

Risk Analysis of Graphite Heat Exchangers in Compliance with PED 2014/68/EU

Works Standard

1. Risk Identification

- 1.1 If the permitted operating conditions are exceeded (see 4.1 and 4.2) pressure equipment and its attached parts, e.g. PTFE bellows can
 - a) leak
 - b) burst
- 1.2 The following risks may occur
 - 1.2.1 If pressure equipment and its attached parts leak:
 - a) dangerous media (gases, liquids) can escape
 - b) media can mix or react. To know more about the consequences, see a)
additional pressure formation during the reaction, risks of media escaping under pressure
 - 1.2.2 Dangerous situations can occur when equipment bursts in the event af a) and b). Bursting parts of heat exchangers can also be dangerous.

2. Risk Estimate

From leaky or bursting pressure equipment

- 2.1 operating staff and/or uninvolved people can be contaminated or hurt.
- 2.2 air, water and/or soil can be contaminated.

3. Objectives

The afore mentioned dangers should be recognized and eliminated through suitable calculation, construction and fabrication, as well as with appropriate installation and operating instructions.

4. Analysis

Because of the dangers mentioned above, calculation, construction and fabrication must be executed in compliance with approved technical regulations, e.g. in accordance with AD regulations, other regulations and their updates.

- 4.1. The heat exchanger should only be operated within the allowed scope of operation:
 - 4.1.1 Allowed pressure and vacuum according to drawing, name plate and manual.
 - 4.1.2 Allowed temperature according to drawing, name plate and manual.
 - 4.1.3 Chemical claims: see corrosion resistance list A1 referring to corresponding examinations and confirmations.
 - 4.1.4 The aging of graphite material is not defined by relevant codes (e.g. AD-Merkblatt) and is unknown to us. Repeated pressure testing guarantees the necessary safety.



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- 4.2. Frequently installed PTFE bellows may only be operated within their respective max. allowance data (pressure, temperature, etc.):
 - 4.2.1. Allowed pressures according to the respective works standard 1070/1071/1270/1271 (depending on design).
 - 4.2.2. For allowed temperatures see 4.2.1
 - 4.2.3. Allowance data for PTFE bellows may differ from the data of the pressure vessel itself. Especially at high temperatures, the potentially lower allowed pressure of the PTFE bellows may restrict the allowed pressure envelope. The operator should only operate the equipment in accordance with the allowance data.
- 4.3. Our installation- and operation instructions and references must be observed.
- 4.4. Dangers and risks can be extensively ruled out when pressure equipment is designed, calculated and fabricated according to the approved technical regulations (see 4.), and operated within the scope of the allowed operating conditions (see 4.1 and 4.2)
- 4.5. The risk of bursting can be greatly reduced by reinforcing the outside walls of pressure-loaded graphite parts with carbon fiber.
- 4.6. The remaining risks inherent to all technical devices must be minimized by appropriate operating measures (well instructed, trained staff, compliance with the mounting- and operation instructions, suitable on-site preventive measures such as pressure and temperature monitoring etc.)
- 4.7. Pipework carrying dangerous and/or aggressive media has to be safeguarded so that in the event of a leakage at the flange connection, media cannot escape uncontrollably. Use spray-out prevention tape or a similarly effective product.

5. Final comment

Graphite heat exchangers with and without PTFE bellows have been used for decades. Their dangers and risks are well known. If the applicable rules are observed by the manufacturer and the operator, the remaining risks are tolerable.

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