9.2.5.1 General notes for the calculation and selection of actuators

- A sufficient additional safety factor should always be planned, since an exact calculation of the required actuator thrust is quite complex and there could be a difference in the force balance from final inspection to after commissioning under process conditions as well as after long term operations.
- For DIN/DVGW valves and other quick closing and safety control valves (TÜV certificated) the actuator safety factor must be about 2.
- SAMSON Valve Sizing (SVS and SVSS) creates a general warning, if the safety factor become < 1.1. This min. safety factor expects ideal environmental condition like an in-house installation- and equates to the competitive conduct.
- Environmental conditions at delivery and plant location are often unknown as well how long valves are stored before commissioning. Valves may be delivered in hazardous areas and stored less protected. Then sealing material will be attacked from rain, sand and petrochemical dust and sometimes it can take month before the plant is ready for start up. Any packing-stem system will suffering more under static not pressurized conditions.

The valve system friction may increase also from lack in commissioning (pipe installation without force compensation due to temperature elongation). Long term age-hardening of packing and sealing material occurs in case of no proper frequently maintenance.
It is recommended to use a higher than 1.1 safety factor in case of those unknown (not ideal) random conditions.
Therefore the required actuator force (trust): $F_o = 1.25 \cdot F_a$

- Large effective areas reduce the negative influence of friction forces on control valve performance by minimizing hysteresis and dead band.
  At request of the highest control controllability for expensive products like insulin also a low price actuator of smallest size may close against a moderate low shut down pressure. The valve performance and controllability interacting to the production quality and quantity, which significantly can improved with a larger actuator size selected in the first priority for lowest hysteresis and not for the shut down pressure.
- Diaphragm actuators have a considerably smaller hysteresis than piston actuators (up to 40 % hysteresis due to piston seals), which the positioned is likely to be unable to compensate on long term.
- Several spring assemblies with smaller springs distributed over the circumference offer a greater accuracy and mechanical stability than fewer large springs arranged in the center. In addition, the variability of the spring range and the stiffness of the actuator are increased
- The actuator characteristic should, ideally, be linear and the hysteresis small. Linearity errors stem mostly from a changing diaphragm area which might possibly result in an inadequate actuator thrust in the closed position.

The actuator selection should also consider durability and maintenance.

- An application in the following climatic conditions should be guaranteed:
  - ◊ Moderate
  - ◊ Cold
  - ◊ Dry warm
  - ◊ Humid and warm
- Constructional arrangement of the valve interface and general firmness of the actuator should meet all requirements considering at the same time ambient influences. Demands regarding earthquake safety and/or radiation resistance in nuclear power plants are examples of this point.
- The selection of a suitable actuator should always consider possible future enhancements. Subsequent mounting of a hand wheel or positioner might be taken as examples. Mounting possibilities of further accessories should also be considered.
- Fatigue strength and impact resistance ought to be considered e.g. as they occur on ships.
- Corrosion-resistant paint coatings should be applied, in order to protect the actuator and guarantee the specified service life.
- All aspects of accident safety must be considered, in order to protect users against injuries.

- An adequate quality assurance system (ISO 9001) and attention paid to valid standards and regulations is necessary, to guarantee correct „state of the art“ products.