

Guide YVL E.3, Pressure vessels and piping of a nuclear facility

1 Scope of application

Guide YVL E.3 sets forth requirements for the pressure vessels (including heat exchangers and piping) of nuclear facilities, and the materials and test pieces required for their manufacture and for the manufacture qualifications. The Guide also covers the pressure vessels and piping that are related to the auxiliary systems of emergency power supplies described in Guide YVL E.10, "Emergency power supplies of a nuclear facility". The Guide does not apply to transportable pressure vessels, pressure vessels and piping only needed in the construction of a nuclear facility or temporary ones that serve maintenance duties. In addition, the Guide does not apply to pressure vessels and piping that are excluded from the oversight and inspections by STUK based on the safety classification document of the facility. Furthermore, the Guide does not apply to ventilation and air-conditioning equipment whose requirements are discussed in the new Guide YVL E.13, "Ventilation and air-conditioning equipment of a nuclear facility".

2 Justifications of the requirements

2.1 Chapter 1 Introduction

The introduction presents the key legislation concerning pressure equipment that is behind the requirements of Guide YVL E.3:

1. requirements for the design, manufacture, operation and maintenance of pressure equipment in Sections 60 and 60 a of the Nuclear Energy Act (990/1987), Section 117 a of the Nuclear Energy Decree (161/1988), Sections 3 and 23 of the Radiation and Nuclear Safety Authority Regulation on the Safety of a Nuclear Power Plant (STUK Y/1/2018) and the Pressure Equipment Directive (2014/68/EU)
2. requirements for the manufacturers, licensees and various third parties as regards pressure equipment in Section 60 a of the Nuclear Energy Act (990/1987).

Legislation concerning pressure equipment has largely changed after the previous update of the Guide (2013) (the Nuclear Energy Act, the Radiation and Nuclear Safety Authority's Regulation on the Safety of Nuclear Power Plants, the Pressure Equipment Act, Government decrees on pressure equipment and safety of pressure equipment and the EU Pressure Equipment Directive). Regulations concerning the manufacture and use of conventional pressure equipment at nuclear facilities are presented in the introduction since STUK also controls conventional pressure equipment at nuclear facilities in accordance with Section 60 of the Nuclear Energy Act and Section 117(4 and 5) of the Nuclear Energy Decree. Section 60 of the Nuclear Energy Act refers to the Pressure Equipment Act (1144/2016), which requires that pressure equipment is inspected such that it does not endanger anybody's health, safety or property. The Government Decree on Pressure Equipment (1548/2016) places requirements for the manufacture of pressure

Radiation and Nuclear Safety Authority

120/0002/2016

15.12.2019

equipment through the Pressure Equipment Directive, and the Government Decree on Pressure Equipment Safety (1549/2016) places requirements for in-service inspections and repairs of pressure equipment.

The Guide (Annex C) has adopted the concept of *low energy equipment* similar to the other E series YVL Guides. When the criteria of the definition¹ are met, the pressure equipment belongs to the scope of inspection of the authorised inspection organisation (AIO) and the technical requirements of safety class 3 may be applied to them even though the equipment would belong to safety class 2. Over-dimensioning of low-energy pressure equipment at the service place in view of the load or stress targeting the component can be proven so great that relieving the requirements regarding design, dimensioning and quality control of manufacturing will not cause an additional risk of losing pressure equipment operability during operation. The degree of utilisation of pressure equipment in relation to the allowed stress, fatigue or some other strain impacting their operability is assumed to be small in which case minor undetected manufacturing faults do not probably cause the loss of pressure equipment integrity, tightness or performance. In addition, due to the low process parameters, consequences to the environment in a potential loss of component integrity are smaller than those of a high-energy component. On these grounds, there is room for flexibility in the requirements of low-energy pressure equipment according to the Graded Approach principle (consideration of the safety significance).

