In the event of any differences in interpretation of this guide the Finnish version shall take precedence over this translation

NUCLEAR POWER PLANT PRESSURE VESSELS CONSTRUCTION PLAN. SAFETY CLASSES 1 AND 2

CONTENTS

Postadress
P.O. BOX 268
00101 HELSINKI 10
FINLAND

Telephone
~~659-588~~
61671

Telex
122691 STL - SF

A 4 77-244b/4

1

GENERAL

As stipulated in Guide YVL 3.0, a construction plan shall be prepared for nuclear power plant pressure vessels. The plan shall be approved by the IRP prior to commencement of manufacture. This guide sets forth the requirements for the construction plan of a pressure vessels in Safety Classes 1 or 2.

The construction plan shall include plans for the fabrication and installation of the pressure vessel. The approval of a construction plan concerning installation may be given separately prior to commencement of installation.

The construction plan shall have a front leaf in conformance with Guide YVL 1.2 and as an appendix a list of the documents mentioned in this guide. In case these documents are not included in the material, an account shall be given of when they have been submitted to the IRP. The reference literature used in the documents is sent to the IRP when necessary. The construction plan shall include the data set forth in sections 2 - 8.

2

MANUFACTURER

The documents shall disclose the manufacturer of the pressure vessel and an account is given of the manufacturing license granted by the IRP and of the supervisor of manufacture approved by the IRP as well as the inspection rights of quality control. The procedures relating to the manufacturing license are presented in Guide YVL 3.4.

3

DESIGN DATA

The purpose of the design data is to present in brief the data concerning the operating conditions and loadings of the pressure vessel, which are needed in the inspection of the construction plan and the stress analysis.

The design data shall comprise

- a description of how the pressure vessel functions and how it is connected to the system as well as the operating parameters (operating pressures, temperatures etc.)
- design parameters like pressure and temperature and their alternating ranges and the number of load exchanges

- data needed in the assessment of the consequences of accidents

- necessary data on the contents and external circumstances

The design data shall be in conformity with the PSAR and sufficient for the inspection of materials, quality control programmes, basic dimensioning, drawings and the stress analysis, which is presented later.

4 CONSTRUCTION MATERIAL REPORT

The construction material report gives a picture of the applicability of the construction materials to the fabrication method and to their intended use and it presents unambiguously the acceptance criteria and limits for material properties.

The construction material report comprises the material data for all pressure retaining parts and parts fastened to the pressure frame as well as for the procedure and work tests that are performed in the qualification of fabrication and installation. The matters are specified as follows:

1. A component-specific list of basic materials and welding filler materials giving the numbers of the parts in question (reference to welding drawing and inspection plans), standard markings of basic materials and welding filler materials and the numbers of the report sheets dealing with these materials.

2. Structure-specific reports which show

   - standard marking and type of the basic material and welding filler material

   - fabrication method and delivering status of the basic material and the type of the material certificate

   - significant fabrication processes from the standpoint of final product characteristics (moulding, heat treatment) or a reference to the document where they are to be found

   - construction material properties, testing methods and scope of testing required of the final product and data concerning the reception of the material and its control.

The basic materials and welding filler materials for all pressure retaining parts and parts fastened to the pressure frame as well as for the test pieces qualifying their fabrication and installation shall be approved as construction materials for pressure vessels. The

acceptance procedure is dealt with in more detail in Guide YVL 3.9.

The basic material, weld and heat affected zone of the final product shall fulfil the chemical and mechanical requirements and physical properties set forth in the construction material report. Testing methods and the scope of testing shall be determined on the basis of the Safety Class, type and quality of the material, fabrication method, operating conditions, measurements and the conformance of the materials with standards.

5 DESCRIPTION OF MANUFACTURE

The purpose of the description of manufacture is to depict the fabrication methods and the quality control measures in the various phases of the manufacture.

Procedure tests mean tests performed to welded joints and welded surfaces. Test pieces are fabricated in such a way that they correspond with the final product in all essential respects. The purpose of the procedure tests is to show the properties of the welded joint and welded surface of the final product or the competence of the company performing the welding.

Work tests mean tests which are specific to welded joints, joint groups or surfaces and which are performed in connection with the fabrication of the product. If the scope of testing is extensive enough, some procedure tests may be replaced by the work tests.

The required qualification tests are determined on the basis of the Safety Class of the component, component type and demands made on the structural part of the component.

Procedure tests are valid either for a restricted period of time or for ever, depending on the standard to be applied, while work tests are specific to welded joints, welded joint groups and surfaces. Usually work tests are only performed in connection with the welding of the most demanding joints.

