STUK

OHJE
GUIDE YVL 3.3

Nuclear power plant pressure vessels

Control of piping

STUK • SÄTEILYTURVAKESKUS • STRÅLSÄKERHETSCENTRALEN
RADIATION AND NUCLEAR SAFETY AUTHORITY

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continues

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RADIATION AND NUCLEAR SAFETY AUTHORITY

Authorisation

By virtue of section 55, second paragraph, point 3 of the Nuclear Energy Act (990/87) and section 29 of the Council of State Decision (395/91) on General Regulations for the Safety of Nuclear Power Plants, the Radiation and Nuclear Safety Authority (STUK) issues detailed regulations concerning the safety of nuclear power plants.

YVL Guides are rules an individual licensee or any other organisation concerned shall comply with, unless STUK has been presented with some other acceptable procedure or solution by which the safety level set forth in the YVL Guides is achieved. This Guide does not alter STUK's decisions, which were made before the entry into force of this Guide, unless stated otherwise by STUK.

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1 General

According to section 117 of the Nuclear Energy Decree (161/88), *the Radiation and Nuclear Safety Authority of Finland (STUK) controls the pressure vessels of nuclear facilities in accordance with the Nuclear Energy Act (990/87) and, to the extent applicable, in accordance with the Act on Pressure Vessels (98/73) and the rules and regulations issued by virtue of these.* In addition, STUK is an inspecting authority of pressure vessels of nuclear facilities in accordance with the Pressure Vessel Decree (549/1973).

According to section 3 of the Pressure Vessel Decree, *a pressure vessel is a steam boiler, pressure container, pipework or other such appliance in which the pressure is above or may come to exceed the atmospheric pressure.* Guide YVL 3.0 describes in general terms how STUK controls pressure vessels.

This guide presents requirements for the pipework of nuclear facilities. STUK controls Safety Class 1, 2 and 3 piping as well as Class EYT (non-nuclear) and their support structures in accordance with this guide and applies the provisions of the Decision of the Ministry of Trade and Industry on piping (71/1975) issued by virtue of the Pressure Vessel Decree.

According to section 3 of the Pressure Vessel Decree, piping refers to *an external pipe or pipe system joined to a steam boiler or pressure container; piping includes components and systems of components that have a bearing on the operational safety of the piping.* In addition, pipelines to an unpressurised vessel or room or to bodies of surface water and ground water belong to the piping referred to in this guide. A design boundary as per standard SFS 2610 [1] is the design and inspection boundary between piping and a pressure vessel. A weld that is a design boundary is part of the piping. The same principle is also applied to a pipe installation weld between a pipe accessory and piping when the accessory is a boundary between safety classes.

Guide YVL 5.3 applies to valves connected to piping; safety valves are dealt with in Guide YVL 5.4 and pumps in Guide YVL 5.7.

2 Classification of piping

According to section 21 of the Council of State Decision (395/1991), *the functions of systems, structures and components important to the safety of a nuclear power plant shall be defined and the systems, structures and components classified according to their safety significance.* The safety classification of piping is determined on the basis of Guide YVL 2.1. Piping valves and other accessories belong primarily to the same safety class as the piping.

Pipework are classified into Safety Classes 1, 2, 3 and Class EYT on the basis of their importance to nuclear safety. Class EYT piping are further divided into Groups A and B according to the degree of loading they are subject to and their overall importance to safety.

Group A comprises Class EYT piping

1) which is dimensioned on the basis of the creep or fatigue strength of the material, or
2) which contains a substance causing exceptional corrosion or wear, or
3) which contains steam or gas whose maximum temperature is +120 °C, and the product of the maximum operating pressure (bar) and the square (mm^2) of the nominal diameter (DN) of which exceeds 10^6, or
4) which contains only steam, liquid or gas whose temperature exceeds +120 °C, and the product of the maximum operating pressure and the square of the nominal diameter of which exceeds 10^5, or
5) which contains liquid or gas dangerous for reasons other than radioactivity and the product of the maximum operating pressure and the square of the nominal diameter of which exceeds 10^4.