2.2 Chapter 2 Scope of application

The requirements of Guide YVL E.3 apply to the pressure vessels (including heat exchangers) and piping of nuclear facilities as well as the materials and test pieces required for their manufacture and qualifications. Pressure vessels belonging to the nuclear facility are listed in the licensee's safety classification document. The Guide does not apply to transportable pressure vessels, pressure vessels and piping only needed in the construction of a nuclear facility or only serving maintenance duties carried out by the personnel, or pressure vessels and piping excluded from regulatory control and inspections by virtue of instructions or decisions issued by STUK. A change from the earlier version (2013), Guide YVL E.3 does no longer apply to ventilation and air-conditioning equipment for which there is a new YVL Guide, Guide YVL E.13.

The requirements set for pressure vessels are also applied to the internal structures of the reactor pressure vessel, of the steam generator and of the pressuriser, and to the steam boiler, of a nuclear power plant. In accordance with Guide YVL D.7, "Release barriers of spent nuclear fuel disposal facility", Guide YVL E.3 also applies to the final disposal canister of spent nuclear fuel where applicable.

The requirements set forth for pressure vessels are also applied to the manufacture and construction inspection of the steel containment, and the steel penetrations of the concrete containment, of a nuclear power plant unit. Guide YVL E.6, "Buildings and

¹ In safety class 2, a low-energy component shall refer to a component with a design pressure of up to 20 bar(g) and a design temperature of up to 120 °C and to which the design, dimensioning and quality-control requirements of corresponding equipment from safety class 3 can be applied without causing a risk of the component losing operability.

Radiation and Nuclear Safety Authority

120/0002/2016

15.12.2019

structures of a nuclear facility”, sets forth requirements for the steel, concrete, and composite structures of the containment.

The Guide applies to some equipment that does not meet the general pressure limit defined for pressure equipment (> 0.5 bar g), but in these cases, it is taken into account that pressure is not a dimensioning factor. The scope of applicable sub-components includes the internal structures of the reactor pressure vessel, steam generator and pressuriser as well as the disposal canister. The internal structures of the reactor pressure vessel also include the control rod mechanisms.

The scope of application of the Guide is considered to apply to all nuclear facilities unless a requirement is especially restricted to apply to a nuclear power plant.

The requirements of the Guide are aimed at the licensees and licence applicants, plant and equipment suppliers as well as manufacturers of pressure vessels and piping. The object of aiming the requirements also to the suppliers and manufacturers in addition to the licensee has been to make the requirements more readily understandable. This has been done based on project experience.

2.3 Chapter 3 Equipment requirement specification for pressure vessels and piping

This section further specifies the component-level requirements on submitting documents as set forth in Guides YVL A.1, “Regulatory oversight of safety in the use of nuclear energy”; YVL A.3, “Leadership and management for safety” and YVL A.5, “Construction and commissioning of a nuclear facility”. The equipment requirement specifications include both licensee (sections 3.1 and 3.2 of the Guide) and plant/equipment supplier documents (section 3.3) that describe in detail the requirements pertaining to the equipment. These documents serve as the basis for the preparing and processing of the construction plans. A change from the earlier version, the equipment requirement specification for the EYT equipment was removed as part of an effort to reduce administrative burden. Likewise, the requirement to submit a general inspection memorandum (as part of the equipment requirement specification) in connection with the construction licence application was removed as part of an effort to reduce administrative burden. Now, the requirement level is the same with the other E series YVL Guides, and the equipment requirement specification as a whole shall be approved by STUK before the specification is taken into use.

The requirement concerning the general inspection plan has been supplemented by tables 1–3 in Annex A which specify the inspection sequences and necessary supervision thereof. The tables aim to guide the licensee and plant and/or equipment supplier in preparing the inspection plans so that various equipment and manufacturers would have consistent procedures. The tables also provide STUK and the authorised inspection organisations the minimum base requirements to follow when reviewing equipment type-specific or equipment-specific inspection plans. A change from the earlier version, Annex A now includes a new table 3 concerning third parties in connection with the different tasks and stages of manufacture to clarify the issue that has, in practice, proven to be difficult to understand.

Radiation and Nuclear Safety Authority

120/0002/2016

15.12.2019

2.4 Chapter 4 Manufacturer

Requirements set for a manufacturer and approval of a manufacturer are based on requirements set forth in Section 60 a of the Nuclear Energy Act.

