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SUPERVISION OF THE PIPING OF NUCLEAR FACILITIES

CONTENTS

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1 GENERAL

The Finnish Centre for Radiation and Nuclear Safety (STUK) follows this guide in supervising nuclear power plant piping of Safety Classes 1, 2 and 3 and Class EYT (non-nuclear), including the supporting structures of the piping. The guide is based on Guides YVL 1.0, YVL 1.1 and YVL 3.0. This guide is not applied to such piping of Class EYT that is exempted from supervision as per TTL Guide 5/82/P. The repairs and modifications of piping constructed before this guide became effective will be supervised in accordance with this guide. In well substantiated cases, the continuation of an earlier practice in making modifications to an operating plant can be allowed. However, this guide will be applied to new constructions forming a separate entity.

The pressure vessels that are connected to the piping are supervised in accordance with Guide YVL 3.0 and other associated guides. Valves are supervised according to Guide YVL 5.3, safety valves according to Guide YVL 5.4, and pumps according to Guide YVL 5.7. Piping made of reinforced plastics can be used in Class EYT and, after further reviews, also in Safety Class 3. The requirements concerning piping made of reinforced plastics are dealt with in TTL Guide 7/81 P.

The safety class of the piping is determined pursuant to the classification document, which is described in Guide YVL 2.1. The valves and other accessories of the piping belong to the same safety class as the piping itself.

The supervision comprises the following phases:

- review of the classification document
- granting of manufacturing and inspection licenses

and control over them
- inspection of the construction plan and the stress analyses
- supervision of construction
- construction inspection
- commissioning inspection
- supervision of start-up testing and inspection of the operation of supporting structures
- supervision of inservice inspections
- supervision of repairs and modifications.

This guide deals with each supervisory phase in turn expounding, for instance, the role of the safety class in the scope of supervision.

1.1 Classification of piping

Piping is every external network of pipes or some other pipeline with necessary accessories that is connected to a pressure vessel. The pipelines leading to a non-pressure vessel or room or to surface or ground waters are also included in the piping denoted by this guide. The design and inspection limit between a piping and a pressure vessel is the design limit defined in Standard SFS 2610. A welded seam forming a design limit is part of the piping.

The division of piping into Groups A and B. On the basis of their importance to nuclear safety, pipes are divided into classes 1, 2, 3 and EYT. On the basis of their degree of stress and their general importance to safety, the pipes in Class EYT are further divided into groups A and B as follows (see App. 1):

1) Group A comprises Class EYT piping
   1) which is dimensioned on the basis

of the yield or fatigue strength of the construction material, or

2) which contains a substance causing exceptional corrosion or wear, or

3) which contains aqueous vapour or gas, whose maximum temperature is + 120°C, and the product of the maximum operating pressure (MPa) and the square of the nominal dimension DN (mm^2) exceeds 10^5, or

4) which only contains aqueous vapour, liquid or gas, whose temperature exceeds + 120°C, and the product of the maximum operating pressure and the square of the nominal dimension exceeds 10^4.

2) Group B comprises the rest of Class EYT piping.

The piping that contains a dangerous (non-radioactive) liquid or gas is classified according to Guide YVL 2.1.

Safety classification of small-diameter piping (DN<50). Guide YVL 2.1 is interpreted as follows in determining safety classes for small-diameter pipes which are directly connected to safety-classified process piping or components:

1) Small-diameter pipes that have a DN≤20 and are connected to Safety Class 1 piping and components belong to Safety Class 2.

2) Small-diameter pipes connected to Safety Class 2 piping and components in the primary circuit belong to Safety Class 2 regardless of their

size (see Guide YVL 2.1). Overflow pipes, with a DN≤20, in the seals of primary circuit components belong to Safety Class 3.

3) Small-diameter pipes that are connected to piping and components of Safety Class 2 not forming a part of the primary circuit, are included in Safety Class 3 or Group EYT/B as per Appendix 2.

4) Small-diameter pipes connected to Safety Class 3 piping and components are included in Group EYT/B as per Appendix 3.

5) Small-diameter pipes whose dimensions exceed the limits given in Appendices 2 and 3 but that are provided with a throttle (flow limiter, pressure reduction valve) reducing the flow, in effect, below the pipe limit, belong to a lower class from the throttle onwards, in accordance with the principles of paragraphs 3 and 4.

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 that is decisive for the classification. Piping of this kind includes, for instance, impulse lines guiding the primary system, fuel pipes of the diesels, and coolant pipes of the pumps. A separate account shall be given of these pipes in the classification document.

Supports will be placed in a safety class that is one step lower than the class of the piping supported by them. However, the supports of Safety Class 3 piping are included in Safety Class 3 and the supports of Class

EYT in Class EYT.

2 REQUIREMENTS FOR MANUFACTURE AND INSPECTION

2.1 Manufacturing license and approval of supervisor of manufacture

The term 'manufacture of piping' means the installation, repairs and modification of piping, as well as the fabrication of the parts of piping in a machine shop and at the installation site.

