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

SUPERVISION OF REPAIRS AND MODIFICATIONS ON NUCLEAR POWER PLANTS DURING OPERATION

Contents

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1 GENERAL

In this guide, the Institute of Radiation Protection (IRP) presents requirements concerning repairs and modifications, performed while the plant is in operation, of mechanical components, piping, steel and reinforced concrete structures, eletrical equipment and instruments.

Additional requirements concerning repairs and modifications during plant operation are found in YVL Guides referred to herein.

Repairs and modifications effected during plant operation shall be made in pursuance of confirmed quality assurance procedures which must be described in instructions. These procedures shall include the general licenses and permits, listed in section 4, bearing on repairs and modifications; the approvals and documents listed in section 5, as well as requirements set forth in section 6 and 7, concerning work, commissioning and records.

Requirements concerning the supervision of nuclear power plants during shutdowns with respect to management controls and general reports are presented in Guide YVL 1.13.

2 DEFINITIONS

Repair — Repair means maintenance work performed to restore the functional capability of a failed component. Repair implies an attempt to bring the component or structure back to normal design condition.

Modification — Modification denotes such a change in a component, piping or structure that it no longer corresponds with the original design.

Spare Part — A spare part is a part, device or structure which is intended to be interchangeable with parts, devices or structures used on the plant.

Failure — Failure signifies a condition where structural weakness or impaired functional capability exceeds prescribed limits, or results in a deviation from the designed function of component or structure.

3 APPLICABILITY

The requirements laid down in this guide are applicable to repairs and modifications of all components, pipings and steel and reinforced concrete structures regulated by IRP with the following exceptions. The exceptions do not apply to requirements listed in section 7.

- Installations of spare parts inspected according to a procedure approved by IRP, excluding operations specified in section 6.2.
- replacement of seals and grinding of sealing surfaces, excluding components belonging to Safety Class 1
- replacement of electrical equipment and instrumentation by components meeting existing requirements
- replacement of standardized parts (bearings, screws, springs etc.)
- repairs and modifications of steel and reinforced concrete structures, possessing little safety significance

In case of urgent repairs, a special arangement for approval of repair plans and supervision and inspection of the work can be negotiated with IRP or its inspector, provided that the failed component is restored to design condition. Urgent repair is defined as an operation which is needed to bring the plant into a safe condition or for which a deadline is set in the Technical Spesifications.

Minor repair plans can be approved on site by an IRP inspector.

More detailed requirements as to supervision will be issued by IRP in separate instructions.

4 GENERAL LICENSES AND PERMITS

Repairs and modifications effected when the nuclear power plant is in operation require the following licenses and permits.

4.1 Manufacturing license for pressure vessels

Manufacture (installation, repair and modification) of pressure vessels is subject to approval by competent authority.

For manufacture of a pressure vessel of Safety Class 1 or 2, a manufacturing license issued by IRP is required. Pressure vessels belonging to Safety Class 3 or Class EYT (non/nuclear safety) may be manufactured on a license issued by the Technical Inspectorate (TI) or IRP. A copy of the license issued by TI must be submitted to IRP before the manufacture is begun. In filing the application to IRP for a pressure vessel manufacturing license, the procedure laid down in Guides YVL 3.4 and YVL 3.0 is observed.

Sub-contractors are subject to the same regulations, where applicable, as the manufacturer.

The resolution 69/75 of the Ministry of Trade and Industry (MTI) is applied to design classes with the following exceptions

Component	Safety Class	Design Class
pressure tanks	1 and 2	A
piping	1 and 2	D

Pumps and valves are manufactured in comformity with Guides YVL 5.3 YVL 5.4, and YVL 5.7.

4.2
Supervisor of Pressure Vessel Manufacture

A prerequisite for issuance and continued validity of a pressure vessel manufacturing license is that the construction takes place under surveillance of an approved supervisor. Guide YVL 5.3 and 5.4 are applied to valve manufacture. Pumps are subject to similiar regulation as valves.