2.4.1 Chapter 4.1 General requirements for the manufacturers of nuclear pressure vessels, piping and piping components

Section 4.1 sets forth requirements for all manufacturers of nuclear pressure vessels and piping with, however, more stringent requirements placed on manufacturers that use special processes (permanent joints, forming, heat treatment). The requirements are in line with Guide YVL A.3, further specifying it on the component-level as regards the manufacture. Basic requirement for all manufacturers stipulates that they shall have a certified or otherwise independently evaluated quality management system. In the new version, appropriate certification has been specified so that the certification body shall be accredited against the requirements of Standard EN ISO/IEC 17021 and the accreditation shall be covered by the Multilateral Agreements or Mutual Recognition Arrangements entered into by FINAS. The earlier requirement set forth for quality management systems of manufacturers of the main equipment of the primary circuit to meet the requirements of Standard ASME NQA-1 has been removed from this Guide. All requirements pertaining purely to the quality management systems are now given in Guide YVL A.3. The section now mentions the obligation of the licensee to audit the quality management systems of manufacturers of pressure equipment and material in safety classes 1 and 2 before manufacturer approval. Mentioned earlier only in Annex A, the requirement is now included also in the Guide.

According to Section 60 a of the Nuclear Energy Act, STUK specifies the nuclear pressure equipment which has a minor significance to safety whose manufacturer or subcontractors are not required to have a manufacturer approval. For STUK, the main principles to obey here are as follows:

STUK shall perform all the necessary organisation approvals regarding the manufacture and use of safety-classified components. In addition, STUK shall specify the equipment whose manufacturer does not require a separate manufacturer approval. As regards this equipment, STUK shall specify the requirements to which the manufacturers must adhere to. STUK or an authorised inspection organisation shall assess compliance with these requirements in connection with the review of the construction plan or another document related to the equipment in question.

1. Equipment whose manufacturer is subject to STUK's approval as provided in Guide YVL E.3 based on the pressure, nominal size, function or manufacturing method:
 - All other equipment except for those mentioned below in sections 2 and 3.
2. Equipment whose manufacturer is subject to evaluation in connection with the inspection of the construction plan based on the pressure, nominal size, function or manufacturing method.

Radiation and Nuclear Safety Authority

120/0002/2016

15.12.2019

- In SC2 and SC3, piping and small valves of size $DN \leq 50$. (The manufacturer-related requirements for the valves and pumps related to the piping are the same as those for the piping according to the nominal diameter. As an exception to this, the category of a safety valve is determined based on the target it protects.) For extensive modifications in SC2, manufacturer approval must be obtained from STUK.
- In SC3, manufacture of all equipment in Class I (PED Class I) of Section 10 of the Government Decree on Pressure Equipment 1548/2016 and installation of all equipment.

The evaluation of the manufacturer shall be performed by STUK/AIO responsible for the construction plan review, and the evaluation applies only to the construction plan in question. The evaluation shall ensure that the manufacturer complies with Guide YVL E.3 in having the following in place as suitable for the manufacturing in question:

- quality system (YVL E.3, requirements 401–406)
 - person in charge (YVL E.3, Chapter 4.2.3)
 - welding coordination person (if not the person in charge, YVL E.3, Chapter 4.2.3)
 - qualification of the personnel that make permanent joints (YVL E.3, requirement 418)
 - confirmation that the company has a list of those authorised to transfer identification markings (YVL E.3, requirement 410)
 - qualified manufacturing procedures (YVL E.3, requirement 417).
3. Equipment whose manufacturer is not subject to STUK's approval as provided in Guide YVL E.3 based on the pressure, nominal size, function or manufacturing method:
- pressure equipment manufactured without welding, hot or cold-forming or heat treatment
 - equipment with pressure ≤ 0.5 bar (g) above the liquid level (requirements from the steel structure side)
 - base material repair performed by the material manufacturer in connection with the material manufacturing process and the related heat treatment (castings) according to the material standard (if the repair and the related heat treatment has been approved in connection with the approval of the manufacturing process)
 - sealing and guide surface weld overlays
 - welding of small nozzles ($DN \leq 32$) on to the valve housing or pump casing
 - caulk welding (including valve bellow welding), lock welding
 - equipment connected directly to the diesel engine, such as, for example, oil, fuel or air filters and cooling or heating units (part of the engine delivery)
 - pressurised housings of high voltage electrical equipment
 - equipment whose $V \leq 1$ L or $PS \times V \leq 50$ ($PS = \text{bar}$, $V = \text{L}$) (serially manufactured component, e.g. standard-made meter body, filter or degasser related to a flow meter device, standard-made pressure difference, surface level or other measuring chamber of an instrument, a filter or scraper trap in a liquid, compressed air or gas system)
 - In SC3, equipment in Section 9 of Government Decree 1548/2016 (PED equipment in compliance with good engineering practice)