The piping of Safety Classes 1, 2 and 3 and Group EYT/A intended for nuclear facilities to be constructed in Finland can only be manufactured by virtue of a manufacturing license granted by the regulatory authority and under the supervision of an approved supervisor of manufacture. The manufacturing license for piping belonging to Safety Class 1 or 2 shall be issued by STUK.

Piping belonging to Safety Class 3 and to Group EYT/A can be manufactured by virtue of a license granted either by the Technical Inspection Centre (TTK) or by STUK.

The manufacturer of piping of Group EYT/B need not have a manufacturing license specified in this guide. However, the principles presented in this guide shall be followed in the manufacture, where applicable.

The manufacturing licenses can be specified to apply either to manufacture in the factory, to installation, or to repairs and modifications during operation.

If there are subcontractors taking part in the manufacture, they shall be introduced in the the application for a manufacturing license, or the license shall in this respect be supplemented later. Wherever applicable,

the subcontractors are subject to the same regulations as the actual manufacturer. The power company can also file an application for its own manufacture.

Before granting a manufacturing license, STUK will perform audits at the manufacturing site to the extent deemed necessary.

The application for the approval of a supervisor of manufacture shall be made in writing to the regulatory authority. However, the application to STUK is made through the power company. The application shall include the personal data and domicile of the intended supervisor, as well as a description of his competence. If the manufacture takes place in Finland, the supervisor must be a Finnish citizen. The licensing procedure is dealt with in more detail in Guides YVL 3.0 and YVL 3.4.

The Finnish Centre for Radiation and Nuclear Safety and an independent inspection agency will supervise the manufacture, as determined in Guides YVL 3.0, YVL 3.6 and YVL 1.8.

2.2 Approval of inspection agencies and inspection personnel

Only companies and inspectors approved by the regulatory authority can perform inspections and act as experts at the nuclear power plants to be constructed in Finland and to be used in Finland. Licenses for individual companies and inspectors are applied for in accordance with Guide YVL 1.3.

If the manufacturer inspects only its own products, inspection licenses for its quality control department and inspectors can be applied for in connection with the application for a manufacturing license.

3 APPROVAL OF CONSTRUCTION PLAN

The construction plan shall be submitted to STUK for approval before the manufacture is begun. The documents shall contain:

1 Description of the manufacturer
2 Design bases
3 Construction material report
4 Rules for fabrication
5 Quality control programme
6 Basic dimensioning (and stress analysis)
7 Drawings

The construction plans are submitted to STUK in accordance with Guide YVL 1.2 utilizing the division used in this guide.

The construction plan is submitted for approval as design entities and the requirements are specified according to safety classes.

In Safety Classes 1 and 2, STUK can issue special regulations deviating from this guide if the operating conditions or dimensions make it necessary.

In the case of piping of Safety Class 3 or Group EYT/A, a so-called piping specification, containing the principles of the construction plan, can be submitted for approval. The piping specification shall include at least the following information:

- description of the manufacturer
- description of the piping section in question (flow sheet) and design data

- construction materials with norm references
- dimensioning norms
- norms of form parts
- norms of supports
- rules for welding and manufacture
- rules for mounting
- norms and programmes for quality control
- inspection plans and rules for inspection
- data on pressure and leak tests
- over-pressure protection of piping
- drawings

When necessary, the piping specification acts as a basis for the construction plan. The construction plan for parts of piping in Group A need not be approved by STUK if the corresponding piping specification has been approved. As concerns parts of piping in Group B, neither the construction plan nor the piping specification needs an approval by STUK.

3.1 Description of manufacturer

The requirements presented in this section concern Safety Classes 1 and 2. In Safety Class 3 and in Class EYT, actions are taken in accordance with the procedure used in the piping specification.

The description shall give a picture of the expertise of the manufacturer of piping. The description shall include an outline of the organization confirmed by the management of the company, showing, for instance, duties, responsibilities and competences, as well as the organization of quality assurance. The description of the quality assurance can be based on the quality assurance manual used by the company.

The description shall include the above-mentioned information also on the subcontractors and inspection agencies that participate in the manufacture or quality control of the piping. The quality control department of the manufacturer, or the inspection agency and the inspectors that are used in the quality control shall be approved by STUK. The approval is applied for in accordance with Guide YVL 1.3.

If the document is essentially similar to a document that has been submitted to STUK previously (eg. application for a manufacturing license), a reference to the previous document together with any modifications or additions is sufficient.

3.2 Design bases

The design bases give a brief account of the data concerning the operating conditions and loading of the piping that will be needed in the review of the construction plan and the stress analysis.

The design bases shall include:

- system-specific coloured flow sheets, which show clearly all safety classes, the division of Class EYT into Group A and B piping, the data on pressure tests, and the accessories of the piping
- process and instrumentation charts
- a description of the operation of the piping with operating parameters (operating pressures, temperatures, etc)

- design parameters, such as pressures and temperatures, their range of variation and the number of load exchanges
- information needed in the assessment of accidents
- information on the contents of the piping and on the external conditions.

The design bases shall be consistent with the safety analysis report and the classification document, and they shall be sufficient to make possible the review of the construction material report, quality control programmes, basic dimensioning, drawings and stress analyses.

