STUK

GUIDE **YVL E.11** / 15 NOVEMBER 2013

HOISTING AND TRANSFER EQUIPMENT OF A NUCLEAR FACILITY

continues

With regard to new nuclear facilities, this Guide shall apply as of 1 December 2013 until further notice. With regard to operating nuclear facilities and those under construction, this Guide shall be enforced through a separate decision to be taken by STUK. The Guide replaces Guide YVL 5.8.

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Authorisation

According to Section 7 r of the Nuclear Energy Act (990/1987), the Radiation and Nuclear Safety Authority shall specify detailed safety requirements for the implementation of the safety level in accordance with the Nuclear Energy Act.

Rules for application

The publication of a YVL Guide shall not, as such, alter any previous decisions made by STUK. After having heard the parties concerned STUK will issue a separate decision as to how a new or revised YVL Guide is to be applied to operating nuclear facilities or those under construction, and to licensees' operational activities. The Guide shall apply as it stands to new nuclear facilities.

When considering how the new safety requirements presented in the YVL Guides shall be applied to the operating nuclear facilities, or to those under construction, STUK will take due account of the principles laid down in Section 7 a of the Nuclear Energy Act (990/1987): *The safety of nuclear energy use shall be maintained at as high a level as practically possible. For the further development of safety, measures shall be implemented that can be considered justified considering operating experience, safety research and advances in science and technology.*

In accordance with Section 7 r(3) of the Nuclear Energy Act, *the safety requirements of the Radiation and Nuclear Safety Authority (STUK) are binding on the licensee, while preserving the licensee's right to propose an alternative procedure or solution to that provided for in the regulations. If the licensee can convincingly demonstrate that the proposed procedure or solution will implement safety standards in accordance with this Act, the Radiation and Nuclear Safety Authority (STUK) may approve a procedure or solution by which the safety level set forth is achieved.*

Translation. Original text in Finnish.

1 Introduction

101. According to the Nuclear Energy Act (990/1987) [1], the use of nuclear energy must be safe; it shall not cause injury to people, or damage to the environment or property. The safety of a nuclear facility is a result of the design, manufacture, construction, operation and maintenance of the facility, its systems and structures in a manner that is compliant with the safety and quality requirements.

102. Government Decree (717/2013) [2] presents general regulations for the safety of nuclear power plants. Requirements for the safety of the plant's structures, construction and operation are presented in Sections 3–27 of the Decree.

103. Government Decree (736/2008) [37] presents general regulations for the safety of nuclear waste facilities. The requirements for the design of a nuclear waste facility are presented in Sections 6–9 of the Decree, and the requirements for construction and operation are presented in Sections 17–18 of the Decree.

104. According to Section 17 of Government Decree (717/2013), *the design of a nuclear power plant shall take account of external events that may challenge safety functions. Systems, structures and components shall be designed, located and protected so that the impacts of external events deemed possible on plant safety remain minor. The operability of systems, structures and components shall be demonstrated in the plant-external ambient conditions on which their design is based. External events to be accounted for shall include exceptional weather conditions, seismic events, effects of accidents taking place in the plant's operating environment and other factors resulting from the environment or human activity. The design shall also consider unlawful actions with the aim of damaging the plant and the collision of a large commercial aeroplane.*

105. According to Section 18 of Government Decree (717/2013), *the design of a nuclear power plant shall take account of any internal events that may challenge safety functions. Systems, structures and components shall be designed, located and protected so that the probability of internal events remains low and their impact on plant safety minor. The operability of systems, structures and components shall be demonstrated in the room-internal environmental conditions used as their design bases. Internal events to be considered shall include fire, flood, explosion, electromagnetic radiation, pipe breaks, container breakages, falling of heavy objects, missiles resulting from explosions and component failures, and other possible internal events.*

106. Special requirements are set for hoisting and transfer functions related to the handling and storage of nuclear fuel and the equipment and structures of a nuclear facility. The purpose of these requirements is to prevent damage to the nuclear fuel.

107. By virtue of Section 63(1)(3) of the Nuclear Energy Act (990/1987), the Radiation and Nuclear Safety Authority (STUK) is authorised to require that *the buildings and equipment intended as parts of the nuclear facility be manufactured in a manner approved of by the Radiation and Nuclear Safety Authority.* The Radiation and Nuclear Safety Authority is authorised *to oblige the licensee or licence applicant to arrange for STUK sufficient opportunity to control manufacture of the fuel or such buildings or equipment.*

108. Safety control exerted by the Radiation and Nuclear Safety Authority (STUK) includes controlling hoisting and transfer functions at nuclear facilities and nuclear safety-classified hoisting device units and load-lifting attachments used for them, insofar as they affect the nuclear and radiation safety of the facilities.

109. STUK's control does not replace the control of hoisting equipment required by other official regulations, or the safety requirements for hoisting equipment established in them.

110. This Guide defines the requirements for hoisting and transfer functions, hoisting device units and load-lifting attachments at nuclear facilities that STUK sets on the licensee, and describes the procedures by means of which STUK supervises fulfilment of the set require-

ments. The requirements for nuclear safety are additional requirements to the level of safety laid down in Government Decrees (400/2008) [4] and (403/2008) [32].

111. Typical hoisting and transfer functions at nuclear facilities include the following:

- Hoisting and transfer linked with refuelling, fuel storage, and final disposal of fuel
- Hoisting and transfer related to reactor internals
- Hoisting and transfer of process equipment in the reactor and fuel buildings
- Hoisting and transfer of tools, service platforms and hatches, and lids in the reactor and fuel buildings.

112. The safety class 3 hoisting device units and load-lifting attachments used for hoisting and transfer operations at nuclear facilities include the following:

- Refuelling and transfer machine
- Other hoisting and transfer devices and load-lifting attachments required for spent fuel handling
- Main cranes of the reactor buildings and fuel storage buildings
- Other hoisting and transfer devices and load-lifting attachments that are significant in terms of nuclear and radiation safety.

2 Scope of application

201. The requirements set forth in this Guide apply to the licensee, the licence applicant, the plant supplier, and the manufacturer of hoisting device units and load-lifting attachments throughout the nuclear facility's lifecycle.

202. This guide defines the nuclear safety requirements that apply to the safety-classified hoisting device units and load-lifting attachments at a nuclear facility in the following scope:

- The requirements concerning the management system as regards hoisting device units and load-lifting attachments
- Design and dimensioning (supervision, inspections)
- Manufacture (supervision, inspections and tests)
- Installation and commissioning (supervision, inspections and tests)
- Operation, maintenance, modifications and repair work (supervision, inspections and tests)
- Decommissioning (supervision, inspections and tests)

The nuclear safety requirements stated above shall also apply to the components of hoisting device units that, at the system level, belong to hoisting device units of class EYT but that have been classified into safety class 3 at the equipment level.

203. This Guide also covers the rail tracks of hoisting device units. The requirements concerning fixed rail track supports in buildings are set forth in Guide YVL E.6.

204. Guide YVL A.1 "Regulatory oversight of safety in the use of nuclear energy" sets forth requirements concerning the documents to be submitted to STUK. The requirements for the licensee's and the supplier's management system processes and functions are presented in Guide YVL A.3 "Management system for a nuclear facility". Guide YVL A.5 "Construction and commissioning of a nuclear facility" sets forth requirements for the construction of a new nuclear facility and plant modifications at existing facilities. Ageing management is discussed in Guide YVL A.8 "Ageing management of a nuclear facility". The requirements for the design of safety systems of a nuclear facility are set forth in Guide YVL B.1 "Safety design of a nuclear power plant". The requirements concerning the safety classification and seismic classification of systems, structures and components are set forth in Guide YVL B.2 "Classification of systems, structures and components of a nuclear facility". The requirements concerning seismic planning are presented in Guide YVL B.7 "Provisions for internal and external hazards at a nuclear facility". The requirements for electrical and instrumentation and control equipment are presented in Guide YVL E.7 "Electrical and I&C equipment of a nuclear facility". The approval of testing organisations is presented in Guide YVL E.12 "Testing organisations for mechanical components and structures of a nuclear facility".