Group B comprises the rest of Class EYT piping.

When the safety class of small-diameter piping (NS<50) that is directly connected to safety-

classified process piping or components is determined, Guide YVL 2.1 is applied as follows:

1) Small-diameter piping (NS ≤ 20) connected to Safety Class 1 piping and components belongs to Safety Class 2. The leakage control pipes with DN 20 of the sealings of primary circuit components belong to Safety Class 3.
2) Small-diameter piping connected to Safety Class 2 piping or components belongs to Safety Class 3.
3) Small-diameter piping connected to Safety Class 3 piping or components belongs to Group A of Class EYT.

However, the class given to small-diameter piping is not lowered if a leak in the pipe would result in the loss of the safety function on which the classification is based. Piping of this kind could include, for instance, impulse lines controlling the main system, fuel pipes of the diesels, and coolant pipes of the pumps.

Piping supports will primarily be placed in a safety class one step lower than the class of piping they support. The supports of Safety Class EYT piping are included in Class EYT.

3 General manufacturing and testing requirements

3.1 Manufacturer's prerequisites for operation and qualifications of manufacturing supervisor

According to paragraph 2 of section 6 of the Pressure Vessel Decree, *pressure vessels may only be manufactured by a manufacturer whose [– –] prerequisites for operation have been assessed as sufficient by an inspection agency. Furthermore, manufacturing shall take place under supervision of a manufacturing supervisor as referred to in chapter 4* (of the Pressure Vessel Decree). According to section 10 of the Pressure Vessel Decree, *the manufacturer shall request an inspection agency to assess whether the manufacturing supervisor has the qualifications required in section 9 of the* (Pressure Vessel) *Decree.*

Welding, heat treatment and moulding at the engineering works or place of installation is considered manufacture of piping or of its part.

The procedure for assessing a domestic or foreign manufacturer's prerequisites for work and a supervisor's qualifications is described in Guide YVL 3.4.

Where Group B piping in accordance with this guide is concerned, assessment of the manufacturer's prerequisites for work and of the qualifications of the manufacturing supervisor are not required. The principles set forth in the guide shall be followed when applicable, however.

Supervision of the manufacturing of piping is described in Guide YVL 1.14.

3.2 Approval of testing agencies and testing personnel

According to paragraph 1 of section 113 of the Nuclear Energy Decree (161/88), *non-destructive examination of a nuclear power plant's structures and components may only be carried out by a testing company or a tester approved by the Radiation and Nuclear Safety Authority (STUK).*

The approval procedure for testing companies and their personnel is described in Guide YVL 1.3.

4 Construction plan

4.1 Approval of construction plan

A construction plan to be submitted to STUK for approval in accordance with the requirements of this chapter shall be prepared for piping or a piping section prior to the commencement of manufacturing or repair.

The construction plans of Group B piping need not be submitted to STUK for approval. The piping shall be made sufficiently strong, however. The materials and manufacturing methods shall be appropriate and the piping shall be safe in use.

4.2 Manufacturer and testing agency

The construction plan shall make reference to the evaluation certificate of the prerequisites for operation of the manufacturer and the qualifications of the manufacturing supervisor as well as corresponding information about the sub-contractors and inspection agencies participating in the manufacturing or quality control of piping. The description shall indicate how the various parties have contributed to manufacturing.

Due to features specific to the manufacturing and installation of piping, the aforementioned references can also be made in a document that is separate from the construction plan before manufacturing or installation is commenced. In such a case, there shall be a mention of this in the piping construction plan. The document shall indicate the division made between manufacturing at the engineering works and installation work.

4.3 Design bases

The design bases shall be so extensively presented that it is possible on their basis to inspect the piping overall planning, flow rate and strength calculations as well as requirements set for condition monitoring.

