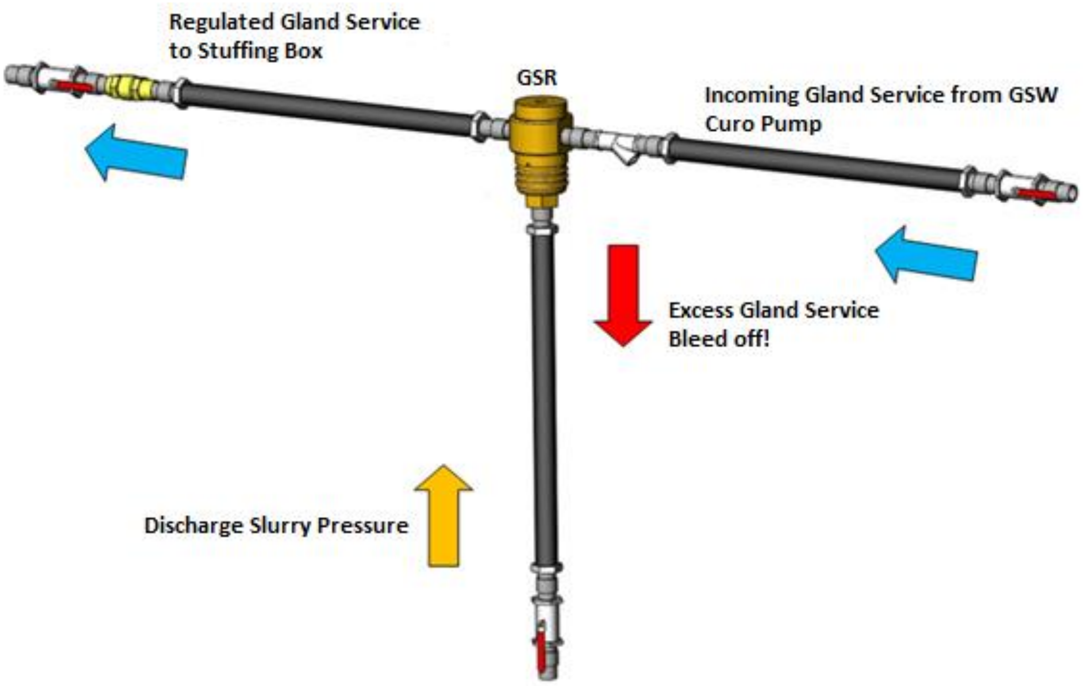
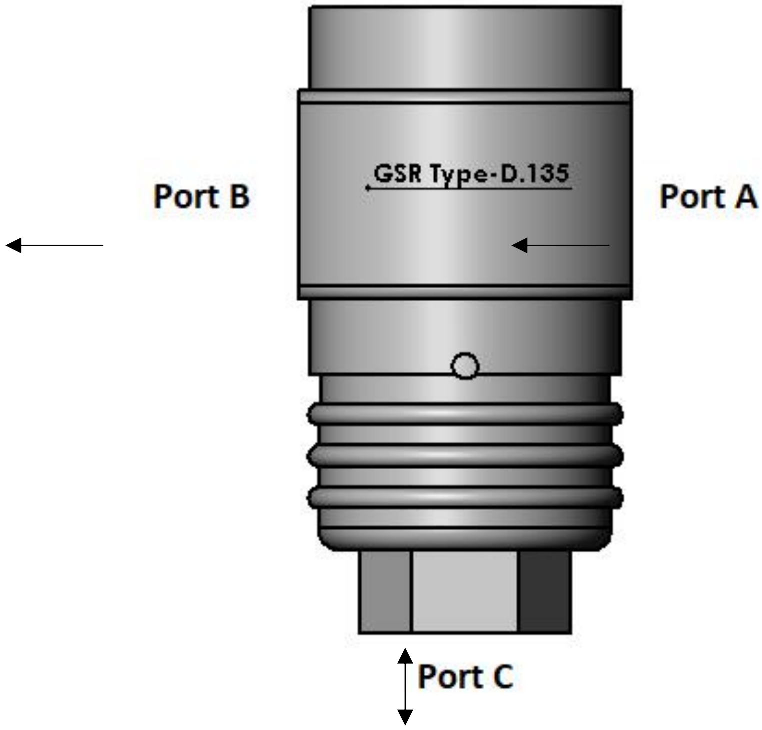
A schematic shown below illustrates the flow of Gland service through a single GSR Control Unit.