205. Guide YVL D.3 "Handling and storage of nuclear fuel" discusses the storage and handling of fresh and spent nuclear fuel. The final disposal of nuclear waste is discussed in Guide YVL D.5 "Disposal of nuclear waste". Guide YVL D.2 "Transport of nuclear materials and nuclear waste" describes the transport of nuclear fuel and nuclear waste that takes part outside of nuclear facilities.

3 Equipment requirement specifications for hoisting device units

301. In addition to the requirements of Guide YVL A.3, the licensee's management system shall meet the additional requirements pertaining to hoisting equipment presented in this Chapter.

302. The licensee shall possess a general requirement specification for the hoisting device units in a nuclear facility; the specification shall include the general design requirements, quality control requirements, and regulatory requirements for safety-classified hoisting device units as well as other units. The requirement specifications serve as the basic requirements set forth by the licensee, and they shall be followed, supplemented with location of use-specific requirements, when making purchases.

303. The design requirements for a hoisting device unit shall define the requirements for construction material, the design and dimensioning standards, and the other general structural and functional requirements that the licensee sets as the minimum requirements for purchases.

304. As a rule, the design, manufacture, testing, and installation of a hoisting device unit shall follow a single set of standards; deviations from it shall be justified.

305. At a minimum, the requirement specification shall define the following requirements concerning quality control:

- Inspections and tests that the licensee requires for the structural materials and hoisting devices during procurement, manufacture, installation, and commissioning;
- Parties responsible for the supervision of inspections and tests;
- Reporting requirements for inspections and tests;
- Inspection and test instructions.

306. The general requirement specifications shall present any additional requirements set forth in separate STUK decisions that are related to the design or quality control of the hoisting device units.

307. The licensee shall have in place procedures based on an applicable standard (SFS-ISO 15513 [20], for example) for the operation of the hoisting device units, the persons authorised to operate them, and the qualification requirements for the operation of the units. The selection of the standard shall be justified.

308. Instructions shall be drawn up for the operation of the nuclear fuel hoisting device units and handling systems, and for their malfunction and accidents. These instructions shall define, for instance, the functions to which the fuel is subjected, and the preconditions, measures, responsibilities and records of these functions.

309. The conditions linked with safety of the nuclear fuel handling shall be included in the Operational Limits and Conditions

310. Instructions shall be provided for the decommissioning of hoisting device units before decommissioning.

4 Manufacturer

4.1 General

401. The manufacturer of the hoisting device unit or load-lifting attachment shall be the main supplier, who shall also be responsible for the suppliers of the electrical and I&C systems and any related auxiliary systems.

4.2 Obligations of the licensee

402. The licensee shall meet the requirements set forth in Guide YVL A.3 in the assessment, selection and training of the equipment suppliers, manufacturers and subcontractors.

403. The licensee shall describe the requirements and procedures concerning the qualification of manufacturing procedures in its management system and related instruction manuals. The instructions shall take into account the manufacture of the equipment and the installation performed at the plant site; therefore, the requirements shall apply to the equipment suppliers and their subcontractors, the welding contractors, and the licensee's own manufacturing.

404. The licensee shall ensure that a manufacturer performing manufacture, installation, repair, modifications or service is wholly familiar with the safety requirements and quality requirements related to the delivery.

405. The following factors shall also be taken into consideration when evaluating the manufacturer:

- Performance in deliveries of demanding hoisting devices
- The level of the management system
- Qualification of special processes by means of procedure tests
- Qualification of the persons making permanent joints.

406. The licensee shall follow up on the realisation of the periodic audits performed for the manufacturer's management system. The audits shall verify that the manufacturer maintains and complies with the management system.

407. If necessary, STUK shall evaluate the manufacturer's management system by making inspection visits to the manufacturer's premises.

408. In the purchase agreement, the licensee shall define methods pursuant to its management system for the processing of non-conformities discovered in the manufacture, inspections and testing. STUK's approval shall always be obtained for deviations from the requirement level of YVL guides and STUK-approved specifications.

4.3 Requirements for the manufacturer

409. The manufacturer's quality management system shall meet the requirements set forth in the SFS-EN ISO 9001 quality management system [5] or a corresponding quality management system, and it shall be independently audited.

410. The manufacturer shall have in place systematic and documented methods for the assessment, selection and supervision of its subcontractors. The manufacturer shall evaluate the effectiveness of the subcontractor's management system and ascertain that the subcontractor has the prerequisites for delivering products or services that satisfy the requirements.

The same regulations and obligations shall apply to both the manufacturer proper and the subcontractors involved in manufacture. The manufacturer shall also be responsible for the activities of the subcontractor as regards the manufacture of the hoisting device unit or load-lifting attachment in question.

411. The manufacturer shall have documented procedures in place for the qualification of manufacturing procedures and personnel, for the validity of the qualifications, for the manufacturing itself, for testing, and for the processing of deviations.

412. The manufacturer shall employ professional, experienced personnel, and be in possession of the methods, tools and equipment required for the activities.

413. The manufacturer shall have available competent welding co-ordination personnel who plan, draw up and qualify the necessary welding and work instructions pursuant to the applied standard.

414. The manufacturer shall have in place qualified manufacturing procedures for the manufacture of the equipment or structure, or the preparedness to qualify the methods before manufac-

ture is started. Persons making permanent joints in load-bearing structures shall be qualified according to the applied standard.

415. The manufacturer shall maintain a list of the following items, among others:

- Qualified manufacturing procedures (such as welding, forming, heat treatment)
- Qualified manufacturing instructions
- Qualified persons making permanent joints (welders and welding operators)
- Persons who are authorised to transfer material identification markings.

416. The manufacturer shall ensure that sufficient prerequisites exist for compliant operations, and that manufacturing is carried out in accordance with the applicable regulatory requirements and decisions as well as manufacturing documents.

417. The manufacturer shall hand over to the licensee the documents that will be attached to the hoisting device's construction plan within the scope defined in this guide, the records pertaining to the manufacture, inspections and testing of the hoisting device, and the instructions for the operation, condition monitoring, and maintenance of the hoisting device.

418. If essential changes occur in the preconditions for operation, the manufacturer shall inform the licensee of them without delay.

4.4 Material manufacturer

419. The material manufacturer shall have in place a quality management system certified under standard SFS-EN ISO 9001 [5] or a comparable standard. In this context, material shall refer to load-bearing materials (such as plates, tubular beams etc. and welding consumables, fasteners, and machine parts). The requirements laid down in Guide YVL E.7 shall apply to the materials of the electrical and I&C systems. The requirements of the appropriate YVL Guides shall apply to the materials of the auxiliary systems.

5 Design

5.1 System design

501. The system-level design of safety-classified hoisting device units and hoisting functions shall be started during the construction licence stage of the nuclear facility.

502. The preliminary safety analysis report of a nuclear facility being designed shall present a system description of the safety-classified hoisting device units; it shall define the basic operational and safety requirements set for the various subsystems and fields of technology for the purpose of detailed design of the hoisting device unit. The basic requirements pertaining to the safety analysis report and the system description are set forth in Guide YVL B.1 and Section 6 of this Guide.

503. The design of hoisting functions and hoisting device units shall be based on both deterministic and probabilistic methods. More specific requirements concerning these methods are set forth in Guides YVL A.7, B.1, B.3, and E.7.

504. The design of the hoisting functions and hoisting device units shall ensure adequate criticality prevention, nuclear fuel cooling and radiation protection, and that the probability of nuclear fuel damage is minimal.