3.3 Construction material report

The construction material report demonstrates the applicability of the construction materials and the manufacturing processes to their intended purposes and defines unequivocal bases and limits for the approval of the properties of construction materials.

The construction material report shall embrace all pressure-bearing parts and the parts welded to them, as well as the procedure and work tests validating manufacture and installation. The subjects are specified as follows:

1 List of base materials and welding filler materials specific to each piping. The list shall give the numbering of the parts (reference to welding drawings and to inspection plans), the standard symbols of the base materials and the filler materials, and references to the applicable reports.

2 In Safety Classes 1 and 2, reports on each construction material showing

- manufacturing process and delivery condition of base material
- manufacturing procedures that are essential to the properties of the final structure (working, heat treatment), or references to documents where they are to be found
- material properties required of the final structure, procedures and extent of testing, data on the receipt and control of the material, and type of the material certificate.

All base materials and welding filler materials used for pressure-bearing parts and for parts welded to them, as well as for test pieces validating the manufacture and installation of these parts, shall be approved as construction materials for pressure vessels. The approval procedure is described in Guide YVL 3.9. The requirements also apply to soldered joints.

The base material, weld, and heat-affected zone of the final structure shall meet the requirements set forth in the construction material report for chemical and mechanical properties. The procedures and extent of testing shall be determined on the basis of safety class, type and quality of material, manufacturing process, operating conditions, dimensions, and the compatibility of materials with standards.

3.4 Rules for fabrication

3.4.1 General

The rules for fabrication are required in the extent presented here only in Safety Classes 1 and 2. The regulations concerning Safety Class 3 and Class EYT are given in Guide YVL 3.2.

The rules for fabrication describe the manufacturing processes and the role of quality control in the various phases of manufacture. The procedure and work tests that are required are determined according to the safety class of the piping and the demands placed on it.

Procedure tests mean tests that are performed on welded joints and on welded overlays. The test pieces are fabricated in such a way that their essential variables correspond with the final structure. The purpose of the procedure tests is to disclose the properties of the welded joints or overlays in the final structure or to ascertain the competence of the company to make welded structures.

Work tests mean tests performed by each welder on a welded joint or a group of joints and on an overlay in connection with the manufacture of the structure. If the tests are extensive enough, they can act as substitutes for procedure tests.

The procedure tests are valid either for a fixed period of time or permanently, depending on the standard to be applied, whereas the work tests relate only to one component, one welded joint and one overlay. Work tests are usually performed only in welding the most demanding joints.

The rules for fabrication present a description of the fabrication of the piping and of the parts and blanks used for it. The description shall include the following information:

1 Manufacturing process of pressure-bearing parts and other parts subject to great strain (eg. rolling, forging, casting, hot and cold working of the parts and blanks).

2 Description of the joining methods, especially rules for welding.

3 Inspection schedule.

4 Heat treatment procedures, their timing in the manufacture, and the allowable and used heat treatment times, temperatures and rates of temperature change.

5 Description of the work and procedure tests of welding and their approval limits.

6 Other rules for fabrication, eg. rules for grinding.

The manufacturing process and quality control of pressure-bearing parts shall be described in such detail that the final properties of the structure can be assessed on the basis of the description.

3.4.2 Supports

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, for instance, with the following questions:

- construction materials
- dimensioning
- welded joints
- surface treatments
- inspections

The anchor fastener to be used shall have a type approval that is effective in Finland or its operation shall be otherwise depicted in a report based on tests conducted in an approved testing facility. An anchor fastener is not to be used without a justified reason

- in fastenings that may become dynamically loaded, or
- in securing pipes of Safety Classes 1 and 2.

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

If fasteners of some other kind are to be used, a report shall be prepared of their operation, installation and quality control.

3.5 Quality control programme

The design criteria of piping in the various safety classes, eg. the technical requirement level of quality control, are not described in detail in YVL Guides or in standards. Therefore it is practical to prepare a document illustrating the design and quality control

requirements at each power plant unit and to submit it to STUK for approval before the component-specific construction plans (see Guide YVL 3.0). The component-specific quality control programmes are drawn up following the principles and requirement level of the document.

Safety Classes 1 and 2

The quality control programme gives a systematic presentation of the quality control of the piping with associated inspections.

The quality control programme shall include

- inspection plans for base materials, filler materials, welded joints, and the completed structure, as well as for the procedure and work tests to be conducted during manufacture
- rules for inspection, or a list of them, or references to the rules submitted previously.

The quality control programme shall be prepared in such a way that there are no discrepancies with respect to the construction material report.

The inspection plans shall be given of the quality control of the base material, work tests, welding and the completed structure, separately for each type of part and welded joint.

The plan shall be prepared in such a way that it shows

- the numbering of each part and welded joint in accordance with the drawings
- name and quantity of the part

- standard symbol of the base material and the filler material
- list of procedure tests indicating which of them validates each pressure-bearing welded joint
- inspections to be conducted on parts and welded joints.

