

Safety precautions for High-Pressure Technology

If the proper safety precautions are installed and sound working practices are adhered to then using high-pressure equipment is very safe. We would therefore like to encourage you to work in this exciting and very rewarding field. The dangers of high-pressure should always be borne in mind and therefore it is essential to maintain the highest safety precautions at all times.

Every user of high-pressure equipment has to be aware that high-pressure also means potential energy. The energy depends on pressure, temperature, volume and the compressibility of the fluid. Gases are very compressible and therefore contain a lot of energy when compressed, but liquids are also compressible, for example water is compressed by 12 % at 4000 bar. The power of a high-pressure liquid can be demonstrated by the industrial high-pressure water jet cutting. However the potential dangers of high-pressure technology can be kept under control if the necessary precautions have been taken and a suitable material of construction is chosen for each specific application.

Most high-pressure units can be built with SITEC components. These stainless steel components should be used whenever possible because of their proven reliability in many situations over a long period of time. The pressure containing components are monitored at all stages of their manufacture. Details of the tests may be known by use of the Heat-No which is stamped on each body part.

Please note the following special working conditions:

- **High temperatures:** Use of nickel- and cobalt-base superalloys. Strength calculations based on creep and rupture strength. Increased danger of corrosion.
- **Low temperatures:** Danger of brittle fracture. Improvement of the notched-bar impact strength by increased nickel content.
- **Corrosion:** Pitting, stress corrosion cracking, galvanic corrosion, oxydation.
- **Hydrogen embrittlement:** Depends on H₂ partial pressure and the working temperature. Austenitic stainless steels are best suited for this application.
- **Oxygen service:** Absolute cleanliness mandatory for all wetted parts.
- **Cycling pressures:** May reduce the material strength after 10⁶ - 10⁷ cycles to 25-30% of the tensile strength. By autofrettage or with shrunk cylinders the strength for infinite life expectancy may be increased by 80-150%.

Additional safety precautions:

- Professional introduction and training of staff and operators. Request the SITEC HP catalogue for the maintenance and technical staff.
- Externally heated pressure vessels operated at high internal pressures should only be subjected to moderate temperature gradients across the wall. Pressure and temperature induced stresses are additive and may exceed the safe operating strength.
- High-pressure tubing must never be heated for bending as this would reduce its material strength. For information on bending radii see catalogue 770.02.
- Vent lines for rupture disc safety heads and relief valves should be sized large enough and be piped to the outside of the building.
- Emergency instructions have to be fixed visibly to the plant.
- Fire extinguishers and a first-aid kit should be ready at hand.
- Safety devices should protect the operating staff. They may range from a simple mirror-system for the surveillance of the operation to safety enclosures with remote operation and monitoring.