The design bases shall include

- safety class of piping
- process and instrumentation charts
- a description of the operation of piping, with operating and design parameters (pressures, temperatures, etc. as well as their range of variation and the number of load cycles)
- information on the contents of piping and external conditions
- information on pressure tests and piping accessories.

Sufficient structural measures (supporting, venting, inclinations, pressure equalisers, heat shields, etc.) shall be used to prevent harmful dynamic and fatigue-inducing loads, such as vibrations, pressure shocks, the restriction of thermal expansion, temperature fluctuations in thermal mixing locations and thermal stratification of the medium. Susceptibility to erosion corrosion shall be limited by the choice of materials; also areas of flow discontinuities and exceptionally high flow rates shall be avoided for the same reason. Planning shall also consider phase transitions of the flowing medium and the accumulation of uncondensable gases in the piping.

Piping shall be placed, routed and provided with accessories in a way that facilitates appropriate operation, maintenance and inspection. Inclinations shall be made sufficient for all operating conditions. The pressure vessel, its piping accessories and components shall form a safely operating entity.

The piping planning has to consider the form and location of welded seams to ensure sufficient space for inservice inspections. The number of welded seams shall be kept as low as practically possible to reduce the need for inspection. Furthermore, the radiation protection requirements of Guide YVL 7.18 shall be considered in the design of piping.

4.4 Dimensioning

4.4.1 Flow rate calculations

Flow rate calculations shall indicate that piping and accessories operate as designed under normal operating conditions. The analysis of flow rate calculations for transients and accidents is dealt with in Guides YVL 2.2 and YVL 3.5.

Flow rate calculations shall take into account pressure losses in piping and their accessories, characteristic parameters of pumps connected to the same system as well as flows entering or exiting piping ends and branchtrees. Cavitation analyses shall consider pipe sections on the

suction side of pumps as well as pipe sections where heavy pressure reductions occur.

Flow rate calculations are not required for Safety Class 3 and Class EYT/A piping if piping with a corresponding design and accessories has been ascertained acceptable earlier in a functional test supervised by STUK.

4.4.2 Strength calculations

It shall be shown by strength calculations that the dimensioning and geometry of piping sections meet the requirements of applicable standards.

Basic dimensioning shall cover piping design conditions (pressure and temperature) that usually do not include temperature gradients or repeated loads. Dimensioning calculations are based on drawings of the piping and its sections that shall show the necessary dimensions and geometry.

Safety Class 1 (DN $\geq$ 50) piping sections shall be dimensioned to Standard ASME Boiler and Pressure Vessel Code, Section III [2], point NB-3600 in the first place. Deviations are allowable if they are based on an acceptable standard effective in the manufacturing country, or some other acceptable nuclear facility standard.

Safety Class 1 (DN < 50), 2, 3 and Class EYT piping sections shall be dimensioned to SFS-EN standards or other acceptable standards.

No specific strength calculations are required to assure the basic dimensioning of such parts of Safety Class 2, 3 and Class EYT piping sections (e.g. shape pieces, flanges and couplings) that have been dimensioned according to some Finnish or foreign pressure classification standard. When standard piping components are chosen it shall be ensured that their pressure class corresponds to the specific temperature and contents defined in the standard.

The flexibility of piping shall be established to determine loads that affect the piping itself or the accessories and pipe supports connected to it. As regards Safety Class 1 components, this can be done in accordance with ASME Code Section III or a corresponding approved standard.

In Safety Classes 2, 3 and Class EYT the need for flexibility analysis is determined on the basis of nominal diameter and design temperature. An analysis shall be made when design temperature exceeds +120°. However, this does not apply to DN < 100 piping.

Piping stress analysis shall be made to find out the stresses and fatigue of the structure arising from thermal transients and discontinuities. Safety Class 1 piping and other primary circuit piping, as well as parts that extend up to the isolation valves outside the containment in the steam and feed water systems of pressurised water reactor plants shall be, in addition to basic dimensioning, subject to a detailed stress analysis in accordance with Standard ASME Section III NB-3600 and Guide YVL 3.5.