505. In the design of the service life of the hoisting device units and load-lifting attachments, all stages of the nuclear facility's lifecycle, and the planned operating conditions, shall be taken into consideration.

506. The reactor hall's main crane shall be designed for the entire service life of the nuclear facility, including decommissioning and any related use of the crane.

507. It shall be possible to perform the functional tests and in-service inspections of hoisting device units and the load-lifting attachments throughout the planned service life.

508. The materials of the hoisting device unit shall be suitable for their locations of use under all design conditions.

509. The hoisting device units and load-lifting attachments shall meet the functional requirements set for them. The parts shall retain their integrity under design conditions throughout the planned service life; this shall be demonstrated by means of analyses, tests or operating experience data.

510. The hoisting functions and hoisting routes shall be designed in such a way that

- the handling of heavy loads above the fuel is avoided
- the transfer of heavy loads on top of equipment important to safety is avoided
- the transfer of heavy loads can be performed such that collision of loads is avoided
- the transfer of heavy loads can be performed such that tangling of loads is avoided
- the integrity of the storage pools and the fuel (including water purity) is not jeopardised.

511. Safe heavy load handling areas shall be defined and shown in the construction plan.

512. The seismic design of the hoisting device unit shall be performed according to Guide YVL B.7.

513. Ageing management for the hoisting device unit shall be planned in accordance with the requirements of Guide YVL A.8.

514. A risk analysis shall be drawn up for the hoisting functions and hoisting device units; it shall include a risk analysis for the falling, collision, and tangling of a heavy load, and it shall demonstrate the fulfilment of requirement 504.

515. Results from the hoisting device unit's risk analysis shall be taken into account in the design and layout of the nuclear facility's buildings, structures and systems, and in the definition of safe handling areas for heavy loads.

516. The safety design of the hoisting device units and their control equipment and the related analyses shall follow the general requirements of the Government Decree on the Safety of Machinery (400/2008) [4] and related safety standards (for example, SFS EN ISO 12100 [21], SFS EN ISO 13849-1 [22]).

517. Safety functions that have been identified on the basis of the hoisting device unit's risk analysis shall be focused on the hoisting device unit's subsystems as functional requirements.

518. The design of the safety functions shall follow the requirements of Guide YVL B.1.

519. The safety class 3 safety functions of the hoisting device unit shall be single failure proof.

520. The hoisting device units and load-lifting attachments whose damage may result in the possibility of significant radiation exposure at the nuclear facility or in the environment shall contain a calculated safety margin and/or safety enhancing structural solutions, components and safety functions such that the reliability of the load-bearing components can be considered equal to the single failure tolerance.

Methods to improve reliability are described in references SFS-EN 13001-2 [7], SFS-EN 13135 [11], KTA 3902 [23], NUREG-0554 [24], NUREG-0612 [25], and ASME NOG-1-2010 [26].

521. The hoisting device units and load-lifting attachments used for handling the nuclear fuel shall not lose their ability to carry their loads safely as a result of a single failure.

522. The hoisting device units shall set themselves to a state that is most beneficial to safety in case of failure or the loss of electrical power. The most beneficial state shall be justified. The analysis shall also cover, from the point of view of safety, the restoration of electricity after an outage.

523. If necessary, the hoisting device units and load-lifting attachments shall be equipped with safety equipment and functions, such as:

- minimisation of swaying of the load-handling device

- minimisation of swaying of the load
- overload protection
- protective devices that stop the movement as the load is considerably lightened
- protective devices to interrupt a hoisting and transfer movement in the event of a power cut, when the supply voltage is reduced so as to endanger operation, and in overload and overspeed situations
- redundant protective devices that limit the movements to permitted areas
- redundant mechanical travel stops of the hoisting, lowering and transfer movements
- speed limiters in the area of reduced hoisting, lowering and transfer speeds
- prevention of simultaneous movement across several axes of movement
- limit switches to prevent the movement of the carriage and the bridge outside the specified limits
- stop of the movement as the hoisting rope loosens
- indication of the reliable fastening and unfastening of the load when using grabs
- a load weight indicator
- an emergency stop device, which enables all operations to be stopped at the same time
- instrumentation for determining the exact position of the fuel
- an adequate lighting and monitoring system.

524. The irradiated nuclear fuel transfer device units shall be capable of transferring the fuel safely from one place of disposal to another under a water layer shielding from radiation whenever water is used as a means of radiation protection.

525. The grabs of hoisting device units involved in transferring the nuclear fuel shall be designed such that loosening the grip is prevented by two means independent of each other, and that the grabs remain in a safe position in the event of a power cut (loss of electricity, vacuum, etc.).

526. Hoisting equipment, load-lifting attachments and their components that are in contact with pool waters shall be designed such that their materials and lubrication are suited to underwater activities.

527. Hoisting equipment, load-lifting attachments and their components that are in contact with pool waters shall be designed such that they have no adverse effect on the characteristics of the water.

528. Hoisting equipment, load-lifting attachments and their components that are in contact with radioactive substances in the air or water shall be designed such that they are not easily contaminated and can be decontaminated.

5.2 Structural design

529. The design shall meet the safety level requirements of the regulations related to the Government Decree on the Safety of Machinery (400/2008) [4], harmonised standards based on them, and this Guide.

530. The design, dimensioning, manufacture, inspections and testing of the hoisting device units and load-lifting attachments shall be based on established, valid standards related to equipment and nuclear technology. Harmonised standards, such as the reference standards [6-20] take preference. Of the standards related to each stage of the lifecycle (design, manufacture, inspection, testing), the latest valid updates which are valid when the stage is being defined shall be used.

531. The design of load-bearing structures shall be based on applicable standards in the cases where separate strength calculations are not required.

532. The starting point for the structural design of the hoisting device units shall be their operational classification that is defined according to the design standards for hoisting equipment.

533. In selecting the materials of the hoisting device units, the operating and environmental conditions and the requirements and restrictions set by manufacture and installation shall be taken into consideration.

534. The design, selection and manufacture of the hoisting device units' structural materials shall follow the requirements of the harmonised standards.

535. The materials of the hoisting device units and load-lifting attachments shall be suitable for the purpose. The material properties, including manufacturing tolerances, shall fulfil the requirements set by the design conditions and related phenomena.

536. The materials and welding filler materials of load-bearing structures shall be approved, and their material properties shall be verified in accordance with applicable standards.

537. The design and implementation of the hoisting device units shall take into account the special requirements set for surface materials inside the reactor containment and in the spaces outside the reactor containment that are subject to decontamination or radiation tolerance requirements in the room classification of the safety analysis report. The special requirements concern the following factors: radiation tolerance, decontamination abilities, chemical resistance, durability under operating conditions, durability under accident conditions, and fire resistance properties.

5.3 Design of electrical and I&C systems

538. As part of the construction plan for the hoisting device unit, the licensee shall present the design documents and reports pertaining to the electrical and I&C systems. This documentation shall demonstrate that the systems of the hoisting device unit function reliably and without being overloaded in all designed operating conditions and environmental conditions, and that they fulfil the requirements defined in the system description of the hoisting device unit.

539. The design, implementation, quality management, and qualification of the electrical and I&C systems and equipment of the hoisting device units shall cover the connections of the systems and devices, the functions related to power supply, controls, protections and interlocks, and they shall be in line with what is stipulated in Guides YVL B.1 and YVL E.7.

540. The following analyses shall be presented for the electrical and I&C systems belonging to safety class 3 with a view to demonstrating fulfilment of the safety and performance requirements:

- Failure tolerance analysis
- Operating experience analysis
- Selectivity analysis
- Safety assessment

541. The suitability assessment for electromechanical components may be replaced with corresponding construction plan documentation that also includes the information required for the electro-technical suitability assessment.