If an inspection is included in the plan, it shall be indicated whether the inspection is carried out at the manufacturing site of the material, in the machine shop or at the installation site, and which parties (eg. manufacturer, power company, approved inspection agency, regulatory authority) will perform the inspection or supervise it. The inspections that will be carried out at the installation site can be described in separate inspection plans.

There shall be rules for making inspections concerning the manufacture and installation of the piping and the results of the associated work tests. The rules shall specify the procedure, extent, requirements and reporting of the inspection. In details, reference can be made to standards.

The quality control procedures that are presented in the rules can be grouped as follows:

- identification, marking and certificates of materials
- sampling in material testing
- destructive testing
- checking the competence of welders
- supervision of welding
- destructive testing
- supervision of heat treatments

- checking the dimensions of structures
- leak and pressure tests
- other inspections.

Safety Class 3 and Class EYT

The quality control programme of piping in Safety Class 3 and in Class EYT is prepared following the principles of the piping specification and Standard SFS 2610.

3.6 Basic dimensioning and stress analysis

The basic dimensioning shows that dimensions and design of the piping parts meet the requirements set forth in standards.

The basic dimensioning is prepared so as to correspond with the design conditions of the piping (pressure and temperature), which do not generally include temperature gradients or repeatability of a load. The basic dimensioning calculations are based on drawings depicting the piping and its parts and revealing the necessary dimensions and the shape of the structure.

The parts of piping belonging to Safety Class 1 (DN>50) shall be dimensioned according to Paragraph NB-3000 in Section III of the ASME Boiler and Pressure Vessel Code. Deviations can be allowed if they are based on a nuclear power plant standard that is in effect in the country of manufacture.

No segment curves are approved in Safety Classes 1 and 2, nor are pipes or pipe bends with longitudinal seams, unless there are well-substantiated reasons to the contrary.

The parts of piping belonging to Safety Classes 1 ($DN \leq 50$),

2 or 3 or to Class EYT will be dimensioned in accordance with an applicable standard, which is one of those mentioned below or some other standard approved by STUK.

1 ASME Code, Section III NC-3000 (2nd Class), ND-3000 (3rd Class)
2 SFS 2610 "Design of pressure vessels. Basic requirements" and SFS 3273 "Design of pressure vessels. Piping. Basic requirements"
3 AD-Merkblatt B.

Parts of piping, such as pipes, pipe bends, flanges and connecting pieces, that conform to a national or international standard, are approved as such with respect to dimensioning in Safety Classes 2 and 3 and in Class EYT.

The flexibility of the piping shall be found out in order to determine the loads that will affect the piping itself and the associated components and pipe supports. In Safety Class 1 this is made following the regulations in ASME Code Section III. In Safety Classes 2 and 3 and in Class EYT, the need for a flexibility analysis is determined on the basis of the nominal diameter and the design temperature. The analysis shall always be carried out when the design temperature exceeds +120°C, but not for pipes in which DN≤100.

The stress analysis reveals the stresses caused by thermal transients and discontinuities and the fatigue of the structure. The piping in Safety Class 1 and other piping in the primary circuit, as well as the parts that extend up to the outer isolation valves of the steam and feed water systems inside the containment of pressurized water reactor plants, shall be subject to basic dimensioning and a detailed stress analysis in accordance with Guide

YVL 3.5 in the cases and at the times determined by the guide.

Extra attention shall be paid to the dynamic stresses of the piping. Depending on the circumstances one shall take into account

- the mechanical vibrational loads caused by machinery and equipment
- the pressure shock loads caused by the opening and closing of valves and by the adjustments made in the process
- the loads caused by the liquid flowing in the pipe or by the turbulent or uneven flow of gas
- the loads caused by the contents of the pipe discharged after a pipe rupture or by flying missiles.

The stresses that cannot be calculated accurately enough must be determined experimentally by means of measurements.

Pipe supports will be dimensioned according to the loads given by flexibility calculations. The piping shall be supported in such a way that the allowable strains of the piping and the allowable supporting reactions of the associated components are not exceeded and the minimum gradient of the piping is not lost.

The power company shall present plans showing how to prevent the sequence of damages caused by the breaking of pipes in Safety Classes 1 and 2.

In the design of piping, enough room shall be reserved for inservice inspections. The requirements set by inservice inspections shall also be taken into account

in the design of welded joints. To reduce the need for inspections, it is recommended that the number of welded joints be minimized. In addition, the requirements presented in Guide YVL 7.18 shall be given consideration in the design of piping.

3.7 Drawings

The drawings will describe the assembly and details of the piping in such a way that the sizes, shapes, manufacture and mounting of the parts with the allowable tolerances are depicted in sufficient detail.

The drawings shall be unambiguous and clear. They shall show

- safety classes and their limits, room symbols and associated drawings
- dimensions and shapes used in strength calculations and in other analyses or chosen on the basis of these
- assembly and part assembly data with part lists
- nominal dimensions of the parts of piping, pressure classes, and reference to the drawings of unstandardized parts
- locations, dimensions and groove shapes of welded joints (or reference to welding rules)
- reference to the quality of the construction material and filler material in pressure-bearing parts and in parts welded to them, and to the applicable standards
- reference to the welding rules or a description of the welding data with respect to the welded joints
- reference to the rules for quality control and inspection with respect to the piping.