Specific attention shall be paid to the dynamic stresses of piping. Depending on the circumstances, the following shall be considered:

- mechanical vibration loads caused by machinery and equipment
- pressure impact loads caused by the opening and closing of valves and process adjustments
- loads caused by turbulent or uneven flow of liquid or gas in piping
- loads caused by pipe contents discharging after a pipe rupture and loads caused by missiles.

Stresses that cannot be calculated accurately enough shall be established by experimental measurements.

4.4.3 Supports

Piping supports shall be dimensioned to withstand all loads they are subjected to during design basis operational conditions and accident situations. Supporting forces and torques that are exerted to pumps, valves and other associated components shall be restricted so that they

do not impair the leaktightness, integrity and operability of the components. The supports must make piping flexible in a way that suits the operating conditions to prevent harmful vibrations and restriction of thermal expansion.

Basic dimensioning shall consider loads in accordance with flexibility analysis and mechanical design loads. In addition, the dynamic loads and thermal transients referred to in sub-section 4.4.2 shall be included in stress analysis.

Requirements for the stress analysis of supports and provision made against piping ruptures by means of rupture supports are set forth in Guide YVL 3.5.

4.5 Construction material report

Piping for nuclear facilities may only be manufactured of approved materials and filler materials. The operating conditions of the piping as well as the requirements and limits arising from manufacturing (i.a. corrosion, stress corrosion and minimisation of materials contamination) shall be considered when choosing materials. The materials approval procedure is described in Guide YVL 3.9.

The data on materials contained in the construction plan shall cover all pressure-bearing parts and parts welded to them, as well as procedure and work tests that qualify manufacture and installation. This information includes

- a piping-specific list of components, giving the standard symbols of base materials and filler materials plus reference to standards and material specifications
- mainly in Safety Classes 1 and 2, reports on each piping main block material, which shall show
  - manufacturing process and delivery condition of base material
  - manufacturing procedures essential for the properties of the final structure (working, heat treatment), or reference to relevant documents
  - material properties required of the final structure, the testing procedures and extent of testing, data on the receipt and control of material, and the type of material certificate.

All base materials and filler materials for pressure-bearing parts and parts welded to them, as well as for test pieces validating the manufacture and installation of these parts, shall be approved as materials for pressure vessels. These requirements also apply to soldered joints.

Parts of piping manufactured of austenitic cast steel shall not be used in Safety Classes 1 and 2 if they are subject to inservice inspections as per Guide YVL 3.8. Plastic piping is only allowed in Safety Class 3 and Class EYT. Segmented bends and pipes or pipe bends with longitudinal weld seams are not allowed in Safety Classes 1 and 2 without special justification.

The base material and the welded seam of the final structure shall meet the requirements for chemical and mechanical properties set forth in the material report. The procedures and extent of testing shall be determined by safety class, manufacturing process, operating conditions, dimensions, and type of material.

4.6 Fabrication

4.6.1 General

Procedures describing fabrication shall be drawn up and submitted for approval primarily for Safety Classes 1 and 2 in the extent set forth in this guide. Fabrication instructions for Safety Class 3 and Class EYT piping shall be given when applicable. The necessary welding procedure and work tests shall be determined according to the safety class of the piping.

Welding procedure tests refer to the testing of material properties of the welded joints and claddings of the planned piping. Test pieces shall be fabricated in such a way that essential variables are analogous with those of the final structure. The procedure tests shall show the properties of welded joints and claddings or of their repairs.

The welding procedures used in the manufacturing of pipes shall be qualified separately for every subcontractor by procedure tests.

Work tests mean tests performed by each welder on a welded joint or a group of joints and on a cladding in connection with the manufacture of the structure or in advance. If the work test scope is extensive enough, including mechanical tests, work tests can replace procedure tests. Work tests shall be conducted if the welding technique or circumstances are exceptionally demanding considering the performance of the work.

