EUnited Turbines/VGB Background Paper

(Based on a VDMA/VGB document established in German language)

European Union Directive 97/23/EC – Pressure Equipment Directive (PED)

Law Applicability of Pressure Equipment Directive for steam turbines and their major components

To secure uniformity in the application of the Pressure Equipment Directive (PED), the European steam turbine manufacturers through their association EUnited Turbines elaborated in cooperation with VGB PowerTech the following guide for the applicability of the PED to steam turbines and their major components.

In accordance with the specifications of Article 1, Paragraph 3.10 of the PED, equipment comprising casings or machinery for which pressure is not a significant design factor is excluded from the scope of the Pressure Equipment Directive. The directive goes on to state that such equipment may include gas or steam turbines.

The PED allows some room for interpretation as to the treatment of steam turbines and their major components. A definitive statement as to whether turbine plant piping and valves are included in the scope of the PED cannot be found there. Even the guidelines related to the application of the PED established with the aid of various expert committees (with additional information and examples of its application) shed no light on this topic.

From a manufacturer's and user viewpoint the question of applicability of the Pressure Equipment Directive can be answered as follows:

Question:
How should Article 1, Paragraph 3.10 be interpreted for steam turbines, and where are the system boundaries to be located here?

Answer:

- Steam turbines with their associated high- and intermediate pressure steam valves are excluded from the scope of the PED in accordance with Article 1, Paragraph 3.10.
- For the purposes of the PED, the welds/flanges between the main steam lines and turbine valves, the interface to the condenser / exhaust steam line, the weld to the non-return valve in the cold re-heat line, the welds / flanges on the turbine for connection of the non-automatic and automatic extraction lines, and the drain valves form the system boundaries for the steam turbine-generator.
- Internal pipe work (e. g. balancing lines, piston lines, leak-off lines) are considered to be within the boundaries of the steam turbo set.
- The condenser (steam side) is not included in the scope of the PED, provided that an overpressure of 0.5 bar is not exceeded here even under fault conditions.

Rationale:

- Dimensioning and design of turbine components are primarily based on the following criteria:
  - Component service life (due to high number of thermal cycles)
  - Thermal loads together with a complicated form of structure
  - Stiffness of the structure to limit deformation as a result of external mechanical loads and / or due to transfer of high weights and dynamic forces.
  - High dynamic loads and mechanical vibrations caused by flow excitation and large rotating masses.
  - Requirements for little deformation and elongation because of complex functional requirements
- The dimensioning of internal steam pipe work of the steam turbine is mainly done according to dynamic loads caused by vibrations including the weight force and withstand stationary and instationary thermal expansion
- The well-proven high safety standard achieved within the EU is assured by the longstanding good engineering practice implemented by manufacturers, coupled with their in-house design and analysis standards.
  This constitutes established safe industrial practice, essentially based on the application-specific requirements and development work of the manufacturers. They apply far more stringent safety standards in a number of areas.
- This design approach has proven itself in the past, as no case of pressure-induced failure of turbine casings or of steam or condensate carrying lines making up the turbine plant piping has been reported to date. The aim of providing appropriate protection against pressure hazards – while pressure is clearly not a significant design factor – is thus achieved in all cases (see Guideline 1/11 related to Article 1, Paragraph 3.10).
- In the manufacturer's declaration to be drawn up pursuant to the European Union Machinery Directive 98/37/EC the manufacturer certifies that the steam turbine-generator in its capacity as a component part of a power plant corresponds to the state of the art and that its safe operation is possible.
- A further point worth mentioning is that the steam turbine is similarly excluded from other international codes and standards such as the ASME Code, and the Pressure Vessel Code formerly used in Germany.

In our opinion, the above definition can provide the detail necessary to give a uniform and binding approach on which to base industrial practice for placing steam turbine plants on the market and putting these into service in the future. This is of equal importance for licensing authorities and inspectorates, as well as for turbine manufacturers and operators.

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