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1 Subject of specification

This specification and other documents referenced herein establish the minimum requirements for the design, fabrication, installation, testing and inspection for all types of heat exchangers being operated on LOTOS Group S.A. plants.

2 Scope of validity

This specification applies to the preparation of tender documents, inquiries and contracts for new investments and modernization projects planned by LOTOS Group S.A.

This specification shall also be a basis for preparation both detailed specifications and inquiries for individual or package unit supplies.

2.1 Deviations

Any deviation from this specification and the relevant specifications, standards and related documents including proposals, which the bidder claims to be economically and / or technically superior solutions must be submitted in writing for review and approval by Grupa LOTOS S.A. Non-approved exceptions are not acceptable by Grupa LOTOS S.A.

The supplier must report in writing any ambiguity in this or any other specifications of Grupa LOTOS S.A. or non-compliance with the referred documents / standards and obtain a written explanation from Grupa LOTOS S.A.

3 General requirements

3.1 Design

3.1.1 The design requirements are defined in the specifications specific to individual types of heat exchangers:

- Specification No. 2310 – Shell-and-tube heat exchangers
- Specification No. 2320 – Air coolers
- Specification No. 2330 – Plate Heat Exchangers

3.1.2 For special (atypical) heat exchangers the manufacturers' standards taking into consideration of PED 97/23/EC requirements shall be valid.

3.1.3 Heat Exchangers, irrespective of the type, shall be subject to strength analysis (calculation) in accordance with ASME BPVC Code or any other design code agreed in writing with Grupa LOTOS S.A.

3.2 Heat exchanger type selection criteria

The main criteria for the selection of the type of heat exchanger are the process requirements and parameters.

Where permitted by the process, air coolers shall be selected instead of water coolers. For water coolers the limiting skin temperature on cooling water side is 90 ^{o}C, retaining minimum water velocity 0,6 m/sec.

If water coolers are used for temperatures in excess of the above-mentioned limiting temperature, they must be changeover double coolers to allow chemical removal of fur deposits during operation.

Special (atypical) heat exchangers may be used if they are required by process conditions, and if they are specified in the basic engineering.

3.3 PED 97/23/EC requirements

Heat exchangers, irrespective of the type, subject to a pressure of more than 0,5 bar g shall be considered as pressure vessels and shall be subject to PED 97/23/EC requirements.

Moreover, heat exchangers shall conform to the Grupa LOTOS S.A. specifications no. 8100 and 8200 with regard to UDT (Office of Technical Inspection) requirements.

4 Technical documentation.

4.1 Design documentation

Design documentation shall include the following, as a minimum:

4.1.1 Assembly drawing of the heat exchanger

Drawing shall include as minimum following:

- Regulations applied for design
- Working pressure [bar (g)]
- The highest / the lowest allowable pressure [bar (g)]
- Test pressure [bar (g)]
- Working temperature [ºC]
- The highest / the lowest allowable temperature [ºC]
- Process Medium
- Flow
- Pressure drops
- Condensation curve (if applicable)
- Capacity of each space [m^3, L - litre]
- Heat exchange area [m^2]
- Corrosion allowances [mm]
- The weight of the exchanger (during operation, when empty, during a water pressure test, the weight of the tube bundle) [kg]
- Type and thickness of insulation
- Dimensions necessary to verify the strength analysis

- Welding connection details
- Type and scope of non-destructive examinations
- Type of heat treatment
- Specification of materials with a listed grades and standards
- Fluid group/ Category / Module according to PED 97/23/EC

4.1.2 Drawing of the tube bundle

4.1.3 Drawing of the test ring

4.1.4 Strength analysis in accordance with the regulations / Code applied

4.1.5 Risk Analysis

4.1.6 Operating and Maintenance Instruction – in Polish language (if original in English is available it must be included)

4.2 Final documentation

4.2.1 General Requirements

- Documentation supplied with a heat exchanger shall be provided in number as specified in the contact, including 1 (one) copy of original documents signed by Notified Body. Additionally documentation has to be sent in an editable electronic form. Requirements for electronic form of documents are included in specification LOTOS Group S.A. No. 6200.
- All certificates, reports and confirmations for imported materials and equipment shall be prepared in English.
- All instructions, manuals in English language shall be translated to Polish language

4.2.2 Scope of final documentation

- Design documentation (drawings and analyses/calculations) agreed with Notified Body
- Safety equipment data – only if supplied together with the equipment. The scope of this documentation is defined in specification LOTOS Group S.A. No.: 8400
- Fittings data – only if supplied together with the equipment
- Instruments for measurement, control, signalling and automatic blocks – only if supplied together with the equipment
- Feed equipment – only if supplied together with the equipment
- Measurement card (protocol) of main parts of equipment
- Test results of welding joints
- NDE reports with NDE plan and certificates of qualified NDT personnel
- Mechanical (run) test report – if required
- Heat Treatment Certificate with heat treatment plan and temperature vs. time chart– if required
- Certificate of performed anticorrosion protection in accordance with EN ISO 12944-8

- Certificate of pressure test and certificate of water used for pressure test
- Certificate of conformity issued by manufacturer
- Certificate of conformity issued by Notified Body
- List of materials for pressure parts
- Information card (protocol) about the marking place of every part of equipment
- Material certificates including welding consumables followed by the list of the names of the equipment parts with the indication of: item no. according to the drawing, grade of material, material std., heat number, certificate number and successive number of the certificate acc. to the list - certificates required according to EN 10204 / 3.1..
- Welding map including welders' identification numbers for each weld. List of welders including welders' qualifications. Certificates of Qualified Welders
- WPS, PQR
- Report of documentation approval by Notified Body
- Certificate on the inspection of the construction and first pressure test issued by Notified Body
- Assembly drawings " as built "
- Risk analysis

Any change must be clearly indicated. "As built" must be stamped on the drawing. If the changes have any influence on the results of strength analysis the " as built " drawing must be again approved by Notified Body.

- Other documents - when required:

- Instruction for transport, preservation, storage and erection
- Maintenance and repair instructions. They must be in Polish language (if original in English is available it must be included
- Instructions for erections (notes on erection, heat insulation as well as testing and test run of equipment)
- Certificate of design examination EC or certificate of type examination EC issued by Notified Body

4.2.3 Other documents - when required

- Instruction for transport, preservation, storage and erection
- Maintenance and repair instructions. They must be in Polish language (if original in English is available it must be included)
- Instructions for erections (notes on erection, heat insulation as well as testing and test run of equipment items)
- Certificate of design examination EC or certificate of type examination EC issued by Notified Body

5 Relevant documents

Any "Technical Specification" issued by Grupa LOTOS S.A. listed in Contract Files.

6 Codes and standards

Design, manufacturing, inspection and test shall be in accordance with the latest issues of specified codes and standards given in equipment specific Grupa LOTOS S.A. specifications.

7 Record of changes

No.	Date	Description	Introduced by
0		This specification entirely replaces the former LOTOS Group S.A. standard No. PR 07 230 with the same title.	B. Kowalewski
1	30-11-2013 (rev. 1)	Review, update, standardize and changes to the Standard within scope of order No. OK/990/2012	Editorial board coordinated by T.Wróbel
-	31-08-2015	Page layout corrections, no contents changes.	T. Wróbel