Radiation and Nuclear Safety Authority

120/0002/2016

15.12.2019

- In SC3, pressurised mechanical equipment (a machine or equipment component that operates under internal pressure with dimensioning and structure determined primarily by a factor other than pressure, such as required power transmission ability or stiffness or manufacture-related factors due to which the component in question is oversized relative to the pressure. An exception to this, a pump shall be specified as pressure equipment in all safety-classified cases.)

However, the requirements of the YVL Guides apply to the pressure equipment manufacturers (a certified quality system and, if necessary, qualified manufacturing procedures and persons making permanent joints).

2.4.2 Chapter 4.2 Approval of a nuclear pressure equipment manufacturer for special processes

Pressure equipment manufacturers' approval procedures for special processes remain unchanged for the most part. As part of an effort to reduce administrative burden, in addition to the previously accepted notified or certification bodies as referred to in the EU Pressure Equipment Directive (PED), the Guide also accepts other certification bodies with sufficient competence demonstrated by approved accreditation to provide qualifications for permanent joints of safety-classified equipment. The objective of the change is to make it easier to find an approved qualification body for objects where PED is not otherwise a binding requirement.

The Chapter now specifies that the declaration for the control of manufacturing provided by the person in charge of the manufacturing before the pressure test is not the same as the declaration of conformity required by the PED and certain standards at the end of the manufacturing.

2.4.3 Chapter 4.3 Manufacture of materials and standardised components

There were no significant changes to this Chapter in this revision round. The need to present requirements for the manufacturers of certain materials and standardised components is based on experience. The manufacture of materials and parts considered to be standardised components may involve special processes, in which case it was deemed necessary for the manufacturer to have a similar approval than that required for special product manufacturing processes. However, the requirement only applies to higher safety classes 1 and 2.

Safety classes 1 and 2 place requirements for manufacturers of materials and standardised parts, but a separate manufacturer approval is not necessary as the standards (e.g. RCC-M) include manufacture qualification requirements. This material group includes, for example, large castings and forgings. Safety class 3 requires an appropriately certified or otherwise independently assessed quality management system.

2.5 Chapter 5 Construction materials and welding consumables

There were no significant changes to this Chapter in this revision round. Requirements for and approval of materials and welding consumables are a part of the design process, and the requirements in the YVL Guide are presented mainly on

the basis of the Radiation and Nuclear Safety Authority Regulation on the Safety of a Nuclear Power Plant (STUK Y/1/2018).

In safety class 1, the materials shall be approved equipment-specifically (location-specifically) prior to the submission of the construction plans. In safety classes 2 and 3, specifications of materials with the scope of application to be specified later in the construction plan may be submitted for approval in advance. The construction plan review shall include, for example, the verification of sufficient extent of testing of these materials. Annex B to the Guide contains a table on the material certificate requirements for the materials and welding filler materials. Noteworthy in the table is that also the safety class of the supports is defined in YVL Guide B.2. The purpose behind the table has been that material with an EN 10204/3.2 certificate verified by a PED notified body and purchased from a material manufacturer shall be considered approved without more detailed reports on the scope of the control measures by the notified body (YVL E.3/808). In this revision round, some material certificate requirements for materials with lesser safety significance (Annex B) were relaxed from 2.2 to 2.1 that has been considered more suitable in practice.

2.6 Chapter 6 Design

Design requirements for nuclear pressure vessels and piping are presented in Chapters 6.1–6.5. Chapter 6.1 discusses general requirements for the equipment, and Chapter 6.2 discusses the hydrodynamic design. Detailed requirements for nuclear pressure vessels are given in Chapter 6.3 and those for piping in Chapter 6.4. Chapter 6.5 discusses the selection of materials.