The GSR Valve consists of both; a self-regulating flow control device and a self-regulating pressure control device. The GSR Valve has three ports for flow entry and discharge:

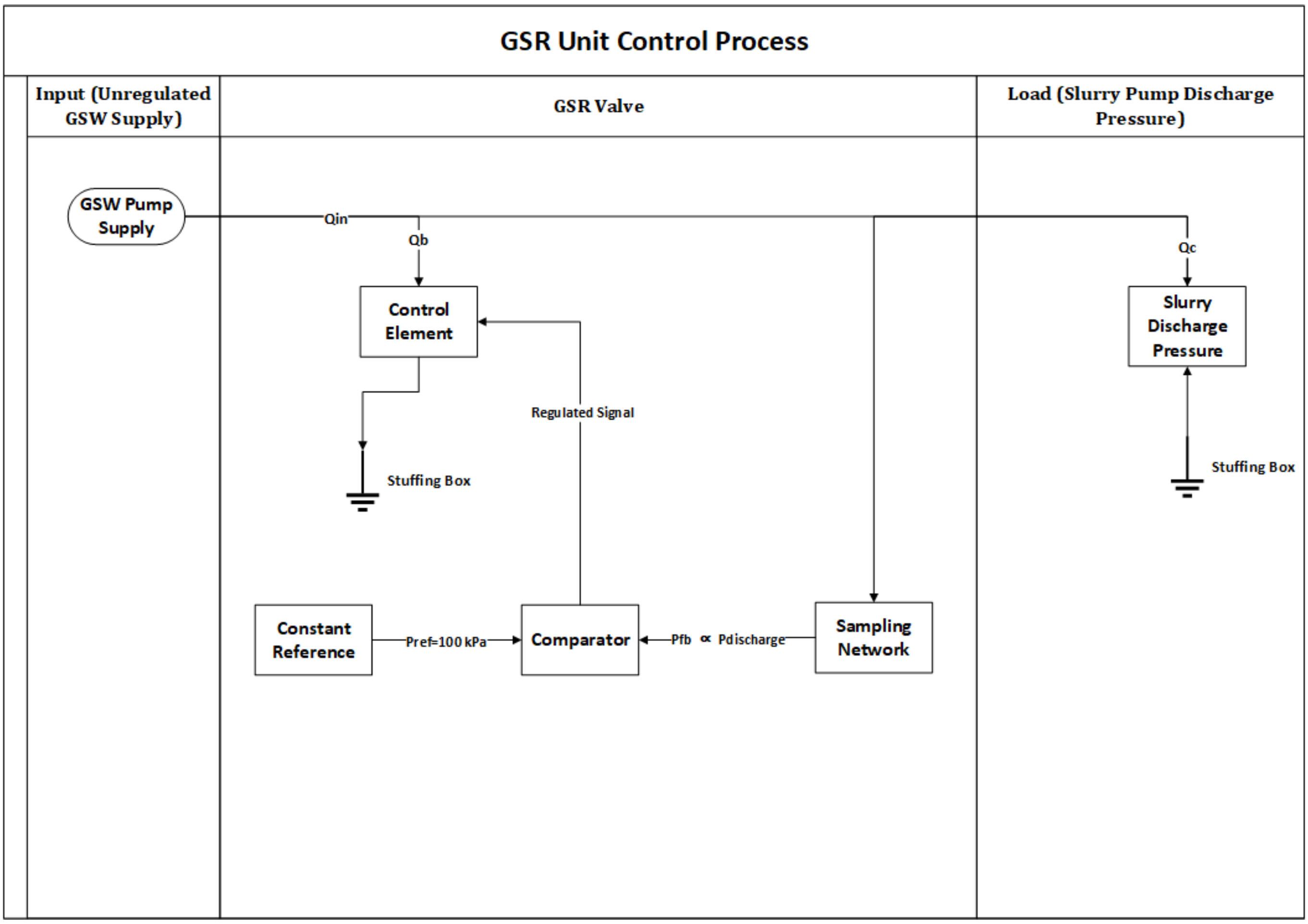
1. **Port A, The incoming Gland Service Port:** this is the input/upstream port. It connects the GSR Valve to the incoming **unregulated gland service** from the GSW Pump.
2. **Port B, The regulated Gland service to stuffing box port**: this is the output/downstream port. It connects the GSR Valve to the stuffing box of the corresponding slurry pump.
3. **Port C, The discharge slurry pressure port**: **Port C** of the GSR is connected to the discharge of the corresponding Slurry Pump.



The internal mechanism (Spool arrangement et al) of the GSR Valve regulates the flow and pressure at Port **B & C** in accordance with the Load Pressure at **Port C**. This internal assembly ensures that the **Ports B** is always approx. **100kPa** above the Slurry Pump's discharge pressure.

The flows through Port-A, B and C are $\boldsymbol{Q_A}$, $\boldsymbol{Q_B}$, and $\boldsymbol{Q_C}$ respectively. And $\boldsymbol{Q_A = Q_B + Q_C}$ **Please Note that $\boldsymbol{Q_A = Q_{in}}$, the incoming Gland Service Flow for the respective GSR Unit.**

The flow diagram below illustrates the GSR Control Unit's working principal. The self-regulation is achieved by having the control element (GSR Valve) in parallel with the Load (Slurry Pump Discharge Pressure).