542. The I&C technical equipment shall be type approved to a level of reliability that is required by the harmonised machine safety standards that are applied in the design.

5.4 Auxiliary system design

543. The design, manufacture, installation and commissioning of auxiliary systems that form a fixed part of the hoisting device unit (such as piping, valves etc.) shall be completed according to the relevant YVL Guides and attached as part of the system design and structural design of the hoisting device unit.

6 Design documents

6.1 System description

601. In the preliminary safety analysis report of a nuclear facility that is being designed, the licensee shall present a system description of the hoisting device units.

602. The system description of the hoisting device unit shall be updated in the final safety analysis report. Guides YVL A.1 and YVL B.1 set forth detailed requirements concerning documents and their submittal and updating.

603. With regard to new hoisting device units or an extensive modification to an existing hoisting device unit at an operating nuclear facility, the licensee shall submit a conceptual design plan concerning the modification to STUK for approval. The basic requirements concerning the conceptual design plan are set forth in Guide YVL B.1.

604. In addition to the design bases and analyses referred to in Guide YVL B.1, the system description of the hoisting device unit delivered with the preliminary safety analysis report or conceptual design plan shall present the following:

- Device description
- A preliminary failure modes and effects analysis (FMEA) for the hoisting device unit
- A risk analysis of the hoisting device unit, including a risk analysis of the falling, collision and tangling of a heavy load.

605. Before approval is sought for the construction plan of the hoisting device unit, a system description that meets the requirements of Guide YVL B.1 shall be submitted to STUK for approval along with the following documents:

- A description of the documentation structure
- Requirements for the manufacture, transport, installation, operation, maintenance, testing and inspection
- The division of the hoisting device unit into subsystems, and the design basis concerning the subsystems
- Requirement definitions and qualification plans for the electrical and I&C systems
- Deviations from the preliminary system description

606. For the purpose of designing and implementing safety-classified hoisting device units or their modifications, a unit-specific quality plan shall be prepared and implemented. Guides YVL A.3 and YVL B.1 set forth detailed requirements concerning the quality plan and its contents.

607. Requirements concerning the management system, technical competence, deliveries to nuclear facilities and other references shall be presented for the manufacturer and the manufacturer's subcontractors. Furthermore, the methods and acceptance criteria used by the licensee, plant supplier or main contractor for the approval of the hoisting device unit's manufacturer and its subcontractors shall be defined.

608. The description of the documentation structure shall contain a list of the documents produced during the design process of the hoisting device unit and their interrelations.

609. Furthermore, the documents and methods presented in the requirements of Guides YVL B.1 and YVL E.7 shall be included for the hoisting device unit's subsystems belonging to safety class 3, such as the electrical and I&C systems and auxiliary systems.

6.2 Construction plan

6.2.1 General

610. The licensee shall define in the construction plan the structural safety, operation and safety equipment of the hoisting device unit.

611. The construction plan shall present detailed and clear references to source literature. Whenever reference is made to a small part of the source documentation, or literature is difficult to obtain, the section referred to shall be identified and appended to the design documentation.

612. The construction plan for the hoisting device unit shall include the following information:

- Summary of justifications
- Description of manufacturer and testing organisations
- Detailed design information
- Design bases
- Design acceptance criteria
- Structural design
- Materials and coatings
- Drawings
- An updated failure modes and effects analysis and a risk analysis that also includes the falling, collision and tangling of a heavy load
- An inspection plan
- A description of the manufacture
- Procedures and analyses related to operation
- Information on the design documents of the electrical and I&C systems and auxiliary systems included in the hoisting device unit
- A preliminary suitability assessment for the electrical and I&C equipment pursuant to Guide YVL E.7

613. The construction plan for repairs and modifications shall include the above information where applicable.

6.2.2 Summary of justifications

614. The licensee shall enclose with the construction plan a summary of justifications concerning the compliance of the hoisting device unit or load-lifting attachment that it has drawn up. It shall include justifications based on the information in the construction plan for the following items:

- The requirements laid down in the YVL Guides and STUK's decisions concerning the hoisting device unit or load-lifting attachment are met.
- The requirements of the approved system description are met.
- The manufacturer and the manufacturer's subcontractors have the means to make the delivery of a nuclear technology product.
- The testing organisations that are used have been approved.
- The requirements set for integrity and function are met under all design conditions according to the selected design standards.
- The electrical and I&C systems have been qualified or the necessary qualification plans have been drawn up.
- The testing and inspections performed during manufacturing are sufficient to ensure the compliance of manufacture.

615. The justifications in the summary of justifications shall make reference to individual documents in the construction plan, and to their page and section numbers, if the documents are extensive.

616. If the construction plan is submitted for approval as individual documents or in batches that do not form a cohesive whole, the licensee must enclose a summary of justifications pursuant to requirement 375 of Guide YVL A.1 concerning the acceptability of each document with the individual documents. The justification shall indicate the complex of issues for which acceptability is being demonstrated.

6.2.3 Description of the manufacturer and testing organisations

617. The construction plan shall include a description of the management system of hoisting device unit manufacturers and assessments of said system, including a report on:

- the independent approval of the management system
- the subcontractor assessment, selection, familiarisation and supervision processes conducted by the manufacturer
- the validation of design software used by the manufacturer
- the delivery references in the nuclear energy sector
- the procedure tests of the different manufacturing methods performed and their supervision, as well as the licensee's statement on their acceptability and suitability for the manufacturing concerned
- qualification of the persons that make permanent joints.

618. As regards testing organisations, a reference shall be made to STUK's decisions on the approval of the testing organisation pursuant to Guide YVL E.12, including the periods of validity.

6.2.4 Design

619. The construction plan shall be based on the design bases presented in the approved system description.

620. Analyses included in the construction plan shall demonstrate that the hoisting device unit meets the safety requirements established as the design basis. These analyses include:

- a functional analysis of the hoisting device unit, an FMEA, and a risk analysis, which also includes a heavy load drop, collision and tangling risk analysis.
- structural analyses that prove strength of the various components under the anticipated loading conditions
- analyses of the electrical and I&C systems that prove their suitability for the designed hoisting device unit, and fulfilment of the requirements pertaining to the safety functions.

621. Standards serving as the basis for design shall be identified.

622. The design bases shall be presented to the extent that they may be applied in assessing the selection of equipment or structures, operational conditions and structural requirements, and, if necessary, inspecting the general plan, dimensioning, stress and fatigue analyses as well as condition monitoring requirements.

623. The construction plan shall indicate the acceptability of structural solutions in meeting all design bases. The construction plan shall present dimensioning calculations and structural analyses, which are used to show that the equipment or structure fulfils the design bases and the requirements of applicable standards.

624. Various mutually supportive methods, such as standards, analyses, trial studies, type tests and operating experience data, shall be used as the basis for structural solutions.

625. The licensee shall refer to source literature on which his calculation methods are based, and shall also indicate the points in the source literature that have been used. The source literature shall be presented to the inspector of the construction plan upon request.

626. The construction plan shall show how the loadings used in dimensioning and structural analyses are derived from the design bases.

627. Source data, calculation methods, illustrated results, the acceptability of results and conclusions shall be presented in the calculations included in the construction plan. A free body diagram or structural model of the equipment or structure dimensioned or analysed shall serve as the basis for calculations. The free body diagram or structural model shall describe the functioning of the actual structure as accurately as possible.

628. When using special calculation methods (such as the finite element method), a comprehensive and clearly written report shall be drafted, based on which the analysis can be examined unambiguously.

629. The purpose of dimensioning is to specify the structural dimensions in hypothetical loading situations, so that stresses and deformations remain within allowable limits. Dimensioning calculations shall be made to apply to equipment design conditions.

