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Technical Requirements in the PED in relation to former National Legislation with a particular reference to materials

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Administrative differences – PED contra AFS 1994:39

The main difference between the **Pressure Equipment Directive (PED)** and the former Swedish Ordinance **AFS 1994:39** concerning Pressure Vessels is that a piece of pressure equipment which complies with the PED and bears the CE marking is allowed to be put into service under the conditions specified by the manufacturer, whereas according to the AFS 1994:39 i.a. an installation inspection, for vessels comparable with a category II vessel, was to be performed by an Accredited Body.



Forms for the selection of materials according to the PED

According to section 4.2 (b) of Annex I of the PED, the following forms are available:

- ❑ by using materials which comply with harmonized standards
- ❑ by using materials covered by a European approval of pressure equipment materials in accordance with Article 11
- ❑ by a particular material appraisal

Forms for the selection of materials according to the AFS 1994:39

According to the former Swedish Ordinance AFS 1994:39 concerning Pressure Vessels, the following forms were available:

- ❑ by using materials covered by Swedish standards for pressure equipment materials, which are listed in the Swedish Pressure Vessel Code 1987 or the Swedish Piping Code 1978
- ❑ by using materials covered by an officially approved firm specification
- ❑ by a particular material appraisal performed by an Accredited Body



Design requirements for ferritic steels – PED contra AFS 1994:39

PED

- R_{eH} is accepted
- Permissible general membrane stress, the smaller of, $2/3$ of $R_{e/t}$ and $5/12$ of $R_{m/20}$
- Impact energy KV, greater equal 27 J for the finished equipment (see guideline 7/18)

AFS 1994:39

- R_{eL} is to be used
- Permissible general membrane stress, the smaller of, $2/3$ of $R_{eL/t}$ and $7/10$ of $R_{m/20}$
- Impact energy KV, greater equal 27 J (40 J for $R_{eL/20} > 310 \text{ N/mm}^2$) for the finished equipment



Essential Safety Requirements (ESRs) relating to materials in the PED

In Annex I of the PED the following sections are applicable as regards ESRs relating to materials

- section 2.2.3 (a), first and second paragraph
- section 2.2.3 (b), fifth indent
- section 2.6
- section 3.1.1
- section 3.1.2, first and second paragraph
- section 3.1.4
- section 3.1.5
- section 4
- section 7.5 [by reference from section 4.1 (a)]



ESRs on materials – some key guidelines

Guideline 7/1 (extract)

Answer:

In the case of a harmonised supporting standard for materials, 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 item of equipment. Consequently the technical data stated in the material standard shall be assessed against the design requirements of this specific item of equipment to verify that the ESRs of the PED are satisfied.

Note:

Subsequent manufacturing processes affecting properties of the base material shall be taken into account when assessing the conformity of the pressure equipment to the material requirements of the directive.

(For guidelines see <http://ped.eurodyn.com>)

ESRs on materials – some key guidelines (continued)

Guideline 7/18

Question:

Do the essential safety requirements on materials specified in Annex I section 4.1 and section 7.5 apply to the base material or to the pressure equipment?

Answer:

They apply to the pressure equipment in its entirety, i.e. also to the heat affected zones of a weldment, but not to the non pressure-bearing parts.

Note:

Subsequent manufacturing processes affecting properties of the base material shall be taken into account when specifying the properties of the base material, as per Annex I, sections 3.1.1, 3.1.2 and 3.1.4 of the PED.



ESRs on materials – some key guidelines (continued)

Guideline 7/19 (extract)

Question:

Which requirements apply to components, such as dished ends, bolts, flanges, welded tubes, welded fittings etc, which are placed on the market as such?

Answer:

To be incorporated into an item of pressure equipment, components which are manufactured from materials such as plates, coils and bars shall meet all the relevant essential safety requirements related to the manufacturing process used; for instance in the manufacturing of welded dished ends, sections 3.1 and 7.2 of Annex I are relevant in addition to section 4.

