



Technical Guideline

Number

10.13e

B-MT

Documentation and Certificates for Cryostat Thermal Shields

Status

2011-09-15

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1. Scope

- 1) This document defines the certificates, documentation and structure of documentation to be delivered with together with thermal shields for the use in applications like
 - magnet cryostats
 - cryogenic supply systems
 - cryogenic transport systems
 - cryogenic current lead boxes
 - auxiliary cryogenic systems within FAIR accelerators.
- 2) This document is NOT related to any other purpose as aforementioned.
- 3) This document is NOT a replacement for any requirements defined by [1] and [2].

2. Definitions

- 1) A *cryostat* in terms of this guideline is a technical system enclosing another technical system to be operated at temperatures far below room temperature (e.g. 4.5K).
- 2) A *thermal shield* in terms of this guideline is an actively (by cooling tubes) or passively (by thermalisation straps) cooled construction of sheet metal inside a cryostat, shielding a cold technical system from exceeding radiation heat load.

3. Codes and Standards

- 1) The European pressure equipment directive 97/23/EC [1] defines the legal basics for the documentation of pressure equipment.
- 2) The AD 2000 Code [2] is defining all engineering and documentation requirements related to pressure equipment.
- 3) DIN EN 10204 [4] defines the requirements on material certificates.

4. Required Documents and Certificates

- 1) In case any tubing, identified as pressure equipment in terms of [1], is part of the full thermal shield assembly, all documentation as defined by [2] must be delivered:
- 2) In case a cryostat thermal shield, including pressurised cryogenic tubing, is identified to be of a category lower than I according to 97/23/EC at least all documentation as defined in 97/23/EC – Module A for a device of the category I in terms of 97/23/EC must be delivered.
- 3) In any case of pressurised components being part of a thermal shield at least the following documentation must be delivered:
 - certificate stating the pressure resistance of all pressure loaded components according to [2],
 - testing certificates fulfilling the requirements of [1] and [2] for all welding seams applied at pressurised tubing,
 - documentation of all safety relevant calculations in terms of [2],
 - documentation of a hazard analysis according to [1],
 - operation manual in German and English language according to [1],
 - quality documentation proving properties, for all tube fittings and flanges applied to the tubing,
 - process description of all welding processes applied,
 - certificates of all welders participated in the manufacturing process.
- 4) Any documentation or certificate not listed but found to be required for any reason must be also delivered. In case the documentation must be attached to the relevant documentation as defined in 4.1 - 4.6.

4.1. Engineering Documentation

- 1) At least the following engineering documentation must be delivered completely for each cryostat thermal shield, respectively once for a series of components identical in construction:
 - engineering calculations performed within the design and construction of the thermal shield,
 - safety relevant calculations which are at least
 - a. calculations according to AD 2000,
 - b. calculation of any welds showing safety relevance.
- 2) In case a cryostat thermal shield is identified to be of the category I or higher according to 97/23/EC all relevant documentation as defined by [1] and [2] must be delivered.

4.2. Documentation of Hazard Analysis

- 1) In case pressurised components are part of the thermal shield, the complete documentation of a hazard analysis must be delivered for each cryostat thermal shield respectively once for a series of components identical in construction.



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4.3. Operation Manual

- 1) In case pressurised components being part of the thermal shield, an operation manual as defined by 97/23/EC in GERMAN AND ENGLISH language must be delivered.

4.4. Material Related Documentation and Certificates

- 1) In case pressurised components are part of the thermal shield all relevant material certificates of construction materials used for the production of each thermal shield, which is at least a 3.1 certificate following [4] confirming at least all relevant material properties defined by the standards applying the construction materials in use
- 2) In case of pressurised components are included in the construction of the thermal shield
 - all relevant certificates defined in [2],
 - certificates for transfer of identification,
 - certificates for the used welding fillermust be delivered.
- 3) In case of pressurised steel made components are included in the construction of the thermal shield a certificate of a notch impact strength tested in a Charpy Impact Test as defined in [5] must be delivered.

4.5. Process Related Documentation

- 1) The welder certificates for all welders participated in production of each thermal shield must be delivered.
- 2) The process description for each welding process applied must be delivered for each thermal shield respectively once for a series of components identical in construction.

4.6. Quality Related Documentation

- 1) The following quality related documentation must be delivered for each thermal shield:
 - measurement report of
 - a. dimensional check
 - b. shape- and position tolerance check according to the technical drawings, especially for the interface positions,
 - declaration of conformity with the specified quality and properties.
- 2) In case of pressurised steel made components are included in the construction all documentation and certificates of welding inspection as defined in [2] must be delivered.

4.7. Technical Drawings and CAD - Data

- 1) For any transfer of mechanical engineering data see [3].
- 2) A full set of technical drawings of the thermal shield, released by the contracting entity must be delivered.
- 3) A full set of technical drawings of special construction tooling and equipment must be delivered.

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| Prepared by: | J.P. Meier | Doc. Name: | f-tg-k-10.13e_documentation_and_certificates_for_cryostat_thermal_shields_20110915.doc | |
| Date: | 2010-05-17 | Version: | 1.1 | Page 3 of 4 |

- 4) An electronic copy of the full CAD-Model of the thermal shield must be delivered as defined by [3].

5. Structure of Documentation

- 1) All documentation and certificates (except mechanical engineering data as described in 4.7) must be transferred into EDMS – documents following the relevant EDMS – guidelines.
- 2) In case of text, tables, diagrams and pictures the electronic version must be delivered in the PDF-format without any access restrictions.
- 3) All documentation must be delivered within compiled and structured files, including a table of content.
- 4) Any certificates must be delivered compiled in files and must be electronically scanned for electronic compilation.
- 5) Documentation and certificates must be compiled separated for the content defined in 4.1 - 4.6.

6. References

- [1] Directive 97/23/EC, European parliament and the council of the European Union, <http://eur-lex.europa.eu>, 1997
- [2] AD 2000 Code, Verband der TÜV e. V., Beuth Verlag GmbH, Berlin, Germany, 2009
- [3] Terms and Conditions for the Exchange of Mechanical Engineering Data, GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany, 2009
- [4] DIN EN 10204, Metallic products - Types of inspection documents; Deutsches Institut für Normung e.V., Beuth Verlag GmbH, Berlin, Germany, 2004
- [5] GSI Technical Guideline 2.3e: Cryostat Vacuum Shell Materials