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

Depending on the intended application and the safety class, the piping is described in drawings of various types:

- when necessary, location drawings which are prepared as projections on the basis of the flow sheets to illustrate the progress of the piping in which DN>50. The locations and types of supports shall be given for flexibility studies
- isometric drawings which are prepared for DN>50 piping to give the manufacturer enough information for the pre-fabrication
- when necessary, pre-fabrication drawings of the entities that are pre-fabricated, with information of the welded joints and other phases of fabrication
- part drawings shall be made of all unstandardized parts of piping and they shall show all the information that will be needed in the basic dimensioning and in an eventual stress analysis
- drawings of small-diameter piping can be made in connection with mounting for piping that will be mounted without using any pre-fabricated parts.

The drawings of piping supports shall be classified according to support types.

Extra attention shall be paid to the rapid updating of the drawings in connection with modifications and additions.

4 CONSTRUCTION INSPECTION

The piping and the supporting structures shall undergo a construction inspection, which comprises the review of the results of quality control, the inspection of the implementation of the construction plans for the piping and its parts, the inspection of the quality of work, and the pressure test.

The construction inspection will be carried out by an inspector employed by STUK, unless otherwise indicated below.

The requests for inspection shall be submitted to STUK as per Guide YVL 1.2. The construction inspection will be performed after the piping has been completed. However, if certain examinations cannot be made later, they shall be performed during the manufacture. The objects of these partial examinations include, for instance, pipe bends, flanges, connecting pieces, bellows expansion joints, as well as branchtees, increasing and reducing sections, and accessories, such as closing devices, safety and drainage valves, measurement and control equipment and pumps.

The construction inspection of the piping is carried out in accordance with Guide YVL 1.15 and applying Standard SFS 3323. A record shall be prepared of a completed inspection. Finally, a summary record concerning the piping of a whole system will be compiled of all partial examinations.

The construction inspections of valves, safety valves and pumps will be carried out according to Guides YVL 5.3, YVL 5.4 and YVL 5.7.

The construction inspection of piping in Safety Class 3 and in Group EYT/A will be performed by an inspector employed or approved by STUK. STUK will not perform construction inspections for piping in Group EYT/B. The power company shall see to it that the piping has been constructed according to pertinent regulations and plans.

5 COMMISSIONING INSPECTION

5.1 General requirements

The piping shall not be commissioned until it has been approved in a commissioning inspection with its accessories and supporting structures.

The commissioning inspection will be carried out following Guide YVL 3.7, and for practical reasons the inspection is divided into two phases: verification and functional tests.

The commissioning inspection of piping in Safety Classes 1, 2 and 3 and in Group EYT/A will be performed by an inspector employed by STUK.

STUK performs no commissioning inspections for piping in Group EYT/B. However, the power company shall ensure the readiness of the piping before the commissioning of the plant, for instance in the same way as in the case of EYT/A piping, or during the start-up testing of the system.

In some cases it may be necessary to continue the inspections concerning the mechanical operation of piping even after the nuclear facility has been started so that the operation could be ensured with the normal operating parameters of the piping.

According to Guides YVL 5.7 and YVL 5.3, the pumps and valves of Class EYT do not fall under the control of STUK. The operation of these pumps and valves is nevertheless inspected in connection with the commissioning inspection of the relevant piping. In addition, it is checked that the associated documents meet the regulations of the power company.

In connection with the commissioning inspection, it is ascertained that the piping complies with the Final Safety Analysis Report, eg. as concerns process and instrumentation charts.

5.2 Verification

In the verification it is checked that the construction plans of the piping of a whole system, including the plans of parts and accessories, have been approved and that the construction inspections have been completed in an acceptable way.

5.3 Functional tests

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

The measurement programmes and reports relating to the

control of thermal movements and vibrations of the piping shall be submitted to STUK.

The thermal movements of Safety Class 1 and other primary circuit pipings shall be controlled with measurements at the various power levels of start-up testing. The reversion of thermal transitions to their original temperatures during cooling shall be checked.

The acceptability of the measured thermal movements shall be judged on the basis of the flexibility calculations of the piping. Furthermore, it shall be visually checked during the start-up testing that all accessible pipings with associated structures and equipment have sufficient margins for thermal movements.

The vibrations of piping in Safety Class 1 shall be controlled at the various power levels of start-up testing by means of measurements both in normal operation and during tests causing transient vibration loads. The measurements shall show the highest vibrational stresses of the piping either directly or by means of a calculational model applied to the results. In addition, the vibrations of all accessible pipings shall be controlled visually applying criteria approved by STUK for each case. When necessary, compliance with the criteria shall be proved with measurements.

6 INSERVICE INSPECTION

The piping in Safety Classes 1 and 2 will be subjected to inservice inspections carried out with non-destructive methods as per Guide YVL 3.8. The company and its personnel performing inservice inspections shall be approved by STUK in accordance with Guide YVL 1.3. STUK will review the programmes for inservice inspections and the summary

reports of the results.

