

Safety Requirements

The PED is primarily concerned with safety. It is therefore important to understand what possible risks the pressure equipment pose to people during normal operation, possible fault conditions or as a result of misuse. Start by describing the equipment and its purpose, and then consider all possible fault scenarios.

Safe Operating Limits

The maximum pressure the vessel/pipework will contain or generate in service, it must include any static head. The pressure relief valve must be set so that this pressure can't be exceeded.

The maximum temperature the vessel/pipework will experience in service at its hottest part. Suitable safety margins must be included (ESR 2.2.3b)

When determining the operating limits it is important to consider all reasonably foreseen fault scenarios that the vessel/pipework could experience as part of the whole pressure system, such as: -

- Overheating/ loss of cooling
- Unstable chemical reactions
- Fire and explosion
- Leakage from one vessel chamber to another (heating and cooling jackets, heat exchangers etc.).
- Surges and water hammer effects
- Over pressure caused by slow discharge through safety devices
- Vacuum conditions caused by fast discharges or steam condensing
- Very low temperature, below 0°C, caused by the process or adverse weather conditions.

If any of the above conditions are possible and the risk can't be eliminated by any other means, such as using suitable protective device, the design conditions should be increased.

Design Considerations (ESR 2.0)

Materials :- The material used to make the vessel/pipework must resist corrosion and erosion by the fluid it will contain and any vapour the fluid may produce. (ESR 2.6)

If corrosion is permitted suitable allowances must be made to the vessel thickness and adequate inspection access provided. (For inspection access BS470 is recommended)

The vessel material must not degrade at the design temperature, consideration should be given to the following (ESR 2.2.3b):- Ageing, Creep, Phase changes, Brittle fracture, Thermal fatigue etc.

Cyclic Loading :- A Fatigue analysis should be considered for the vessel and its support structure if it is subjected to any of the following (ESR 2.2.3b):-

- Pressure cycling or major pressure fluctuations
- Thermal cycling
- Filling and emptying cycles or load fluctuations

Should the life of the vessel be restricted?

External Forces:- All external forces acting on the pressure equipment must be carefully evaluated

- Vessel stability during filling and operation. (ESR.2.9)
- Pipework loading. (ESR 6)
- Thermal stress caused by thermal expansion. (ESR.2.2.3b)
- Wind, snow and ice loadings and toppling moments. (ESR.2.12)
- Seismic effects (ESR 2.12)
- Fire and explosion of adjacent equipment (ESR.2.12)
- Lifting and handling during transportation and

installation. (ESR 2.2.3c)

- Misuse (Damage caused by passing vehicles etc.) (ESR.2.2.1)
- Maximum weight of contents during service and during test. (ESR.2.2.1)

Protection:-

The pressure equipment must incorporate adequate protection:-

- Safety devices (Relief valves, bursting discs, vacuum breakers etc.) (ESR 32.11, 2.10)
- Interlocks
- Warning labels (ESR 3.4)
- Guards covering hot surfaces and dangerous discharges etc. (ESR 2.3)
- Inspection access (ESR 2.4)
- Adequate drainage and ventilation of Vessel and associated pipework (ESR 2.5)

Instructions (ESR 3.4)

Operating :-

Adequate information must be given to the operator to enable the equipment to be started, run and shut down in a safe controlled manner. In addition:-

- The safe working limits of the equipment
- Any specific hazards associated with the process or fluid used.
- Daily inspections and / or safety checks.
- How to identify fault conditions and necessary corrective action
- Any other information that the operator should be aware of to ensure safe operation of the equipment.

Maintenance:-

The maintenance instructions should typically include:-

- Installation and piping instructions.
 - Size / rating and pressure setting of safety valve and any other protective device.
 - Safety aspects, such as permitted use and permitted vessel contents etc.
 - Inspection requirements, unless the equipment is covered by a written scheme of examination.
 - Preparation for internal inspection
 - Venting and draining procedure
 - All parts that require periodic replacement
 - Any special requirements that must be followed during dismantling and assembling the equipment, a detailed drawing may be adequate for most equipment.
 - Calibration of instrumentation.
-