General requirements presented in Chapter 6.1 mainly discuss design bases, geometry, structural configuration and location of welds. The Chapter also includes general instructions on the use of the standards. Strength analysis of the nuclear pressure vessels and piping shall be performed on the basis of the applicable standards using methods of design by formula or design by analysis. In practice, this means that pressure design is required of all nuclear pressure vessels, piping and associated components unless compliance with the design solutions can be directly verified. In this revision round, the requirement concerning leakage monitoring systems found previously in the Government Decree (717/2013) and currently in Section 10 of STUK Regulation Y/1/2018 was added in the Chapter.

Equipment-specific general requirements followed by detailed requirements for pressurise-retaining parts and components, internal structures and supports are presented at the beginning of Chapters 6.3 and 6.4. Nuclear pressure vessels, piping and associated components shall be dimensioned to withstand mechanical loads. The need for a piping flexibility analysis is determined on the basis of the safety class, nominal diameter, design temperature and piping components. Stress and fatigue analyses shall be performed on equipment important to safety. A strength analysis pursuant to Guide YVL E.4, "Strength analyses of nuclear power plant pressure equipment", shall be performed on the equipment in the highest safety classes. Requirements concerning the design of the steel containment were removed from Chapter 6.3 as they can be found in Guide YVL E.6.

Radiation and Nuclear Safety Authority

120/0002/2016

15.12.2019

Dimensioning and analysis shall be performed by the requirements of the applicable standard. In case of exceptional situations outside the scope of the standards in question, the design shall be conducted using a strength analysis or experimental stress analysis pursuant to Guide YVL E.4. Guide YVL E.4 may also have to be used in case the equipment's risk significance proves to be higher than expected, or due to some other technical reason.

As regards material requirements, a reference is made to Chapter 5. Surface treatment requirements are given in Guides YVL E.6 and YVL B.6, "Containment of a nuclear power plant".

2.7 Chapter 7 Construction plan

A construction plan shall be drawn up and submitted for approval for all nuclear pressure vessels and piping so that it is possible to assess the compliance of the equipment. As a document, the construction plan is similar to those technical documents required for the EC plan review pursuant to PED. However, the construction plan for pressure vessels and piping cannot be replaced by other inspection procedures.

This section aims to describe what documents shall be submitted, as well as the content of these documents. Technical requirements for the materials, design and manufacture are presented in the respective Chapters. A summary of justifications refers to the documentation of a document inspection by the licensee so that the authority or an authorised inspection organisation can verify the scope of the inspection. The summary of justifications is a counterpart for the presentation memorandum prepared by STUK's inspector. The aim of the requirement concerning the summary of justifications is to delegate more of the construction plan review responsibility to the licensee, with STUK monitoring the licensee's performance. In this revision round, the summary of justifications was removed from Guide YVL A.1, and the content was entered in this Guide in more detail in place of the previous reference.

Special attention has been paid to the content and clarity of the calculation reports. Subsequently, Guide YVL E.3 specifies the calculation results that shall be presented for heat transfer calculations, hydrodynamic design, dimensioning calculations and analyses. As regards the number of intermediate results and results illustrated with plots and figures included in the report, the safety significance, acceptance criteria and marginals of the item in question shall be taken into account. In Finland, the correctness and acceptability of the calculation results are primarily ensured by regulatory inspection of the calculation report.

Provided in the earlier version of the Guide as part of an effort to reduce administrative burden, the possibility to have simple and common repair and modification work approved by STUK's inspector was reintroduced in the Guide. For the same reason, it is sufficient to have only the deviation from the YVL Guide approved by STUK if the construction plan otherwise falls within the inspection area of the inspection body. Earlier requirement required that the entire construction plan involving the deviation from the YVL Guide had to be approved by STUK. Smaller amendments to the Guide include a note reminding of the material identification (PMI)

as part of the material testing, if necessary, and a requirement to provide justifications should the pressure test be replaced with NDT inspections.