630. The calculation of force variables and specification of integrity shall be included with the dimensioning calculations. Dimensioning calculations for load-bearing structures shall show that the dimensioning and design meet the requirements of the applicable standards.

631. Stress analyses shall be conducted using the calculation formulae or strength analyses specified in the standards. Stresses shall be analysed using experimental measurements, if they cannot be calculated accurately enough.

632. Structural analyses shall also be conducted in cases where the standards do not provide any dimensioning instructions for unusual loadings or unconventional designs.

6.2.5 Materials and coatings

633. The quality inspection programme shall describe the methods by means of which fulfilment of the requirements set for materials, welding consumables, coating materials, and surface finishing systems and surface finishing work is verified.

6.2.6 Drawings

634. The structural assembly and details of the hoisting device unit shall be shown by drawings in such a way that dimensioning, manufacture and installation of the hoisting and transfer device and its components can be seen in sufficient detail.

635. The drawings shall be explicit and clear.

636. The following items shall be shown in the drawings:

- location and connection to other structures

- assembly, including lists of the components, materials and welding filler materials and layout of the control devices
- dimensions and forms with allowable tolerances
- locations and dimensions of welded joints and types of joint preparation, and references to welding procedure specifications shall be given in the welding drawings
- coatings and surface finishes
- hydraulic and pneumatic system diagrams
- layout drawings, which show the operating ranges and movement restrictions of the hoisting device
- catwalks and service platforms
- reference to the quality inspection programme or to the instructions for inspections and testing.

6.2.7 Inspection plan

637. An inspection plan shall be drafted for inspections and tests to be conducted on the materials, structures and operation of the hoisting device unit.

638. References to corresponding inspection procedures and/or standards shall be presented in the inspection plan for the purpose of conducting inspections and tests, with an indication being made as to whether the inspections of various parties are hold points (H) or witness points (W).

639. The quality inspection of the materials, welded joints, coatings, installation and finished structures shall be described with respect to each component.

640. The inspection plan shall include the non-destructive testing of load-bearing structures.

- All welds shall be given an overall visual inspection.
- The testing of load-bearing welds shall be documented.
- At least 25% of the welds on load-bearing structures, including rope drums and welded gearboxes, shall be tested for surface cracks.
- 100% of load-bearing, full-penetration butt welds shall be subjected to ultrasound testing.
- 100% of the machined surfaces on hook seat and shank surfaces shall be tested for surface cracks.
- 100% of the lifting gear wheels and pinions shall be tested for surface cracks.

641. A construction inspection shall be included in the inspection plan as a single phase.

642. The inspection plan can be divided into an inspection and testing plan, in which references can be made to inspection and testing instructions. These provide a more detailed description of methods, reporting and supervision.

643. If procedure tests or production tests are needed to qualify the manufacturing procedures, a separate plan shall be presented for their inspection.

644. Furthermore, a separate plan is needed if the properties of the materials or welded joints are altered during the manufacture such that the information provided in the materials report is no longer valid.

645. As regards every inspection and test entered in the plan, the facts to be presented include the date of the inspection vs. the manufacturing phase, the inspection facilities, the inspector, the reporting, and those responsible for the supervision.

646. Inspection procedures shall be given for inspection and supervisory measures that are linked with the manufacture, installation and functional tests of the hoisting and transfer device.

647. Inspection procedures shall specify the inspection method, scope, requirements and reporting. In the details, references can be made to standards or valid safety regulations and instructions published by the authorities that supervise hoisting equipment.

648. A test loading plan shall be presented and the inspections to be carried out during the test loading shall be defined.

649. Inspection and testing instructions shall present:

- The material certificates required for construction materials: for load-bearing parts and welding consumables, type 3.1, and for other parts and welding consumables, type 2.2 according to standard SFS-EN 10204 [30]; the division may follow standard KTA 3903 [40], for example
- For hoisting ropes, a batch-specific certificate of the meeting of the strength values
- Destructive testing of materials, with the requirements for material certificates and supervision
- Non-destructive testing and inspections during manufacture
- Testing and inspection of finished products

6.2.8 Description of fabrication

650. Fabrication shall be based on manufacturing instructions approved in accordance with the management system. The quality management system of a manufacturer performing welding shall take into account the requirements of standard SFS-EN ISO 3834-2 [31]. The quality management system of a manufacturer performing heat treatment in connection with welding and related processes shall observe the requirements of standard SFS-EN ISO 17663 [39].

651. The manufacturing instructions and the personnel involved in fabrication shall be qualified in accordance with the procedures described in the management system.

652. The welding of load-bearing welded joints shall be qualified by means of procedure tests in compliance with the SFS-EN ISO 15614-1 [27] standard or a similar generally accepted standard.

653. Welders shall be qualified in accordance with the SFS-EN 287-1 [28] standard, and welding operators shall be qualified in accordance with the SFS-EN 1418 [38] standard or similar generally accepted standards before beginning any welding.

6.2.9 Type approval of serially manufactured mechanical components

654. The construction plan and construction inspection of a serially manufactured mechanical component that is installed on a safety-classified hoisting device unit may be replaced with an EC type approval certificate, if the dimensioning calculations contained in the hoisting device unit's construction plan unambiguously demonstrate that the design values and other properties of the component meet the requirements set by the location where the component is to be used.

655. The third party that is authorised to perform the type inspection and type conformity assessment of serially manufactured hoisting device units shall be a certification body that has been accredited for the conformity evaluation of the applied standards according to SFS-EN ISO/IEC 17065 [36], or an inspection organisation accredited for a similar task according to standard SFS-EN ISO/IEC 17020 [34]. In order to supervise the testing, the certification body or inspection organisation shall have applicable qualifications according to standard SFS-EN ISO/IEC 17025 [35]. The certification body or inspection organisation shall also be a notified body appropriate to the task.

656. The conformity of a serially manufactured EC type inspected component to be used at a nuclear facility shall be indicated using the modules specified in Decision 768/2008/EC [29], so that the component is type inspected as a design type conforming to module B and a production type conforming to module F, wherein at least 1 of the randomly selected, identical components of a delivery lot are inspected.

657. Copies of the EU type inspection certificate, type inspection report and declaration of conformity, outlined by a third party, regarding EU type inspected components shall be appended to the construction plan.

658. Upon request, the licensee shall provide STUK with materials related to the type approval of a serially manufactured component, such as design documents, dimensioning calculations and test reports.

7 Manufacture

7.1 Requirements concerning the licensee

701. Prior to beginning any manufacturing work, the licensee shall ensure that the manufacturer and any subcontractors it may be using, and any testing and inspection organisations involved, all possess the necessary permits and qualifications specified in the YVL Guides, and that all inspections and supervision required by STUK can be carried out.

702. The licensee shall give STUK an opportunity to assess the implementation of the manufacturer's management system by means of on-site inspections, prior to the beginning of and during the manufacturing work.

703. The licensee shall make a provision in agreements that grants the right to conduct on-site oversight and inspections at the facilities of the manufacturer's subcontractors.

704. The licensee shall ensure that the manufacturer has at its disposal an approved construction plan for initiating manufacturing work and the decision concerning the plan, if necessary, translated into the language used in the project, as well as any other applicable technical information, requirements and regulatory provisions.

705. The licensee shall supervise compliance with the approved construction plan in manufacturing.

706. The licensee may use third party service providers in controlling the compliance of manufacturing. The independent oversight of third party service providers shall be specified in procurement documents.

7.2 Requirements concerning the manufacture

7.2.1 Procurement, testing and handling of materials

707. Materials, such as sheets, pipes, bars, wrought and cast iron and welding consumables, shall meet the specifications listed in an approved construction plan or the requirements of a standard specified for compliance.

