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Position paper for the application of the Pressure Equipment Directive for Process compressors

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Excluded from the scope of the Pressure Equipment Directive (old: 97/23/EC, current: 2014/68/EC) are, according Art. 1 Par. 2. J) „equipment comprising casings or machinery where the dimensioning, choice of material and manufacturing rules are based primarily on requirements for sufficient strength, rigidity and stability to meet the static and dynamic operational effects or other operational characteristics and for which pressure is not a significant design factor, such equipment may include:

…

(ii) steam engines, gas/steam turbines, turbo-generators, compressors, pumps and actuating devices; “

In guideline A-11 by the Pressure Equipment Directive PED 2014/68/EU Commission's Working Group "Pressure" this exclusion has been specified. After consultation with notified bodies in connection to the previous Pressure Equipment Directive 97/23/EC, the adopted phrases also in the current version and keeping in mind that the responsibility for the design remains with the manufacturer, this results in the following conclusions for process compressors:

Casings or machinery related to process compressors could be

- the limitation of the compression chamber e.g. cylinder with locking devices
- the pressure containing part of the casing for each stage (in between suction and pressure side) including flanges
- pressurised crankcases
- coolers integrated into the casing

Judgement of the factors listed under item 3 of guideline A/11 with regard to compressors

- *dynamic loads with vibrations or very high number of cycles*
  Mainly with oscillating positive displacement compressors significant vibrations occur, which have to be controlled by respective design of the casing. But also with turbo compressor avoiding of resonances is a main design factor
- *thermal loads together with a complicated form of structure*
  Compressor casings show for functional reasons always a complicated form of structure (e.g. cooling fins, fluid dynamic reasons) and are always subject to thermal loads due to the

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compression heat. It is often the complicated form of structure which affords a greater wall thickness due to casting reasons

- *stiffness of the structure because of external mechanical loads or requirements related to high weight*
  Generally external socket forces have to be taken into account during design. Additionally the weight of accessories (e.g. pulsation dampers on cylinders) have to be handled. Important design factor for low pressure and high volume flow turbo compressors (e.g. integrally geared and axial flow turbos) is the dead weight.
- *requirements related to low elongation, low change of diameter or low other deformation because of functional requirements to rigidity*
  With all compressors very small clearances must be realised in order to meet the desired efficiencies. The design heads for an extreme rigidity in order to avoid contact of rotating parts and/or unacceptable clearances.

Taking into account the above, it can be generally assumed that compressor casings are excluded from the Pressure Equipment Directive.

Frankfurt, 2022-01-07

Guideline A-11

Pressure Equipment Directive PED 2014/68/EU Commission's Working Group "Pressure"

Guideline related to: Article 1 paragraph 2 (j)

Question:

How can article 1 paragraph 2 (j) more specifically be understood, especially the wording "for which pressure is not a significant design factor"?

Answer:

1. Article 1 paragraph 2 (j) excludes pressurized equipment comprising casings or machinery from the scope of the PED

   a) if this equipment is primarily dimensioned for loads other than pressure, i.e. for which pressure is not the significant design factor and
   b) if it is primarily designed to move or rotate or fulfil other functions than pressure containment.

2. Such equipment may include

   - engines including turbines and internal combustion engines;

- steam engines, gas/steam turbines, turbo-generators, compressors, pumps and actuating devices and curing moulds for tyres.

3. For such equipment, pressure can be considered as not being a significant factor, if other factors alone or together are more significant than pressure. Other factors are, e.g.:

- dynamic loads with vibrations or very high number of cycles;
- thermal loads together with a complicated form of structure;
- stiffness of the structure because of external mechanical loads or requirements related to high weight;
- requirements related to low elongation, low change of diameter or low other deformation because of functional requirements to rigidity.

This shall be decided on a case by case basis, taking into account established safe industrial practice.

4. An over-dimensioning as such shall not result in exclusion from the PED with regard to article 1 paragraph 2 (j).

Reason

Note 1 No factor is included in the requirements of the PED. Any factor given in a guideline would therefore go beyond the PED and should be avoided.

Note 2 If a factor were used to decide whether the requirements of the PED are applicable or not, overdimensioning could result in a case where pressure equipment need not fulfil the requirements of the PED. This is not acceptable.

Note 3 To decide on the exception with a factor of overdimensioning would consequently result in the necessity of a detailed stress analysis, especially if this factor would have been connected to the primary membrane stress. This is far beyond the present established industrial practice.

Note 4 Furthermore, there is a danger that the more important influences explained in paragraphs 1 to 3 of the above answer could be overlooked if the decision whether the pressure is a significant design factor were based on a factor of overdimensioning only.

Accepted by Working Party Guidelines (WPG) on: 15/10/2015
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EXPLANATORY NOTES

1. No factor is included in the requirements of the PED. Any factor given in a guideline would therefore go beyond the PED and should be avoided.

2. If a factor were used to decide whether the requirements of the PED are applicable or not, overdimensioning could result in a case where pressure equipment need not fulfil the requirements of the PED. This is not acceptable.

3. To decide on the exception with a factor of overdimensioning would consequently result in the necessity of a detailed stress analysis, especially if this factor would have been connected to the primary membrane stress. This is far beyond the present established industrial practice.

4. Furthermore, there is a danger that the more important influences explained in paragraphs 1 to 3 could be overlooked if the decision whether the pressure is a significant design factor were based on a factor of overdimensioning only.