2.8 Chapter 8 Manufacture

Requirements for the manufacture are based on the following task given to the Radiation and Nuclear Safety Authority in Section 117 of the Nuclear Energy Decree: *set more detailed requirements for the manufacture of nuclear pressure equipment and for related quality assurance*. The requirements are based on the procedures presented in, for example, the Pressure Equipment Directive and harmonised pressure equipment standards.

Witnessing performed by a third party can be divided into two groups:

- a) witnessing related to the testing and qualification of materials
- b) overseeing of manufacturing.

Prior to this, overseeing of material testing and procedure and personnel qualification complied fully with the requirements of the Pressure Equipment Directive (PED), and oversight was allowed for notified bodies and recognised third-party organisations (certification bodies) with the area in question included in their accredited operations. Now, as part of an effort to reduce administrative burden, in addition to the previously accepted notified or certification bodies as referred to in the PED, the Guide also accepts other certification bodies with sufficient competence demonstrated by approved accreditation to provide qualifications for permanent joints of safety-classified equipment. A completely new table 3 was prepared and included in Annex A to clarify acceptable organisations at different stages of pressure equipment manufacture.

There are no detailed requirements for a third party performing control of manufacturing; instead, the expertise shall be evaluated during the processing of the construction plan, if necessary. If the organisation controlling the manufacture in the construction plan is not qualified by accreditation, for example, the competence of the organisation shall be justified. If necessary, the justification shall cover personnel information (specifying individuals performing the control and justifying their knowledge of the controlled operations within the construction plan). The principles for performing the control were further specified based on experience.

A change compared to the previous version (2013), an authorised inspection body may now act as both a third party and an inspection body performing public administrative tasks for the same structure or equipment. Performing as a third party does not preclude the possibility of performing as a third party again at different stages of the manufacture. However, the inspection body is required to maintain personal independence, meaning that the same individual may not perform all of these third-party duties. The change aims to reduce the administrative burden and simplify the manufacturing process from the point of view of the licensee. The definition of third-party independence is now similar to that presented in standard EN ISO/IEC 17020:2012 (*Conformity assessment. Requirements for the operation of various types of bodies performing inspection*).

Radiation and Nuclear Safety Authority

120/0002/2016

15.12.2019

In case of a long manufacturing time or a piece of equipment that must be replaced immediately, the guidelines allow the manufacture of a pressure vessel or piping to commence before the entire construction plan is completed. The Guide specifies the approvals needed prior commencing the manufacture of equipment and piping in the primary circuit. In the update, the requirements of the Guide were harmonised with respect to the other E series YVL Guides, hence the current requirement in safety class 3 for the acceptability of the construction plan only before the construction inspection. In safety classes 1 and 2, as a rule, the construction plan still needs to be approved prior to the commencement of manufacture.

The Guide now includes a new Annex E concerning the approval process of a serially manufactured component. The purpose of the annex is to harmonise the requirements with the other E series YVL Guides. In the case of serially-manufactured components, the licensee acquires a fully serially manufactured pressure vessel without additional requirements into their stock. In the construction plan and the associated summary of justifications, the licensee justifies how the serially manufactured vessel shall meet the level of nuclear security and the safety of pressure equipment provided by an individually constructed vessel following any additional testing commissioned by the licensee after the delivery. All justifications shall be provided proportional to the risk significance of the vessel. When reviewing the construction plan and the associated summary of justifications, STUK will compare the serially manufactured vessel against an equivalent individually constructed vessel manufactured pursuant to YVL Guides and ensure that the equivalent safety level is accomplished.

2.9 Chapter 9 Construction inspection

Requirements for the construction inspection are based on the following task given to the Radiation and Nuclear Safety Authority in Section 117 of the Nuclear Energy Decree: *set more detailed requirements for the manufacture of nuclear pressure equipment and for related quality assurance*. The requirements are based on the procedures presented in, for example, the harmonised pressure equipment standards.

The chapter now includes the nameplate inspection and stamping, if applicable, moved over from the commissioning inspection. The person responsible for the manufacture shall provide a declaration of manufacture prior to the construction inspection pressure test. The requirement was further specified insofar that the declaration shall not be required if the manufacturer is not required to provide a separate approval of manufacturer. The section elaborates that the required declaration is not the same as the declaration of conformity required by the PED and certain standards and that the two do not replace each other.