708. The manufacturer shall ensure that compliance with set requirements is verified by means of a construction plan-compliant material test, with an SFS-EN 10204 [30] standard-compliant material certificate.

709. Structural materials for which a batch-specific material certificate is required in the construction plan shall be identifiable and traceable from their individual batches all the way to the completed structure.

710. In connection with the supplier's approval, traceable, batch-specific materials shall be permanently marked with the supplier and destructive testing supervisor ID, the batch and serial number, and the material grade, provided that the standard or specification used does not require more extensive markings.

711. Markings made on materials shall be presented in the material certificate in order to verify their traceability.

712. The manufacturer shall possess instructions, which specify the procedures to be followed in receiving and handling materials and welding consumables. The manufacturer shall take material and welding consumable supplier recommendations into consideration in its instructions.

713. The handling, storage and transport of the materials and welding consumables shall be arranged in a way that does not impair their quality. Welding consumables shall be handled so that they may be identified in every phase of their handling.

714. If the material markings are in danger of being lost due to cutting or some other form of handling, the person authorised to transfer markings shall make new, permanent markings before cutting or handling them in another way, so that the origin of the parts can be verified during the construction inspection. The transfer of markings shall be documented in such a manner that the person transferring them validates the markings with his/her personal ID.

715. Materials or welding consumables found to be unsuitable for the intended purpose during manufacture of the equipment or structure or otherwise, shall not be used. Any material found to be unsuitable shall be clearly marked as such and removed immediately from the manufacturing area.

716. The repair of minor defects found in materials or during the manufacture of equipment or structures shall be done in compliance with the applicable material standard or other procedure approved for the delivery.

717. Repairs made to a material by welding shall be documented, should the applicable material standard or construction plan so require.

7.2.2 Machinery and equipment used in manufacturing

718. The machinery and equipment used in manufacturing shall support the achievement of the required quality level. The manufacturer shall have a maintenance plan in place for machinery and equipment.

719. The manufacturer shall regularly conduct tests and calibrations in order to ensure that the machinery and equipment function flawlessly and are within the acceptable tolerances for hoisting device unit parts. The results of regularly scheduled testing shall be saved.

7.2.3 Manufacturing instructions and qualification

720. Procedures with essential parameters shall be drawn up for demanding work processes such as welding, forming and heat treatment, which affect material strength and properties. Other manufacturing procedures shall also have the necessary procedures for ensuring the quality of work.

721. Manufacturer-specific welding procedure specifications, heat treatment procedures and hot and cold-forming procedures to be used in manufacturing and installation shall be qualified by means of procedure tests before beginning any manufacturing work. The procedure test shall demonstrate that the material properties approved as the basis for design are retained during manufacture, and that the manufacturer is qualified to use the manufacturing procedure.

722. The SFS-EN ISO 15614-1 [27] standard level is the minimum required level for welding procedure tests.

723. Procedures for the qualification of personnel and extending qualifications shall be based on the requirements specified in chapter 5 of this YVL Guide and the applicable standard for joining methods.

7.2.4 Manufacturing

724. The equipment or structure shall be manufactured in accordance with an approved construction plan.

725. An approved quality plan, system specifications, construction plan, procedures and standards related to manufacturing shall be kept at the manufacturing site.

726. The manufacturer shall oversee all demanding work phases. When supervising welding, the requirements of the welding quality management standard that serves as the basis of the manufacturer's approval shall apply.

727. When manufacturing is completed, the manufacturer shall inspect the equipment or structure surface quality and cleanliness in accordance with the construction plan as well as ensure that product quality is preserved during storage and transport.

728. Records on the manufacturing control conducted by various parties shall be kept, describing the manufacturing, inspection or test phase supervised.

729. The manufacturer shall use non-conformity reports to determine the cause of any errors and deviations discovered during manufacturing, assess their significance, and issue a repair recommendation as well as a plan on how to prevent a given non-conformity from recurring.

730. Non-conformities shall be approved in accordance with the procurement agreement and manufacturer management system. If a non-conformity remains in a product, its approval shall be justified in the non-conformity report.

7.2.5 Testing and inspection

731. The manufacturer shall have at its disposal an expert and qualified staff for conducting construction plan-compliant inspections, testing and supervision.

732. The licensee shall ensure that the testing organisation has been approved in accordance with YVL Guide E.12, and that testers possess an NDT Level 2 qualification in accordance with the SFS-EN ISO 9712 [33] standard. The licensee may, with just cause, seek an assessment of the qualifications of the manufacturer's testing personnel in connection with the construction plan.

733. The inspection, measurement and testing equipment shall be regularly checked and calibrated, and the results shall be recorded.

734. A quality control plan approved as part of the construction plan shall be observed while carrying out inspections and testing. Inspections and testing shall be conducted during the manufacturing phase designated for them.

735. If equipment inspections are prevented or hindered during the manufacturing process, the inspections shall be, if necessary, divided across several manufacturing phases.

736. At the factory, the hoisting device unit shall be submitted to a factory test to ensure it functions properly. The factory test shall be sufficiently extensive, taking into consideration any limitations caused by the physical size of the product and conditions at the factory. In factory tests, structures are assembled and fitted together, and machinery is installed and subjected to pre-operational testing on their mounts. Equipment software and safety functions shall be tested as extensively as possible.

737. The manufacturer shall address any non-conformities found in testing and inspections in accordance with the prescribed equipment delivery procedures.

7.3 Subcontracting

738. If necessary, the manufacturer may assign part of the manufacturing or inspections to a subcontractor. The use of subcontractors shall be presented in the section of the construction plan that describes the manufacturer.

739. It is the manufacturer's responsibility to ensure that the subcontractor possesses all the relevant technical specifications and requirements. If necessary, the manufacturer shall provide training for its subcontractors in order to familiarise them with the requirements related to manufacturing.

740. The manufacturer shall ensure that the procedures used by subcontractors and subcontractor personnel are qualified in accordance with the set requirements.

7.4 Manufacturing records

741. The manufacturer shall compile testing, inspection and supervision records, which are compliant with the approved construction plan and installation plans and drafted during manufacturing or installation, to serve as result documentation for manufacturing.

742. The certificates for materials and welding consumables, qualification certificates for personnel, processed non-conformity reports, and other records created during manufacturing, the control of manufacturing, and testing shall be appended to the result documentation.

743. Before commissioning the hoisting device unit, the operating, maintenance and inspection procedures shall be approved for use in accordance with the requirements set by the manufacturer and licensee management systems.

744. The instructions for safety-classified hoisting device units and load-lifting attachments shall be made available to STUK.

745. The manufacturer or importer shall compile installation, operating, condition monitoring and maintenance instructions and submit them and the manufacturing result documentation to the licensee.

8 Construction inspection

8.1 Prerequisites for construction inspection

801. The construction inspection ensures that the equipment or structure has been manufactured, modified or repaired in accordance with the approved construction plan and approved procedures, and that all inspections and tests listed in the construction plan have been conducted on said equipment or structure. In addition, the construction inspection verifies that neither the equipment nor the structure has been treated in a way that would negatively affect its integrity and operation during use.

802. The licensee shall set a condition in their procurement agreement that makes it possible to conduct inspections in accordance with this Guide on the premises of the manufacturer and subcontractors.

803. The licensee, manufacturer and in connection with plant project plant supplier shall, through their own inspections, ensure that the equipment or structure or an subassembly of the two meet the requirements for inspection and approval in the construction inspection.

804. The prerequisite for a construction inspection to be conducted by STUK is that the construction plan of the item to be inspected is approved by STUK.

805. The licensee shall agree with the manufacturer or plant supplier on the inspection dates essential for the construction inspection. The final construction inspection is usually made on completed equipment on the manufacturer's premises before delivery or installation.

806. When agreeing on dates for the construction inspection, attention shall be given to the approval procedures related to different manufacturing phases and any necessary intermediate construction inspections in accordance with the construction plan.