Procedure tests are valid either for a fixed period of time or permanently, depending on the applicable standard, whereas work tests only relate to one component, welded joint or cladding.

4.6.2 Instructions for fabrication

It shall appear from the instructions for fabrication how the piping and its parts and billets are fabricated. The description shall include the following information:

- description of fabrication, indicating the methods of fabrication and heat treatment
- method of fabrication of pressure-bearing parts or parts subject to great loadings (hot and cold forming, etc.)
- welding instructions and a description of other joining methods
- heat treatment procedures and allowable and used heat treatment holding times, temperatures and rates of temperature change
- a description of welding procedure and work tests and their approval limits
- other instructions of fabrication, such as instructions for surface treatment.

4.6.3 Fastenings

A separate set of rules shall be prepared for the manufacture, mounting and quality control of the fastening plates and attachment points of piping supports. The rules shall deal i.a. with the following matters:

- materials
- dimensioning
- welded joints
- surface treatment
- inspections.

The anchor bolt fasteners used shall have a type approval that is in force in Finland or approval and mounting instructions based on tests carried out by an approved inspection agency. Anchor bolt fasteners shall not be used without a justified reason

- in fastenings that may become dynamically loaded
- in the securing of Safety Class 1 and 2 pipes, small-diameter piping excluded.

Separate rules shall be prepared for the installation of anchor bolt fasteners and the quality inspection of installation work. The rules shall also specify the required competence of the installers (see Guide YVL 4.1).

If fasteners of some other kind are used, a report shall be prepared of their operation, installation and quality inspection, which is to be attached to the construction plan. The requirements for the pipe whip restraints are set forth in Guide YVL 4.2.

4.7 Quality inspection programme

4.7.1 General

Before any specific piping construction plans are made it is appropriate to draw up a general plant-specific document that describes the quality inspection requirements for piping in different safety classes. STUK's approval for this document shall be obtained. Quality requirements for detailed plans are then determined by the principles and requirement level set forth in this document.

The quality inspection programme shall be consistent with the construction material report and instructions for manufacture. The programme shall set forth the quality inspection of fabrication, procedure and work tests, testing, and the finished structure.

The plan for the testing of materials properties can also be attached to the construction material report required in subsection 4.5 in case it clarifies component-specific requirement levels.

4.7.2 Quality inspection plan

Quality inspection plans shall be presented of sections of piping, welded joints and finished structures as well as of the necessary procedure and work tests to be conducted during manufacturing.

The plan shall
- refer to drawings of the piping
- state the construction and filler materials as well as the material certificate requirements
- refer to the welding instructions
- state the tests to be conducted and their supervision and refer to standards and quality inspection procedures.

In addition, Safety Class 1 and 2 plans shall indicate in more detail
- division by weld joint and reference made to joint-specific welding instructions
- reference made to material reports and the necessary procedure and work tests.

As regards inspections and tests marked in the plans, it shall be indicated whether they are carried out at the site of manufacturing of the material, in the machine shop or at the installation site, and which parties (e.g. manufacturer, orderer, approved inspection organisation, regulatory body) inspect or supervise them. In a corresponding way, separate quality inspection plans can be prepared for each site of manufacturing.

4.7.3 Quality inspection instructions

Procedures shall be presented for inspections and tests that correspond to the quality inspection plan of the manufacture and installation of piping. The procedures shall give the method, extent, approval limits and reporting of the inspections and tests. As regards details, reference can be made to applicable standards. The quality inspection procedures can also be presented as a separate document in connection with the aforementioned general document describing quality inspection requirements.

4.8 Drawings

The drawings shall describe the configuration and details of piping in such a way that the size, shape, manufacture and mounting of parts and their allowable tolerances are given in sufficient detail. The drawings shall be unambiguous and explicit. They shall show
- safety classes and their boundaries
- installation drawings with parts lists
- standards markings, nominal dimensions and pressure classes of the materials of piping sections or, in a corresponding way, their dimensions and shapes as well as reference to the drawings of non-standardised parts
- location, dimensions and groove shapes as well as reference to welding instructions or an explanation of welding information
- reference to quality inspection plans and instructions.

