

Materials + Welding



ESR 4

Materials used for the manufacture of pressure equipment must be suitable for such application during its scheduled lifetime unless replacement is foreseen.

All pressure vessel materials must be sufficiently ductile and tough.

Steel is considered to be sufficiently ductile if its elongation is not less than 14% and its impact toughness is not less than 27J. However impact toughness of a pressure vessel steel should not normally require testing unless its service temperature is close to its brittle transition temperature or there is a risk of brittle fracture.

Consideration should be given to the following material properties listed in ESR_2.23: -

- Yield strength
- Tensile strength
- Creep or any other form of ageing
- Fatigue
- Toughness
- Corrosion resistance, (chemical resistant to the contained fluid)
- Stress concentrations

Note

Not all materials are suitable for pressure vessels. Discontinuities such as nozzles, heads, supports etc. can generate very high peak stresses, which only ductile materials can absorb. Structural steels should not be

used to retain pressure except on low risk items.

All materials must come from a steel maker with a QA system approved by a European Accreditation Body (ESR 4 last paragraph); otherwise additional material testing may be required.

The material specification must be approved by one of the following forms: -

- Materials specified in a harmonised material standard.
- Non harmonised materials give European Approval (EAM)
- Particular Material Appraisal

Harmonised materials

The following material standards are considered harmonised with the PED subject to the statement below.

- EN 10028 parts 1 to 7
- EN 10213 parts 1 to 4
- EN 10222 parts 1 to 5
- EN 10269 (for fasteners)
- EN 12420 (copper - forgings)
- EN 12451 (copper and copper alloys - for heat exchanges)

"... presumption of conformity to the ESRs is limited to technical data of materials in the standard and does not presume adequacy of the material to a specific equipment. Consequently the technical data stated in the material standard should be assessed against the design requirements of the specific equipment to verify that the ESRs of the PED are satisfied.."

European Approved Materials

Many materials have been submitted, but so far none have been approved. Check the official PED website for further details.

Particular Material Appraisal

If the material is not listed in a harmonised material standard or has not been given European approval, it must be individually appraised every time it is used in a different application. If the material is listed in a recognised pressure vessel code then it should be acceptable providing it

is suitable for the application.

Permanent joining (ESR 3.1.2 + ESR 4))

The directive refers to welding as permanent joining, (permanent joining could also include a wide variety of other joining processes which are outside the scope of this article).

ESR 3.1.2 last paragraph. The examinations and tests to approve welding procedures and personnel must be approved by a third party, ASME employer certification is not acceptable. These examination and tests must satisfy, or be equivalent to the requirements of the harmonised standard. When using alternative standards such as ASME 9 the additional testing and acceptance criterion stated in the harmonised standard should also be applied.

Welding Equivalence: - Draft Guideline 45

Welding consumables are treated as materials and must fulfil the relevant requirements of:

- 4.1
- 4.2(a)
- 4.3 First paragraph, Certificate of conformance required

These requirements must be fulfilled for the deposited weld metal and the joined structure.

The weld must be sufficiently ductile and tough. When carrying out weld procedure tests consideration should be given to impact testing if there is a risk of brittle fracture and an all weld tensile test to determine weld metal elongation. However it could be argued that an all weld tensile test is not required if there is sufficient confidence that an acceptable value would have been achieved had the testing been carried out.

Note:- Material appraisal required by ESR.4.2(b) is not required for welding consumables