The description of manufacture shall include an account of both the pressure vessel itself and of the manufacture of parts and ingots used for it. The account shall comprise the following items.

1. The fabrication method (rolling, forging, casting, etc) of parts and ingots subject to pressure or otherwise great strains

2. A description of methods used for joining parts together, especially welding instructions

3. The timing of inspections in various phases of manufacture

4. The manner and time of heat treatments and the heat treating times that are allowed and that are used, temperatures and rates of temperature changes

5. Other fabrication procedures

6. The fabrication method of work tests, including welding and heat treatment data

7. A description of the welding procedure tests and their results.

The fabrication method, quality control and inspections of pressure retaining parts shall be described to such an extent that it is possible to assess the final properties of the structure on the basis of these descriptions.

6

QUALITY CONTROL PROGRAMME

The quality control programme gives a systematic description of the quality control measures relating to the pressure vessel and of the inspection procedures applied herein.

The quality control programme includes

- inspection plans for basic materials, welding filler materials, welded joints and the final product
- inspection instructions and a list of these or a reference to instructions already submitted

The quality control programme shall be so compiled that it does not contradict the material report.

The inspection plans shall be given with respect to the quality control measures of the basic material, work tests, welding and final product, separately for each part and weld.

The plan shall comprise the following information

- part- or weld-specific numbering in accordance with drawings
- name and quantity of the part
- standard marking of the basic material and the welding filler material
- which procedure test qualifies each welded joint
- division in columns in accordance with the inspection instruction leaves.

Each inspection measure in the plan shall reveal whether it is carried out at the manufacturing site of the material, in the workshop or at the place of installation and which parties (e.g. manufacturer, accepted inspection body, regulatory authority) carry out the inspection or supervise it. A separate inspection plan can be prepared for inspections that are conducted at the place of installation.

Inspection instructions shall be presented for those inspection measures of the pressure vessel which are related to the manufacture and installation as well as to work tests representing them. The instructions shall disclose the method, scope, requirements and reporting of the inspection. In details, reference to standards can be made.

The most common quality control measures to be presented in the instructions may be grouped as follows:

- identification, marking and certificates of construction materials
- taking of test specimens
- destructive testing
- non-destructive testing
- supervision of welding
- supervision of heat treatments
- dimensional inspections of the structure
- pressure and leak tests
- other inspections.

The design criteria, for instance the technical requirement level of quality control, for pressure vessels of Safety Classes 1 and 2 are not manifested in detail in YVL Guides or standards. Therefore it is practical to prepare a document depicting the design and quality control requirements for each plant unit prior to component-specific construction plans and submit it to the IRP for approval (YVL 3.0). The component-specific quality control programmes are prepared following the principles and requirement level set forth in the above-mentioned document and in details making reference to standards.

7 BASIC DIMENSIONING

Basic dimensioning is used to indicate that the dimensions and design of the pressure vessel fulfil the requirements set forth in standards.

Basic dimensioning is based on the design conditions of the pressure vessel which do not usually include temperature gradients or repeatability of the load. Dimensioning calculations rest on the drawings of the pressure vessel which reveal the necessary dimensions and the shape of the structure.

Pressure vessels of Safety Class 1 shall be dimensioned in accordance with standard ASME Boiler and Pressure Vessel Code, Section III (Asme Code Section III), subsection NB-3000. The IRP may allow deviations to this standard, if they are based on a valid nuclear power plant standard in the country of manufacture.

Pressure vessels of Safety Class 2 are dimensioned in accordance with the standards mentioned below or other nuclear power plant standards approved by the IRP.

1. ASME Code Section III NC-3000
2. SFS 2610 Design of Pressure Vessels. Basic Requirements
3. ISO/DIS 2694
4. AD-Merkblatt B

The steel containment is dimensioned in accordance with Standard ASME Code Section III, subsection NE-3000.

The stress analysis is conducted following Guide YVL 3.5.

8

DRAWINGS

The purpose of the drawings is to describe the assembly and details of the structure in such a way that the size, shape and fabrication, with allowable tolerances, are revealed in sufficient detail.

The drawings shall be unambiguous and clear. They shall show

- dimensions and shapes used in or derived from strength calculations and other analyses
- assembly and subassembly data with parts lists
- positions, dimensions and groove shapes of joints
- quality of construction material and welding filler material in parts that are under pressure or welded to the pressure frame, and applicable standards
- reference to the welding instructions or an account of the welding data for each welded joint
- reference to the quality control and inspection instructions relating to the pressure vessel

The drawings shall include the data required in Standards SFS 2223 and 2610.