In addition to the above, and depending on intended purpose of use and safety class, the following drawings shall be presented about the piping:
- location drawings prepared as projections to illustrate the routing of piping with DN $\geq$ 50
- isometric drawings prepared for DN $\geq$ 50 piping to give the manufacturer sufficient information for piping pre-fabrication (the location and type of supports shall be indicated for flexibility analyses)
- when necessary, pre-fabrication drawings of pre-fabricated entities, giving information on welded joints and other fabrication data
- part drawings about all non-standardised parts of piping (which shall show all the information needed in basic dimensioning and in a possible stress analysis).

Drawings of non-standardised piping supports shall be classified by support type.

5 Construction inspection

The requirements for the construction inspection of piping and its support structures are set forth in Guide YVL 1.15.

A construction inspection will be conducted after piping has been completed. However, examinations that cannot easily be made later shall be performed during the manufacture. The objects of these partial inspections may include, for example, pipe bends, flanges, couplings, bellows expansion joints, as well as branchtrees, expanding and reducing sections, and accessories, such as closing devices, safety and drainage valves, measuring and control equipment and pumps. Records covering the piping of the whole system shall be prepared of the partial inspections.

Construction inspections are conducted by STUK's inspectors. The construction inspection of Safety Class 3 or Group EYT/A piping is performed by an inspector employed or approved by STUK. STUK does not inspect the construction of Group EYT/B piping. The licensee shall see to it that such piping has been constructed according to applicable regulations and plans.

6 Commissioning inspection

6.1 General

The commissioning inspection is performed in two phases in accordance with Guide YVL 3.7. Piping shall not be commissioned before it and its accessories and supporting structures have been approved. However, to adjust the equipment and to test its operational readiness, trial operation of piping prior to the commissioning inspection is allowed provided that sufficient care is taken.

The commissioning inspection of Safety Class 1, 2 and 3 as well as Group EYT/A piping is performed by an inspector employed by STUK, unless decided otherwise by STUK.

STUK does not perform the commissioning inspections of Group EYT/B piping. The licensee shall ensure the quality of the piping in the same way as in the case of Group EYT/A piping.

In some cases it may be necessary to continue inspection of the mechanical operation of piping even after the nuclear facility has been started to ensure operation of the piping with normal operating parameters. The operation of all safety-significant accessories plus documents are reviewed in connection with the commissioning inspection of the piping in question.

In connection with the commissioning inspection it is ascertained that the piping is in compliance with the Final Safety Analysis Report i.a. as regards process and instrumentation charts.

6.2 Verification

In the verification inspection it is checked that the construction plans for the whole system's piping and its parts and accessories have been approved and the structures inspected.

6.3 Functional tests

In the functional tests it is checked that piping and the accessories important to its safety operate as intended. Furthermore, it is checked that piping supports operate as intended and thermal movements and vibrations are controlled by measurement programmes.

Measurement programmes and reports at different power levels relating to the control of thermal movements and vibrations of the piping shall be submitted to STUK for approval in connection with the commissioning of the system.

The programmes shall present how the thermal movements of Safety Class 1 and other primary circuit pipework are controlled by measurements. The acceptability of measured thermal movements shall be judged on the basis of the flexibility calculations of the piping. Furthermore, it shall be visually checked during commissioning that all accessible piping and the structures and equipment belonging to them have sufficient margins for thermal movement. When piping is cooled to initial temperature, reversion of thermal movements shall be ensured.

The vibrations of Safety Class 1 piping shall be controlled by means of measurements both in circumstances corresponding to normal operation and in tests causing dynamic impact loads. The measurements shall show the highest vibration stresses of the piping either directly or by means of a calculation model applied to the results. In addition, the vibrations of all accessible piping shall be visually controlled, applying the criteria approved by STUK for each case. When necessary, compliance with the criteria shall be demonstrated by measurements.