For special reasons, STUK can order that the piping in Safety Classes 1, 2 and 3 and in Class EYT should also undergo other inspections to be repeated periodically. These are, for example, measurement of wall thicknesses, control of vibrations, inspections of supports, and control of pressure and thermal transients.

7 REPAIRS, MODIFICATIONS AND SPARE PARTS

If it is intended that the construction of the piping should be changed, the modification of the construction plan shall be approved using the same procedure as in the case of new piping.

The regulations and guides concerning the design, manufacture and installation of piping are applied to the design, implementation and control of modifications and repairs. More detailed instructions are given in Guide YVL 1.8.

Spare parts shall be inspected in the same way as the parts that are replaced by them.

8 BIBLIOGRAPHY

8.1 Acts and decrees

98/73 Act on pressure vessels

1106/81 Amendment to the act on pressure vessels

566/75 Act on the amendment of s. 9 in the act on pressure vessels

549/73 Decree on pressure vessels

672/75 Decree on the amendment of the decree on pressure vessels

636/77 Decree on the amendment of the decree on pressure

vessels

8.2 Guides issued by the Finnish Centre for Radiation and Nuclear Safety and the Technical Inspection Centre

YVL 1.0 Safety criteria for design of nuclear power plants

YVL 1.1 The Institute of Radiation Protection as the supervising authority of nuclear power plants

YVL 1.2 Formal requirements for the documents to be submitted to the Institute of Radiation Protection

YVL 1.3 Mechanical components and structures of nuclear power plants. Inspection licenses

YVL 1.8 Supervision of repairs and modifications on nuclear power plants during operation

YVL 1.15 Construction inspection

YVL 2.1 Safety classification of nuclear power plant systems, structures and components

YVL 2.5 Preoperational and start-up testing of nuclear power plants

YVL 3.0 Nuclear power plant pressure vessels. General guidelines on inspection

YVL 3.1 Nuclear power plant pressure vessels. Construction plan. Safety Classes 1 and 2

YVL 3.2 Nuclear power plant pressure vessels. Construction plan. Safety Class 3 and Class EYT

YVL 3.4 Nuclear power plant pressure vessels. Manufacturing license

YVL 3.5 Nuclear power plant pressure vessels. Stress analysis

YVL 3.7 Start-up inspection of nuclear power plant pressure vessels

YVL 3.8 Nuclear power plant pressure vessels. Inservice inspections

YVL 3.9 Nuclear power plant pressure vessels. Materials and filler metals

YVL 4.1 Nuclear power plant concrete structures
YVL 4.2 Nuclear power plant steel structures
YVL 5.3 Inspection of nuclear power plant valves
YVL 5.4 Inspection of nuclear power plant safety valves
YVL 5.7 Inspection of nuclear power plant pumps
YVL 7.18 Radiation protection in design of nuclear power plants
TTL Guide 7/81 P Use of reinforced plastics in pressure vessels
TTL Guide 5/82 P List of pressure vessels which are not within the scope of the rules and regulations of the Act on pressure vessels as regards manufacture, inspection and operation

8.3 Standards

SFS 2218 Welding. Qualification of welders (2nd edition)
SFS 2610 Design of pressure vessels. Basic requirements (3rd edition)
SFS 2223 Welding of pressure vessels. General rules for fabrication
SFS 3273 Design of pressure vessels. Piping. Basic requirements
SFS 3292 Design of pressure vessels. Stress analysis
SFS 3323 Arrangements, equipment and operation of pressure vessels. Piping systems