Provisions on the supervisor of manufacture and on applying for supervisory rights are set forth in Chapter 4 of Statue on Pressure Vessels (549/73), Chapter 7 of MTI Resolution (69/75) and Guide YVL 3.4. Some of the duties of a supervisor are presented in SFS Standard 2223.

The competence class required of the supervisor is as follows

Component	Safety Class	Competence Class of Supervisor
pressure tanks and piping	1 and 2	A
	3 and EYT	according to MTI resolution 69/75

4.3
Authorization of Official Supervisors

Pressure vessels as well as other components and structures regulated by IRP are inspected by an inspector employed or approved by IRP.

The Institute of Radiation Protection may authorize an employee of the power company to carry out inspections of repairs and modifications performed on following components, for example:

- pressure vessels of Class 3 and EYT referred to in Chapter 4 of The Statute on Pressure Vessels (549/73) to the extent specified by IRP
- piping of Class 3 and EYT
- steel structures of Class 2,3 and EYT
- concrete structures in Class 3 and EYT
- pressure-less tanks and piping in Class 3 and EYT
- pumps and valves in Class 3 and EYT
- ventilation equipment

4.4
Approval of Companies and Inspectors To Carry Out Quality Control

Inspection rights as specified in Guide YVL 1.3 are required of organizations and inspectors conducting quality control inspections

4.5
Approval of Materials

Only approved materials and welding materials may be used for manufacture of pressure vessels or other components for a nuclear power plant. A detailed account of the procedure for approval of materials is presented in Guide YVL 3.9.

4.6
Welding Permits

Prior to repairs and modifications to be made by welding, the following tests shall be succesfully performed to the extent required by the construction or repair plan.

- welders' proficiency tests and additional tests
- welding procedure qualification tests on welded joints
- initial and annual testing of welding materials

4.7
Qualification of Concrete and Concrete Reinforcing Bars

Tests assuring the qualification of concrete and reinforcing bars shall be carried out at an approved institute of material testing. (Finnish Construction Code A1, Section 4)

4.8
Supervisor of Pressure Vessel Operation

The task of the supervisor of pressure vessel operation required by the Statue on Pressure Vessels (549/73 14 §) is to communicate with IRP with respect to repairs and modifications and to supervise that the pressure vessel is duly inspected after completion of repairs and modifications and prior to returning it to service. When maintenance work is undertaken, attention shall be paid to required measures and reports set forth in the Technical Specifications and Guide YVL 1.5

PRE-APPROVAL AND CLARIFICATIONS

Documentary material on repairs and modifications, consisting of clarifications specified in sub-sections 5.1. to 5.4 and, preferably, in this order, shall be submitted to IRP for approval. The amount of needed supplementary information depends on the repair or modification in question. The clarifying information shall be provided with adequate references to other documents and reports. The documents are to be inspected and approved in accordance with the quality assurance procedures adopted by the power company before they are forwarded to IRP for review. In its decision on repairs and modifications, IRP may present additional reguirements as to permits, supervision and inspections.

5.1
Grounds for Modification

Reasons for a modification shall always be presented and substantiated. If the modification will affect the function or functional parameters of a system or component, a description of the effect of modification on functional modes shall be included in the documentary material. Other documents to be provided as needed are a revised process diagram, proposals for changes in the Final Safety Analysis Report and Technical Specifications as well as required corrections in the accident analyses made for the plant.

5.2

Account of arrangements during work

5.2.1
Technical Specifications

If the repair or modification is intended to be made while the plant is in other than cold shutdown or refuelling condition, and operable components regulated by the Technical Specifications must temporarily be removed from service because of the work, an account of actions taken and duration of this state is required.

If the plant is in a cold shutdown or refuelling condition during the work and operable components, having to do with residual heat removal, spent fuel cooling, keeping the reactor in a deep sub-critical condition, containment integrity or securing some of the aforementioned safety functions, must temporarily be removed from service, an account of actions taken and duration of this state has to be provided.