In case the criteria are exceeded, the vibrations shall be attenuated to an acceptable level by appropriate means, such as by finding out and removing its initiator or by altering the mode of support.

General regulatory control procedures for strength calculations pertaining to the test operation of nuclear power plants are set forth in Guide YVL 3.5.

7 Control during operation

Safety Class 1 and 2 piping shall be examined at regular intervals by non-destructive examination methods in accordance with Guide YVL 3.8.

STUK controls by periodical inspections the implementation of condition monitoring and preventive maintenance programmes of piping and reviews the examination results. The methods of control include for example wall thickness measurements, monitoring of vibrations, inspection of supports as well as monitoring of pressure and thermal transients.

8 Repairs, modifications and spare parts

Guide YVL 1.8 applies to the design, implementation and commissioning of repairs and modifications.

Construction plans for piping and its parts also apply to spare parts. All modifications are subject to STUK's approval. The scope of spare parts inspections shall be equal to that of original parts.

9 References

1 SFS 2610. Dimensioning of a pressure vessel. Dimensioning criteria.

2 ASME Boiler and Pressure Vessel Code, Section III, Rules for Construction of Nuclear Power Plant Components, American Society of Mechanical Engineers, New York, 1995.

YVL Guides

General guides

YVL 1.0 Safety criteria for design of nuclear power plants, 12 Jan. 1996

YVL 1.1 Finnish Centre for Radiation and Nuclear Safety as the regulatory authority for the use of nuclear energy, 27 Jan. 1992

YVL 1.2 Documents pertaining to safety control of nuclear facilities, 11 Sept. 1995

YVL 1.3 Mechanical components and structures of nuclear power facilities. Inspection licenses, 22 Oct. 1996 (in Finnish)

YVL 1.4 Quality assurance of nuclear power plants, 20 Sep. 1991

YVL 1.5 Reporting nuclear power plant operation to the Finnish Centre for Radiation and Nuclear Safety, 1 Jan. 1995

YVL 1.6 Nuclear power plant operator licensing, 9 Oct. 1995

YVL 1.7 Functions important to nuclear power plant safety, and training and qualification of personnel, 28 Dec. 1992

YVL 1.8 Repairs, modifications and preventive maintenance at nuclear facilities, 2 Oct. 1986

YVL 1.9 Quality assurance during operation of nuclear power plants, 13 Nov. 1991

YVL 1.10 Requirements for the siting of nuclear power plants, 11 July 2000 (in Finnish)

YVL 1.11 Nuclear power plant operating experience feedback, 22 Dec. 1994

YVL 1.13 Nuclear power plant outages, 9 Jan. 1995

YVL 1.14 Mechanical equipment and structures of nuclear facilities. Control of manufacturing, 4 Oct. 1999 (in Finnish)

YVL 1.15 Mechanical components and structures in nuclear installations, Construction inspection, 19 Dec. 1995 (in Finnish)

YVL 1.16 Control of nuclear liability insurance policies, 22 March 2000 (in Finnish)

Systems

YVL 2.1 Safety classification of nuclear power plant systems, structures and components, 26 June 2000 (in Finnish)

YVL 2.2 Transient and accident analyses for justification of technical solutions at nuclear power plants, 18 Jan. 1996

YVL 2.3 Preinspection of nuclear power plant systems, 14 Aug. 1975

YVL 2.4 Primary and secondary circuit pressure control at a nuclear power plant, 18 Jan. 1996

YVL 2.5 Pre-operational and start-up testing of nuclear power plants, 8 Jan. 1991

YVL 2.6 Provision against earthquakes affecting nuclear facilities, 19 Dec. 1988

YVL 2.7 Ensuring a nuclear power plant's safety functions in provision for failures, 20 May 1996

YVL 2.8 Probabilistic safety analyses (PSA), 20 Dec. 1996

Pressure vessels

YVL 3.0 Regulatory control of pressure vessels in nuclear facilities. General guidelines, 11 Sep. 1996