807. The licensee shall ensure that all manufacturing plans as well as the approvals and conditions pertaining to them are taken into account in the construction inspection.

808. The licensee, manufacturer and in connection with plant project plant supplier shall assess and approve the result documentation regarding the manufacture of the equipment or structure prior to submitting it to STUK.

8.2 Equipment or structure construction inspection

809. In the equipment or structure construction inspection, the licensee shall:

- present the approved manufacturing result documentation and its quality control for examination
- present the equipment or structure, with ID and equipment position markings, for examination, and perform a dimensional inspection or verification thereof
- present the factory test result documentation
- show that the final suitability assessment of electrical and I&C equipment has been addressed in the manner specified in Guide YVL E.7.

The implementation of the construction inspection is presented in greater detail in Appendix A.

810. The licensee shall present an approved construction plan, related STUK decisions and any approved modification documents by the start of the inspection, at the latest.

811. The licensee, manufacturer and in connection with plant project plant supplier shall, upon request, submit to the inspector any other documents related to the construction plan or presented in its list of references.

812. The manufacturer is responsible for the inspection preparations. Those taking part in the inspections shall be provided with safe working conditions, adequate lighting, calibrated measur-

ing instruments and auxiliary devices as well as the necessary assisting personnel.

813. The manufacturer shall ensure, for the purpose of inspection, safe access to an inspection distance from the structural elements of the equipment or structure. If necessary, the structure shall be raised or rotated, thus allowing it to be inspected on all sides.

814. If inspection becomes more difficult in the course of manufacturing or assembly a sufficient number of the intermediate construction inspections shall be carried out during the various manufacturing phases.

The intermediate result documentation and structure inspections specified in the construction plan and conducted during manufacturing and assembly phases are as follows:

a. inspections prior to the loading test and factory test
b. loading test and factory test
c. equipment inspection after the loading test and factory test
d. inspection of equipment or structure to be surface treated prior to receiving the surface treatment
e. other intermediate inspections specified in the construction plan.

815. In connection with the intermediate equipment or structure inspection, the manufacturer shall present the inspector with the result documentation of the manufacturing and test phases completed, including non-conformities.

816. The licensee, manufacturer and, in connection with plant project, plant supplier shall ensure that all remarks made in the result documentation or intermediate equipment inspections conducted prior to the loading test and any defects found in the structure that can compromise the safety or acceptability of the loading test have been cleared before conducting the loading test.

817. The manufacturer shall ensure that there are sufficient prerequisites for conducting factory tests and subsequent equipment inspections. The design and implementation of hoisting device unit systems, subsystems and equipment needed in factory tests shall be approved up until the factory test phase.

818. The manufacturer shall ensure that construction inspections and intermediate construction inspections are conducted during the work phase for which they were planned.

819. Written remarks made during intermediate construction inspections shall have been cleared in the final construction inspection.

820. Where type approved components are concerned, a construction inspection can be limited to determining the type approval and the validity of its terms. Insofar as type approval is not valid, in the installation of a product for example, the licensee shall plan a construction inspection as presented above.

821. In the acceptance inspection, the licensee shall certify the condition and conformity of a previously construction inspected equipment or structure after its transport to the plant site and prior to its installation. The licensee shall possess the instructions and procedures for the acceptance inspection and its reporting.

822. If a construction inspection is conducted at the plant site, the licensee shall, during the acceptance inspection, ensure that the requirements for conducting a construction inspection have been fulfilled.

823. The licensee shall file the construction inspection records until decommissioning the equipment or structure.

8.3 Procedures for non-conformities

824. If an inspection by STUK reveals that the equipment or structure fails to meet the requirements specified in the construction plan or contains deficiencies or flaws that have an impact on safety, the inspector shall report these to the licensee and the manufacturer.

825. If the STUK inspector finds deficiencies, defects or discrepancies in materials testing, manufacturing result documents or the inspection of the structure, he/she may, instead of issuing a rejection, expand the scope of inspections or, at his/her discretion, call for additional testing to supplement original materials testing to become convinced of the acceptability of the equipment.

826. If the inspector by STUK is called upon during the inspection to approve minor, ordinary non-conformities that do not affect the operability, strength or operation of the equipment or structure, the non-conformities shall be approved by the licensee, in connection with plant project the plant supplier and the manufacturer.

9 Installation

901. The hoisting device unit shall be approved in an acceptance inspection prior to beginning any installation work.

902. A construction plan shall be drafted for the installation of the hoisting device unit, and it shall contain the following information:

- installation instructions and drawings and parts list
- qualified welding procedure specifications, if the installation involves welding
- inspection plan for the installation
- installation inspection procedures.

903. For the purpose of maintenance and operation, the hoisting device unit shall be fitted with safe catwalks and service platforms, which shall be submitted for approval as a part of the construction plan concerning installation of the hoisting device unit.

904. The installation inspection plan shall present the installation welding, alignment and other inspections, which can be used to demonstrate the approvability of the mechanical installation of the hoisting device unit.

905. The installation construction inspection and intermediate inspections shall ensure the acceptability of the mechanical installation of the equipment or structure and the installation quality control result documents.

906. In the installation construction inspection, the same requirements concern the plant supplier, installation organisation and licensee as well as inspection procedures that apply in the construction inspection of the equipment in question.

10 Commissioning

10.1 General

1001. The manufacturers' instructions shall be followed in commissioning the hoisting device unit.

1002. The licensee shall ensure that the preconditions for beginning the inspection exist.

1003. The commissioning inspection may begin after

- the construction plan has been approved,
- the hoisting device unit, the travel stops of its rail tracks, auxiliary systems, auxiliary structures and rail tracks have been installed in their final locations,
- the hoisting device unit has been approved in the construction inspection and the installation construction inspection.

1004. Additional requirements set in the inspections and all non-conformities discovered shall be dealt with in the manner approved by STUK and required by the licensee's management system.

1005. The licensee shall commission any auxiliary systems of the hoisting device unit in accordance with the applicable YVL Guides before commissioning the hoisting device unit. The documentation drafted on the commissioning shall be appended to the inspection document of commissioning phase 1.

1006. The licensee shall perform the installation inspection, commissioning inspection and confirmation of the conformity to requirements of the electrical and instrumentation and control systems in accordance with Guide YVL E.7.

1007. The person responsible for the operation of the hoisting device unit and the personnel needed for the functional tests shall be present at the commissioning inspection of the hoisting device unit.

1008. The commissioning inspection is divided into two phases:

- a pre-operational testing licence, which is a precondition for beginning the functional tests, is granted in the first phase (verification inspection).
- the functional tests are carried out in the second phase.

1009. Approved functional tests are a precondition for granting the operating licence.

1010. Before commissioning, safe heavy load handling areas shall be marked at the plant. If this cannot be achieved, specially designed accessories shall be used for supervising that the correct transfer route is followed.

10.2 Commissioning inspection phase 1

1011. In the verification inspection, it shall be shown that the construction plan for the manufacture and installation of the hoisting device unit installed in its place of operation has been approved and that the hoisting device unit has been found to conform to the designs in the construction inspections.

1012. The location of the hoisting device unit, the travel stops of the rail tracks and the acceptability of the rail tracks as well as safety of the catwalks and service platforms shall be inspected.

1013. In commissioning phase 1 of the hoisting device unit, the licensee shall present an inspection document, which shall contain the following items:

- a list of documents,
- covering letters and flyleaves of the documents,
- STUK's decisions and letters,
- original construction inspection and installation inspection records,
- written reports on how the non-conformances detected during inspections have been dealt with,
- design data of the equipment,
- assembly drawings,
- a list of the accessories, including reference data,
- operation and maintenance procedures,
- the spare parts instructions.