5.2.2
Radiation Protection

Plans for radiological protection related to the work shall be included in the documentary material, if the work is expected to cause a collective dose exceeding 10 manrem, or if exceptional measures are taken to provide protection against radiation.

5.2.3
Fire Protection

An account of fire protection arrangements must be included in the documentary material, if the repair or modification work is done in the vicinity of inflammable materials.

5.2.4
Physical Protection

A separate account of the physical protection shall be submitted to IRP, if a deviation from the accepted plan takes place in course of the work. A reference to this separate account of the physical protection shall be made in the documentary material concerning repairs and modifications.

5.3
Construction or Repair plan

The construction or repair plan shall be included in the documentary material and it should be as comprehensive with respect to repairs and modifications as the original plan material, as specified in relevant YVL guides, requires. The following items, where applicable, shall be presented in the plan, or sufficient recerences to plans approved on an earlier date made.

- design data
- material report
- basic dimensioning and stress analysis as needed
- guality control programme
- drawings
- an account of welding procedure qualification

- an account of structural work techniques and related tests
- a list of spare parts to be used
- a list of workers and inspectors
- an account of independent supervision of work and inspections

Technical instructions and regulations bearing on repairs and modifications shall be set forth in the construction plan (e.g. references to standards)

The list of spare parts included in the construction or repair plan should provide

- references to IRP approvals
- drawing numbers
- spare part numbers

If spare parts deviate from original design, a new construction plan shall be submitted for approval. The new text material should be provided with references to the drawing of the component and to part numbers.

The account of work techniques and tests, incorporated into the construction or repair plan, shall include the following information

- description of test programme, purpose of tests and relevant regulation
- control plan and diagrams
- structural and welding materials
- drawings
- non-destructive inspections related to test
- work and its supervision
- diagram for cutting test bars
- testing of test bars and supervision of testing

If components that are different from approved ones are to be used as replacements in electrical or instrumentation systems, an explanation conforming to the requirements of Guide YVL 5.5 is included in the documentary material.

5.4
Testing Programme

If the component is subject to special tightness or functional requirements, set forth, for example, in the Technical Specifications or an IRP decision, it must be tested after completed repairs and modifications. The tests to be performed are presented in the documentary material.

An extra inservice test in accordance with the Technical Specifications procedure is required for components regulated by the same Specifications. Following substantial repairs and modifications, the component must be tested to the extent required by the pre-operational testing procedure.

6
WORK

6.1
Beginning work Repairs and modifications may not commence before the documentary material is approved.

Urgent repair mentioned in Section 3 of this guide are an exception to this rule. The licensee shall negotiate with IRP or an IRP inspector on beginning the work. If no contact can be made with IRP, the work may be started, provided that the matter of supervision of the work is agreed upon as soon as possible.

Work can be started when the approvals required by the power plant's own work permit system are obtained. In the following cases, however, a special permit issued by IRP, or an inspector in the employ of IRP, is needed.

6.1.1
Permit to Start Welding

A precondition for beginning welding of more important components or piping is a permit given by an IRP inspector. If a permit is required, a note of this is made in the IRP resolution concerning repairs and modification in accordance with Section 5 of this guide. Before giving his permission, the IRP inspector checks

- that the construction or repair plan is approved and potential requirements satisfied
- qualification of welders
- results of prosedure tests
- approvals by quality control inspector
- that materials and parts are inspected

- required special arrangements for fire protection

6.1.2
Permits for Reactor Pressure Vessel

- IRP shall be notified of opening of the reactor cover
- IRP's permission is required for closing the reactor pressure vessel cover
- an IRP inspector's permission is required for assembly of reactor internals

6.1.3
Concreting Permits

Concreting of demanding concrete structures can be begun after IRP has accepted the concreting plan. A separate concreting plan need not be sent to IRP, if the construction plan mentioned in subsection 5.3 is detailed enough in this respect.