YVL 3.1 Construction plan for nuclear facility pressure vessels, 27 May 1997 (in Finnish)

YVL 3.3 Nuclear power plant pressure vessels. Control of piping, 4 December 1996

YVL 3.4 Nuclear power plant pressure vessels. Manufacturer's competence, 16 December 1996 (in Finnish)

YVL 3.7 Pressure vessels of nuclear facilities. Commissioning inspection, 12 Dec. 1991

YVL 3.8 Nuclear power plant pressure vessels. Inservice inspections, 13 Dec. 1993

YVL 3.9 Nuclear power plant pressure vessels. Construction and welding filler materials, 6 April 1995 (in Finnish)

Buildings and structures

YVL 4.1 Concrete structures for nuclear facilities, 22 May 1992

YVL 4.2 Steel structures for nuclear facilities, 19 Jan. 1987

YVL 4.3 Fire protection at nuclear facilities, 1 Nov. 1999 (in Finnish)

Other structures and components

YVL 5.1 Nuclear power plant diesel generators and their auxiliary systems, 23 Jan. 1997 (in Finnish)

YVL 5.2 Nuclear power plant electrical systems and equipment, 23 Jan. 1997 (in Finnish)

YVL 5.3 Regulatory control of nuclear facility valves and their actuators, 7 Feb. 1991

YVL 5.4 Supervision of safety relief valves in nuclear facilities, 6 April 1995 (in Finnish)

YVL 5.5 Supervision of electric and instrumentation systems and components at nuclear facilities, 7 June 1985

YVL 5.6 Ventilation systems and components of nuclear power plants, 23 Nov. 1993

YVL 5.7 Pumps at nuclear facilities, 23 Nov. 1993

YVL 5.8 Hoisting appliances and fuel handling equipment at nuclear facilities, 5 Jan. 1987

Nuclear materials

YVL 6.1 Control of nuclear fuel and other nuclear materials required in the operation of nuclear power plants, 19 June 1991

YVL 6.2 Design bases and general design criteria for nuclear fuel, 1 Nov. 1999

YVL 6.3 Supervision of fuel design and manufacture, 15 Sept. 1993

YVL 6.4 Transport packages for nuclear material and waste, 9 October 1995

YVL 6.5 Supervision of nuclear fuel transport, 12 October 1995 (in Finnish)

YVL 6.6 Surveillance of nuclear fuel performance, 5 Nov. 1990

YVL 6.7 Quality assurance of nuclear fuel, 23 Nov. 1993

YVL 6.8 Handling and storage of nuclear fuel, 13 Nov. 1991

YVL 6.9 The national system of accounting for and control of nuclear material, 23 Sept. 1999 (in Finnish)

YVL 6.10 Reports to be submitted on nuclear materials, 23 Sept. 1999 (in Finnish)

YVL 6.11 Physical protection of nuclear power plants, 13 July 1992 (in Finnish)

YVL 6.21 Physical protection of nuclear fuel transports, 15 Feb. 1988 (in Finnish)

Radiation protection

YVL 7.1 Limitation of public exposure in the environment of and limitation of radioactive releases from nuclear power plants, 14. Dec. 1992

YVL 7.2 Evaluation of population doses in the vicinity of a nuclear power plant, 23 Jan. 1997 (in Finnish)

YVL 7.3 Evaluation of models for calculating the dispersion of radioactive substances from nuclear power plants, 23 Jan. 1997 (in Finnish)

YVL 7.4 Nuclear power plant emergency preparedness, 23 Jan. 1997

YVL 7.5 Meteorological measurements of nuclear power plants, 28 Dec. 1990

YVL 7.6 Monitoring of discharges of radioactive substances from nuclear power plants, 13 July, 1992

YVL 7.7 Radiation monitoring in the environment of nuclear power plants, 11 Dec. 1995

YVL 7.8 Environmental radiation safety reports of nuclear power plants, 11 Dec. 1995 (in Finnish)

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