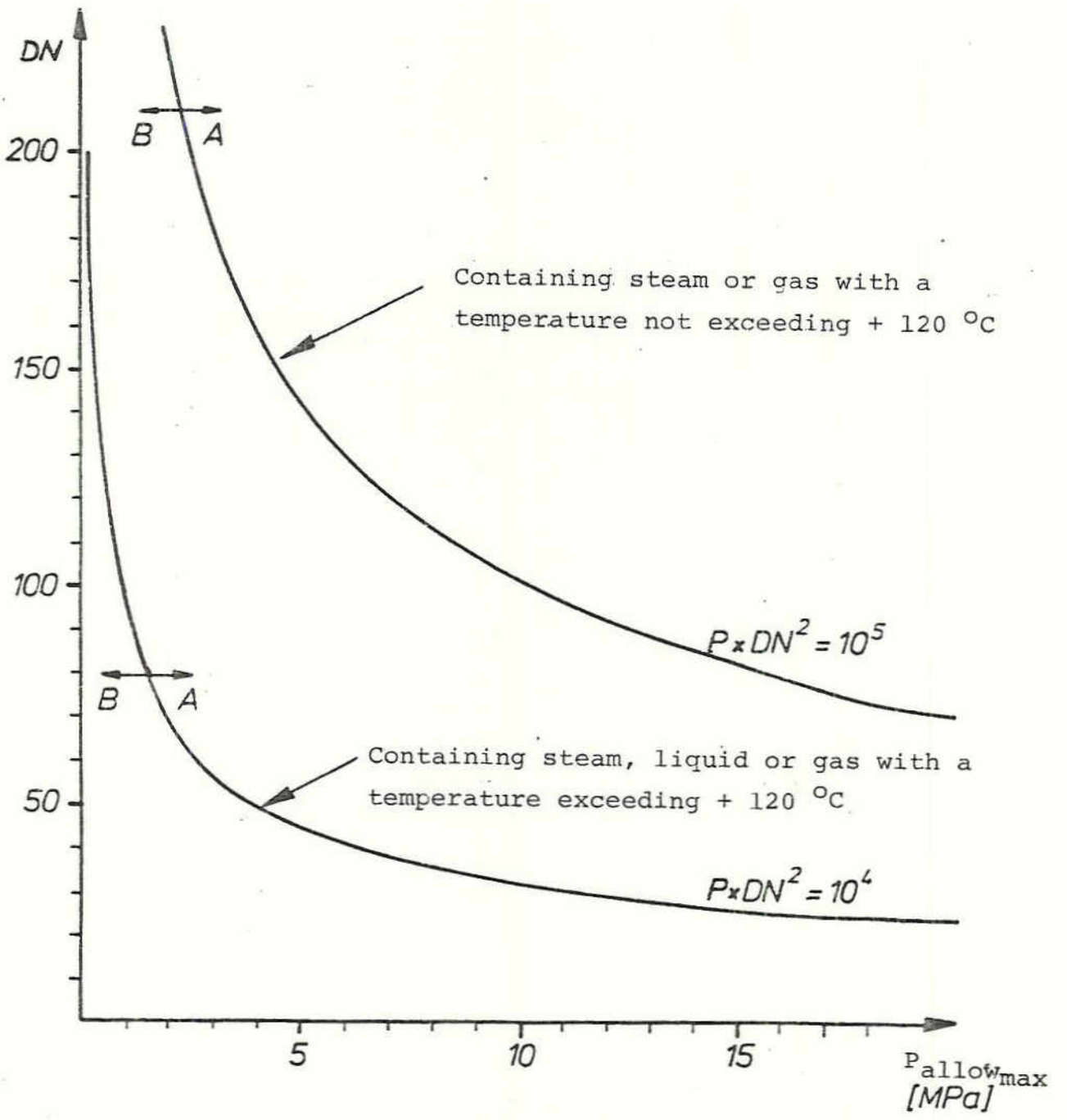
ASME Boiler and Pressure Vessel Code, Section III, Rules for Construction of Nuclear Power Plant Components