6.2
Supervision of Work and Inspections

Repairs done by welding are subject to the same requirements and inspections as the construction. When components of Safety Class 1 are welded, work must be supervised by an inspecting body recognized by IRP.

Furthermore, IRP may require that other operations, in addition to welding, be also supervised by an inspecting body recognized by IRP. Such are for example

- opening and closing of reactor pressure vessel cover
- dismantling and assembly of reactor pressure vessel internals
- dismantling and assembly of main pumps and valves
- installation of seals to main components

With respect to components of Safety Class 1, it is required that the supervision of the most important quality control inspections be carried out by an organization and inspectors authorized by IRP to do that. Supervision of inspections can mean, depending on the work inspected, random checks, continuous prescence in inspections or a repeated inspection.

During repair and modification work, IRP supervises quality control inspections and work to the extent it considers necessary.

6.3
Inspections, Testing and Recommissioning

An inspector in the employ of, or recognized by, IRP carries out the inspection of the repair or modification according to a separate set of rules and regulations (Guide YVL 3.0). Detailed inspection limit for pressure vessels, piping and other components and structures are set forth in instructions to be issued separately.

The following limited inspections may form part of the overall inspection of repair or modification:

- inspection of relevant documentation
- physical inspection
- pressure and tighness tests
- functional test and test operation of components

In the inspection following repairs or modifications, an operating permit conforming to Guide YVL 3.0 is issued for pressure vessels. Other components and structures are reguired to pass the inspection made after repairs or modifications before they are returned to service.

IRP will present requirements concerning functional tests and test operation, their supervision, inspection findings and resultant documentation in a decision described in section 5 or other written notice.

If a component regulated by the Technical Specifications is repaired or modified, and an inspection by IRP of the work, functional tests or test operation is required, the component cannot be declared operable without an approving inspection decision from IRP.

However, components that are vital for maintaining the nuclear power plant in a safe condition may be put to use on an interim basis prior to inspection when special grounds for this exist.

7 DOCUMENTS

7.1 Quality Assurance Records

Inspection document shall be duly compiled and placed in the archives. Inspection records on pressure vessels shall be appended to inspection books.
The quality assurance records must give the true condition of each structure or component after repairs and modifications. Test records are included in these documents.

A note of repairs and modification as well as spare parts used shall be made in component cards and failure register. Work orders, directives and other documents directly related to the work must be compiled and preserved as prescribed.

7.2 Reports

Separate reports, as specified in Guide YVL 1.5, are prepared on repairs and modifications as well as on events leading up to them.

7.3 Final Safety Analysis Report

Required changes in process diagrams and the Final Safety Analysis Report must be made promptly after completion of repairs and modifications, and the revised documents shall be submitted to IRP if this is not done in connection with the statements on Grounds for Modification described in sub-section 5.1.

Litterature

549/73	Statute on Pressure Vessels
69/75	Resolution of the Ministry of Trade and Industry on Application of the Statute on Pressure Vessels
YVL 1.3	Acceptance of separate inspecting bodies to carry out inspections of main components and systems of nuclear power plants. 1975-07-25
YVL 1.5	Reporting nuclear power plant operation to the Institute of Radiation Protection, 1976-07-25
YVL 1.13	Supervision of nuclear power plant shutdowns
YVL 3.0	Nuclear poert plant pressure vessels. General guidance on the supervision, 1978-02-07
YVL 3.4	Nuclear power plant pressure vessels. Manufacturing license, draft 1978-03-15
YVL 3.9	Nuclear power plant pressure vessels. Materials, draft 1978-03-15
YVL 5.3	Inspection of nuclear power plant valves 1979-11-26

YVL 5.5	Inspection of electrical and instrumentation systems and components of nuclear power plants, 1977-12-31
YVL 5.7	Inspection of nuclear power plant pumps, 1977-12-14
YVL 6.1	Control of nuclear fuel and other nuclear materials, 1978-04-23
SFS2223	Welding of Pressure Vessels; General Recommendations (2. edition) Finnish Construction Code