2.10 Chapter 10 Installation

This chapter presents special installation design and implementation requirements for the general design and manufacturing requirements. There were no significant changes to this Chapter in this revision round.

Radiation and Nuclear Safety Authority

120/0002/2016

15.12.2019

2.11 Chapter 11 Commissioning

The requirements in this Chapter take into account the national legislation, such as the Pressure Equipment Act (1144/2016) and the Government Decree on Pressure Equipment Safety (1549/2016). These provide, for example, the requirements concerning the location of the pressure equipment, registration, operation supervisor, and commissioning inspection (first periodic inspection).

The YVL Guide cannot cover the commissioning phase simply as commissioning of a pressure vessel or piping because the pressure vessel and piping refer, according to the definitions, to housing built to contain fluids under pressure. Therefore, the equipment considered during commissioning shall be functioning pressure equipment, meaning that the pressure vessel or piping shall be equipped with accessories necessary for the functioning.

The commissioning inspection of the equipment has two phases. In the first phase, it shall be verified that the equipment has been approved in previous inspections and the preconditions for functional tests of the equipment are met. In the second commissioning phase, the functional tests of the equipment are conducted. Functional tests are typically carried out during the testing of the system. As regards the commissioning of the equipment, the verification of the approval status of the testing programme is always part of the first commissioning inspection phase, even if it should be carried out at a later stage than the inspection of the rest of the documentation.

2.12 Chapter 12 Operation

The requirements concerning the use and periodic inspections of pressure equipment adhere to the requirements set forth in the Pressure Equipment Act (1144/2016) and the Government Decree on Pressure Equipment Safety (1549/2016). According to Section 60 of the Nuclear Energy Act, the provisions given in the Pressure Equipment Act shall apply to pressure equipment unless otherwise provided in the Nuclear Energy Act. Pursuant to the same Section, the pressure equipment to be controlled by STUK only includes equipment that has been approved in the safety classification of the facility (safety classes 1–3 and EYT). According to the Pressure Equipment Act, other pressure equipment shall be controlled by the Finnish Safety and Chemicals Agency (TUKES). The section now obliges the licensee to inform any other owner of pressure equipment in the power plant area of the requirements under the Act concerning the use of pressure equipment.

The licensee and inspection organisations may postpone periodic inspections of pressure equipment subject to registration under restrictions (by 1 month and 6 months, respectively). In case a periodic inspection is to be performed earlier than planned, it is now sufficient to submit a notification of this for information to STUK. Otherwise, periodic inspections shall adhere to the procedure for conventional pressure equipment (Pressure Equipment Act).

2.13 Chapter 13 Modifications

This section presents the requirements for pressure equipment modifications. The section reintroduces the earlier possibility to have a modification plan submitted for

Radiation and Nuclear Safety Authority

120/0002/2016

15.12.2019

approval by a STUK inspector if the modification in question is minor and conventional and does not alter the functional properties of the system. The aim of the change is to reduce the administrative burden. The pressure equipment modification inspection was included according to the Pressure Equipment Act, meaning that it now includes inspection of old pressure equipment imported from one of the Member States of the European Economic Area.

2.14 Chapter 14 Decommissioning

The Guide includes requirements concerning the update of the pressure equipment record and the notification of decommissioning equipment to be submitted to STUK. There were no significant changes to this Chapter in this revision round.

2.15 Chapter 15 Regulatory oversight by the Radiation and Nuclear Safety Authority

Regulatory oversight by STUK is based on Section 63 of the Nuclear Energy Act and Section 117 of the Nuclear Energy Decree. The requirements for an authorised inspection body are set out in Section 60 a of the Nuclear Energy Act.

Division of responsibilities between STUK and an authorised inspection organisation on a level applicable to all nuclear equipment is defined in an Annex to YVL Guide E.1, “Authorised inspection body and the licensee’s in-house inspection organisation”. As regards pressure vessels and piping, the table on the division of inspection responsibilities has been further specified and attached to the Guide as Annex C. Contrary to the other E series YVL Guides, YVL Guide E.3 also includes division of inspection responsibilities in class EYT (Annex D). The aim is to specify the inspections of the piping and its prefabricated components such that the same inspection organisation shall be responsible for both the plant and site inspections. The licensee’s in-house inspection organisation may act in class EYT. It may also perform expert tasks in safety class 3.