AD-Merkblatt, Serie B

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

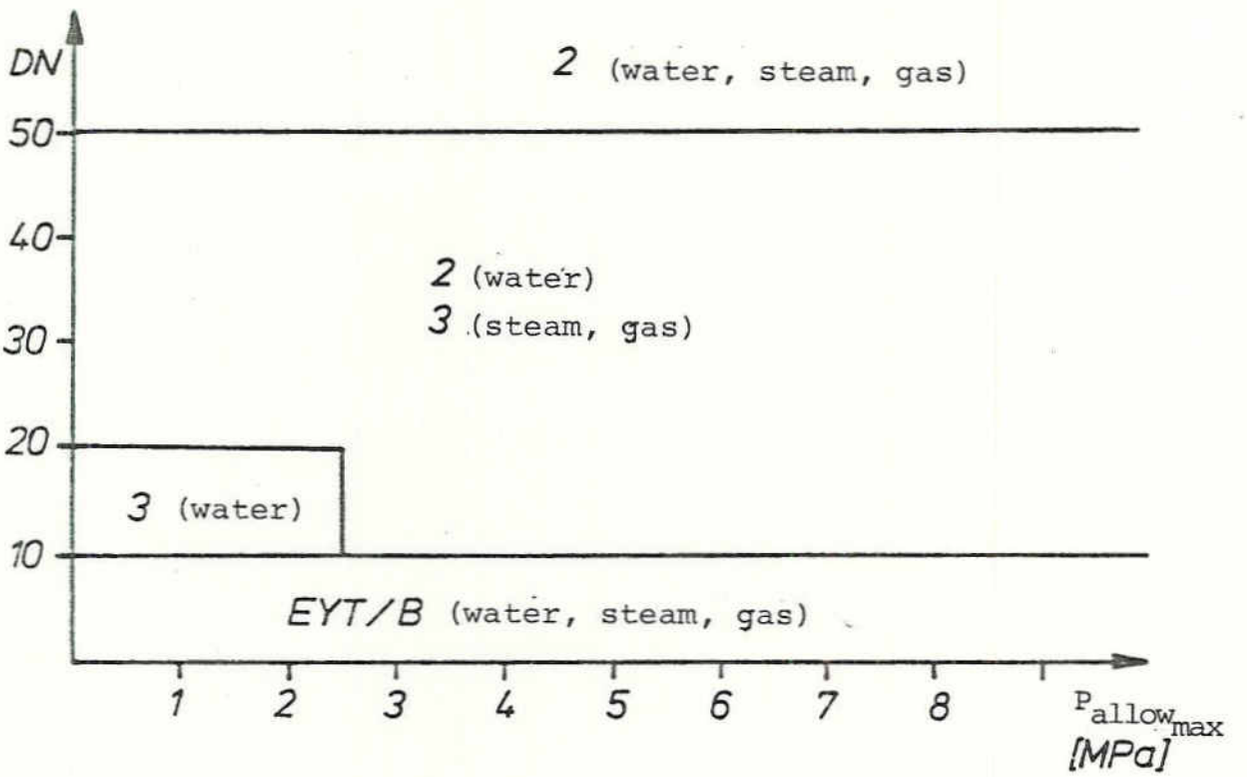
APPENDIX 1

THE DIVISION OF CLASS EYT PIPING INTO GROUPS A AND B ON THE BASIS OF THE MAXIMUM ALLOWABLE OPERATING PRESSURE AND THE NOMINAL DIAMETER



APPENDIX 2

LOWERING THE SAFETY CLASS OF SMALL-DIAMETER PIPING IN A SYSTEM OF SAFETY CLASS 2 NOT BELONGING TO THE PRIMARY CIRCUIT



The piping of Safety Class 2 are placed in a lower safety class as follows:

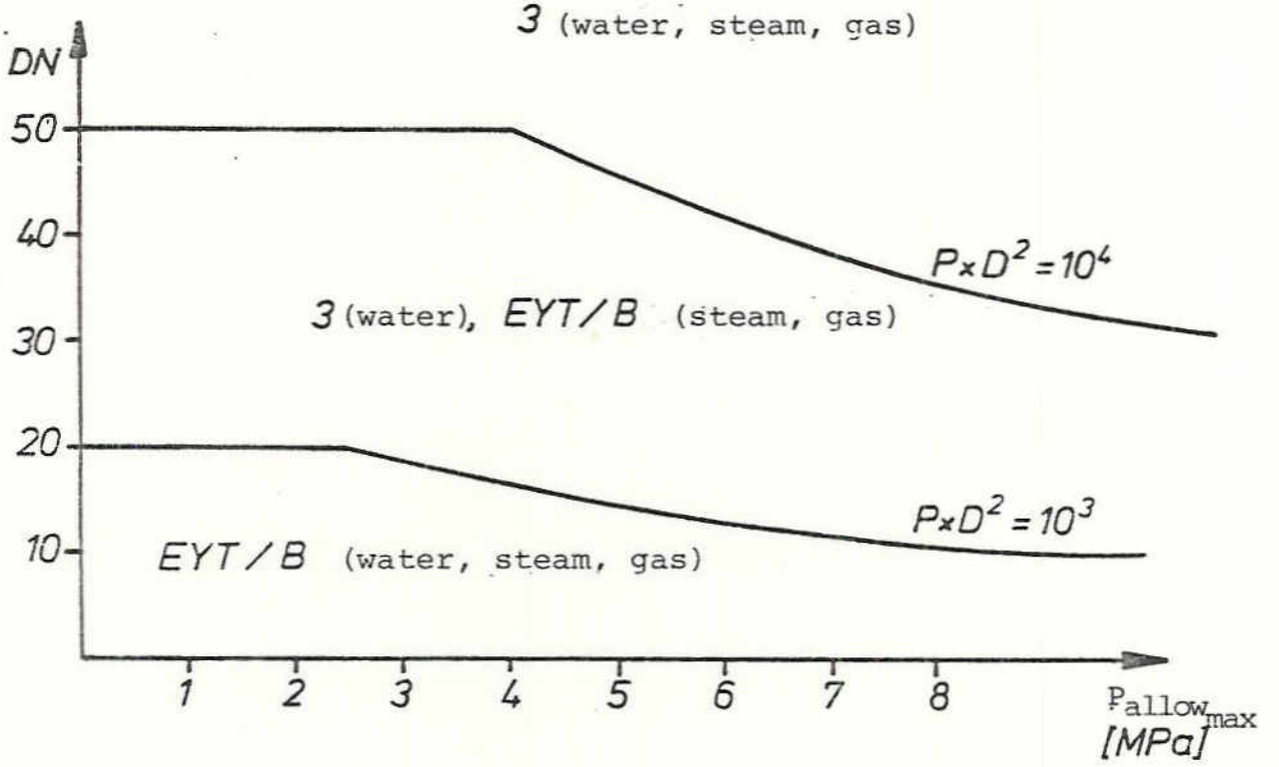
1) Safety Class 3, if
DN $\leq$ 50 and the contents are steam or gas

2) Safety Class 3, if
p $\leq$ 2.5 MPa and 10 < DN $\leq$ 20 and the contents are water

3) Group EYT/B, if
DN $\leq$ 10 and the contents are water, steam or gas

APPENDIX 3

LOWERING THE SAFETY CLASS OF SMALL-DIAMETER PIPING IN A SYSTEM OF SAFETY CLASS 3



The piping of Safety Class 3 are placed in Group EYT/B as follows:

1) $p \times DN^2 \leq 10^4$ and $DN \leq 50$ (steam, gas)

2) $p \times DN^2 \leq 10^3$ and $DN \leq 20$ (water)