In order to prove the conformity to the PED of the pressure equipment containing the component the equipment manufacturer will need relevant documents from the component supplier:

- Material certificates (of the plates, coils, bars ...),

ESRs on materials – some key guidelines (continued)

Guideline 7/20 (extract)

Question:

Does a 3.1.B or 3.1.C certificate alone meet the requirement of Annex I section 4.3?

Answer:

NO

Annex I section 4.3 explicitly requires the material manufacturer to affirm compliance with the specification.

Certificate 3.1.B or 3.1.C alone does not satisfy this requirement as the affirmation is not included in the definition of those documents in EN 10204:1991.

This can be achieved by a separate statement by the material manufacturer in the certificate, or in a separate document.

See also guideline 7/5.

ESRs on materials – some key guidelines (continued)

Guideline 7/22

Question:

What is meant by the following two terms:

Other values, and *other criteria*, in the context of section 7.5?

Answer:

Other criteria refers to further criteria depending e.g. on the type/dimension/product form and strength level of steel or mode of operation, which shall be taken into account to prove its toughness and ductility.

Other values refers to those other criteria which can result in more demanding values for elongation or bending rupture energy or specified values for additional properties.

See also guideline 8/6 for the application of section 7.

ESRs on materials – some key guidelines (continued)

Guideline 7/24

Question:

Annex I, 4.3 of the PED requires that the material manufacturer must prepare documentation affirming compliance with the specification required by the equipment manufacturer.

Does this requirement mean that material properties used in the design of the pressure equipment must be based on those affirmed (guaranteed) by the material manufacturer?

Answer:

Yes, the material properties used in design of the equipment, e.g. yield strength and impact properties, must be based on those of the specification which are affirmed by the material manufacturer.



Harmonized product standards – Materials in some key standards

The following key standard-series under the PED have all a Part 2 covering Materials

- **EN 13445** Unfired pressure vessels
- **EN 13480** Metallic industrial piping
- **EN 12952** Water-tube boilers and auxiliary installations
- **EN 12953** Shell boilers



European steel standards for pressure purposes – Flat products

- **EN 10028-1** General requirements
- **EN 10028-2** Non-alloy and alloy steels with specified elevated temperature properties
- **EN 10028-3** Weldable fine grain steels, normalized
- **EN 10028-4** Nickel-alloy steels with specified low temperature properties



European steel standards for pressure purposes – Flat products

- **EN 10028-5** Weldable fine grain steels, thermomechanically rolled
- **EN 10028-6** Weldable fine grain steels, quenched and tempered
- **EN 10028-7** Stainless steels



European steel standards for pressure purposes – Castings

- **EN 10213-1** General
- **EN 10213-2** Steel grades for use at room temperature and elevated temperature
- **EN 10213-3** Steel grades for use at low temperatures
- **EN 10213-4** Austenitic and austenitic-ferritic steel grades



European steel standards for pressure purposes – Seamless tubes

- **EN 10216-1** Non-alloy steel tubes with specified room temperature properties
- **EN 10216-2** Non-alloy and alloy steel tubes with specified elevated temperature properties
- **EN 10216-3** Alloy fine grain steel tubes



European steel standards for pressure purposes – Seamless tubes

- **EN 10216-4** Non-alloy and alloy steel tubes with specified low temperature properties
- **EN 10216-5** Stainless steel tubes



European steel standards for pressure purposes – Forgings

- **EN 10222-1** General requirements for open die forgings
- **EN 10222-2** Ferritic and martensitic steels with specified elevated temperature properties
- **EN 10222-3** Nickel steels with specified low temperature properties



European steel standards for pressure purposes – Forgings

- **EN 10222-4** Weldable fine grain steels with high proof strength
- **EN 10222-5** Martensitic, austenitic and austenitic-ferritic stainless steels



European steel standards for pressure purposes – Bars

- **EN 10269** Steels and nickel alloys for fasteners with specified elevated and/or low temperature properties
- **EN 10272** Stainless steel bars for pressure purposes
- **EN 10273** Hot rolled weldable steel bars for pressure purposes with specified elevated temperature properties