Items concerning oversight in Chapter 15 are listed in the same order as Chapters 3–14. Any changes to the earlier procedures are discussed in the respective sections in Chapters 3–14 in this Guide.

2.16 Definitions

New definitions included in this revision round include “low energy equipment”, “serially manufactured product”, “built-to-order product”, “spare part”, “steam boiler” and “appropriate certification”.

3 International provisions concerning the scope of the Guide

3.1 IAEA and WENRA instructions

The requirements set in Guide YVL E.3 have been compared with the following IAEA and WENRA requirement documents:

- IAEA safety instructions

Radiation and Nuclear Safety Authority

120/0002/2016

15.12.2019

- Safety of Nuclear Power Plants: Design Specific Safety Requirements, Series No. SSR-2/1 (Rev. 1), February 2016
- Design of the Reactor Core for Nuclear Power Plants, Safety Guide, Series No. NS-G-1.12, April 2005
- Design of the Reactor Coolant System and Associated Systems in Nuclear Power Plants, Safety Guide, Series No. NS-G-1.9, September 2004
- Maintenance, Surveillance and In-service Inspection in Nuclear Power Plants, Safety Guide, Series No. NS-G-2.6, October 2002
- WENRA Reactor Safety Reference Levels for Existing Reactors, September 2014
 - Issue E, Design Basis Envelope for Existing Reactors
 - Issue F, Design Extension of Existing Reactors
 - Issue G, Safety Classification of Structures, Systems and Components
 - Issue K, Maintenance, In-service Inspection and Functional Testing

The WENRA and IAEA guidelines do not include any detailed requirements that would need to be added to the component-level Guide YVL E.3. Many requirements concerning, for example, the design bases, condition monitoring and material selection were already included in the guidelines. Guide YVL E.3 meets the WENRA and IAEA requirements but takes them to a clearly more detailed level.

3.2 International regulations and standards

The primary safety class 1 design standard specified in Guide YVL E.3, the "ASME Boiler and Pressure Vessel Code, Section III", is a standard specially designed for nuclear power plant components. In the control of manufacturing, however, the practice according to ASME where the undertaking itself is responsible for, for example, the personnel qualifications and the oversight is performed by an authorized inspector (ANI) is not approved as such. Instead, the basic requirement is STUK's own oversight and inspections.

In the other safety classes, the requirements set forth in the Pressure Equipment Directive (PED) and harmonised standards SFS-EN ISO 13445 (Unfired pressure vessels) and SFS-EN ISO 13480 (Metallic industrial piping) and their reference standards are used.

4 Impacts of the Tepco Fukushima Dai-ichi accident

The Fukushima accident has not directly impacted Guide YVL E.3. The impacts of the Fukushima accident to the nuclear safety regulations are in particular related to external threats, the reliability of safety functions and protection against loss of these functions, severe accidents, special requirements related to the fuel pools and safety analyses as well as emergency response and the plant site.

5 Needs for changes taken into account in the update

The needs for changes due to changes made to international and national laws/regulations and the change proposals made in connection with the preparation of the YVL Guide implementation decisions (SYLVI) together with others recorded in

Radiation and Nuclear Safety Authority

120/0002/2016

15.12.2019

STUK's change proposal database have been considered when updating the requirements. In addition, the possibilities to reduce the so-called administrative burden have been considered, the most significant result of which is the removal of the requirement to provide requirement specifications for EYT equipment.

The guide has been updated with the changes caused by the changes in the Nuclear Energy Act, Regulation STUK/Y/1/2018 and the pressure equipment legislation. In connection with this, pressure equipment under the area of responsibility of regulatory oversight by STUK was specified in more detail.

In some places, the content and layout of the Guide were changed to harmonise the requirements in line with other E series YVL Guides. Of these, the most significant are the requirements concerning the approval of serially manufactured components for safety-classified applications.