Example 1: **Transient Slurry Discharge Pressure**

Imagine the Slurry discharge pressure is not constant, and the discharge pressure ***increases***. The **sampling network** connected to the discharge of slurry pump measures this ***increase***, and transmits this signal to the **comparator** element of the GSR Valve.

$$P_{FB} \propto P_{Discharge}$$

Here P_{FB} is the Feedback Pressure to GSR Valve.

The **100kPa** offset pressure is added to P_{FB} and the **comparator** sends this **new** regulated signal with ***increased*** amplitude (pressure) to the **Control Element** of the GSR Valve.

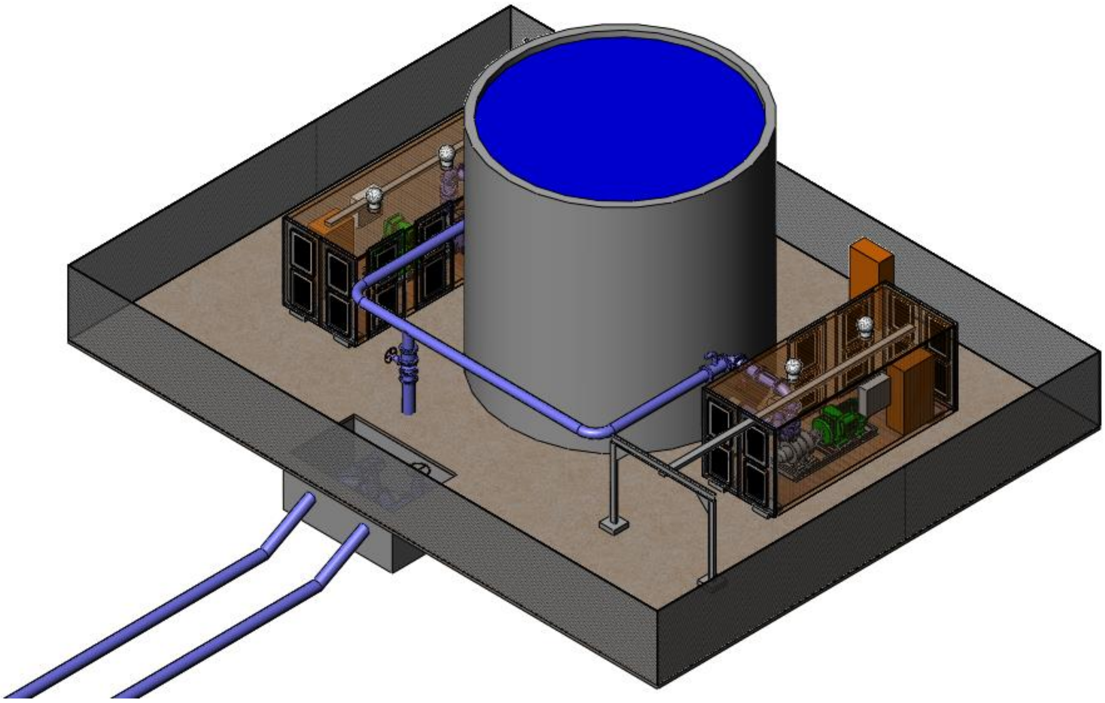
This causes the Control Element to draw **proportionally* more Q_B into the stuffing box, keeping the Approx. 100 kPa above the Load pressure $P_{Discharge}$

The internal assembly is designed such that the pressure drop across the **Control Element** is ****independent*** of the flow through the valve, and is governed by the load at its **port C**.

**Because of the high nonlinearities associated with flow control, it is impossible, in practice, to design such a valve where the pressure drop is completely unaffected by the flow through the Control Element. So, in practice the offset pressure could be 95 kPa or 106 kPa for example, depending on the Load.*

Project Management: Anglo American – 6 Megalitre Booster Station

We were an integral part of the design, supply and installation of the 6 mega litre booster station for the Mogalakwena Mine, Anglo American.



The offer was to create a 6 mega litre pump station to be supplied and installed upon the existing 30km pipeline, the aim was to reduce the friction in the pipeline and thus extent the life of the pump line. The design is modular and mobile. All aspects can be broken down and moved to another location. The design was done with the foresight of having the 10 mega litre in mind for a future date. Thus sufficient capacity was allowed for not only in the tank design but in the pumping design as well.

Currently we are looking at the 10 megaliter option which would include the removal of the entire 30 km pipeline and installation of a new line along with all pumping stations and reservoirs.

Thus our specialty is to design for pumping applications for mining, industry and agricultural use.