1014. In addition to the inspection document, a positive decision on the construction plan and a written report on the fulfilment of the conditions laid down in a conditional decision shall be presented in the commissioning inspection.

1015. During the verification inspection, the licensee shall demonstrate that the installation of the electrical and I&C equipment has been inspected and that their conformity to requirements has been confirmed in an inspection report.

1016. At a later date, the inspection document shall be supplemented with inspection records and result documentation concerning repairs, modifications and the design significant in terms of the supervision of the hoisting device unit's operation or with summaries of and references to this material.

10.3 Commissioning inspection phase 2

1017. In phase 2, the licensee shall carry out the functional tests of the hoisting device unit, whose aim is to demonstrate that the hoisting device unit meets the functional requirements set for it in its place of operation.

1018. As part of the functional tests, it shall also be checked that the requirements for the technical values, such as the quantities measurable after installation (displacement, deflection, electric quantities, safety clearances, etc.), are met.

1019. A pre-operational testing programme shall be drafted for the hoisting device unit, which contains information on the functional testing and test loading.

1020. A precondition for beginning the tests is that STUK has approved the pre-operational testing programme and that phase 1 of the commissioning inspection has been performed in an acceptable manner.

1021. If a special test apparatus is used in hoisting device unit functional tests, STUK shall have approved the test procedure.

1022. Functioning in the different parts of the operating range and the limits of the operating range shall be tested under the most unfavourable loading conditions, if no other procedure has been justified in the pre-operational testing programme.

1023. A record shall be kept of the functional tests, describing explicitly the functional test situation, the tests performed with their results, and the acceptability of the results.

11 Operation

11.1 General

1101. The instructions and methods relating to the operation of the hoisting device unit shall meet the requirements of Guide YVL A.8 concerning ageing management, condition monitoring and maintenance.

1102. The licensee shall maintain a data system, where the documents pertaining to condition monitoring, maintenance and modifications are recorded. The licensee shall also ensure that these documents are available to STUK on request.

1103. If a maintenance work is not part of the service programme or it does not consist of replacing a part with an approved spare part, the maintenance work shall be considered to be a repair, and the licensee will be required to draw up a repair plan. The repair plan shall comprehensively include the information needed in performing and inspecting the work that is required to evaluate the acceptability of the repair work; typically, such information includes the manufacturing and inspection procedures, illustrative drawings, and an inspection plan covering the manufacturing stages, installation, and commissioning.

1104. The licensee shall ensure that the manufacturer prepares the requirements and recommendations concerning the installation, commissioning, operation, condition monitoring during operation, maintenance, in-service inspections, repairs and ageing management of the hoisting device unit or the load-lifting attachment.

1105. The licensee shall have in its possession the instructions and plans concerning the operation, condition monitoring and maintenance of the hoisting device units or the load-lifting attachments (maintenance, in-service inspections and repair work). The instructions and plans shall be based on the manufacturers' requirements and recommendations and on official regulations. They shall always be kept up to date and developed based on accumulated operating experience.

1106. The licensee shall operate and maintain the hoisting device units and the load-lifting attachments in such a way that they fulfil the requirements set for them throughout the planned service life. It shall be possible to perform the functional tests and in-service inspections of the hoisting device unit and the load-lifting attachment throughout the planned service life.

11.2 Condition monitoring

1107. A benchmark of safe remaining service life shall be kept up-to-date for the significant load-bearing components of the hoisting device unit, and it shall be based on actual operation cycles and submitted to STUK for information after every in-service inspection.

The benchmark may be in the form of one created from a separate calculation analysis, or one produced by a continuous analysis system integrated into the unit.

1108. In-service inspections shall be performed on the hoisting device unit in accordance with the Government Decree on the Safe Use and Inspection of Work Equipment (403/2008) [32].

1109. In defining the intervals and scope of in-service inspections, the requirements for operation and reliability, ageing monitoring and Government Decree (403/2008) [32] shall be taken into consideration.

1110. In-service inspections equivalent to those performed on hoisting device units shall be conducted on a safety-classified load-lifting attachment.

1111. The in-service inspection programme shall take account of the requirements for in-service inspections established in the design bases.

1112. The in-service inspection programme shall contain:

- the objects and scopes of inspection,
- the inspection intervals,
- the applicable regulations and standards,
- the qualification requirements for the inspection personnel,
- preparation of the inspection object,
- the inspection methods and equipment to be used,
- the calibration requirements for the inspection equipment,
- the acceptance criteria for the inspection results,
- reporting on the inspections and filing of the inspection records.

1113. The in-service inspection programmes of safety-classified hoisting device units and load-lifting attachments shall be submitted to STUK for information.

11.3 Maintenance

1114. The licensee shall have in place a maintenance programme or similar plan for the hoisting device unit, which defines the maintenances and repairs planned to maintain operability.

1115. Maintenance work shall be scheduled such that the remaining service life of wearing parts is always longer than the design-basis uninterrupted operating cycle without maintenance.

1116. In purchasing spare parts and ensuring the availability of strategic spare parts, the approved construction plans shall be followed.

1117. The spare parts for maintenance and repair defined in the hoisting device unit and load-lifting attachment maintenance plan shall be available to the licensee.

12 Modifications

1201. For any modifications, the licensee shall draw up a plan for principles and the construction, installation and pre-operational testing plans, and arrange the construction, installation and commissioning inspections.

1202. The modifications shall follow the same requirements and methods as those used in the design, manufacture, installation, and commissioning of a new hoisting device unit or load-lifting attachment.

1203. The documentation on the modifications shall be appended to the inspection document of the hoisting device unit or load-lifting attachment.

1204. The modifications shall be carried out following the approved modifications construction plan and the electrical and I&C installation plans.

1205. The licensee shall, irrespective of whether the employee is employed by the licensee or an external company, give the training and familiarisation needed to perform the work and ensure that all employees have the adequate instructions and appropriate tools at their disposal.

13 Decommissioning

1301. When decommissioning components and disposing of components classified as nuclear waste, Guides YVL D.4 and YVL D.5 shall be followed.

1302. The licensee shall submit to STUK for information a notification of decommissioning a component.

14 Regulatory oversight by STUK

14.1 General

1401. STUK supervises the design, manufacturing, commissioning and operation of safety-classified hoisting device units and load-lifting attachments of a nuclear facility using the procedures established in this Guide.

1402. The prerequisites for STUK's supervision of inspections and tests are that the licensee submits the request no later than two weeks before the suggested date, and that the manufacturer, in case of plant project the plant supplier and the licensee have carried out their own inspections to determine that the preconditions for the requested inspections exist.

1403. STUK shall draw up an inspection protocol specifying the item inspected and the inspections made. The protocol shall list any requirements and deadlines for the responses required.

1404. The inspection shall end and the protocol shall be closed when all the required inspections have been performed and when all the requirements have been cleared. The protocol shall be signed by the inspector, and a representative of the licensee acknowledges its receipt.

14.2 Equipment requirement specifications for hoisting device units

1405. STUK shall approve in its decision the equipment requirement specifications set by the licensee for the hoisting device units and load-lifting attachments.

1406. The meeting of the set requirements shall be verified in connection with document reviews and construction inspections, and as part of the construction inspection programmes and operation inspection programmes.

1407. The plant suppliers' and manufacturers' own requirements, which are based on the licensee's requirements, concerning the design, dimensioning or quality control of the hoisting device units or load-lifting attachments shall be approved in STUK's decisions. An approving decision is a prerequisite for using them as a requirement basis or referring to them in documentation submitted to STUK.

14.3 Design documents

1408. STUK shall process the system descriptions of the hoisting device units as part of the safety analysis report in the manner presented in Guide YVL B.1.

1409. A hoisting device unit system description approved by STUK shall be the prerequisite for starting the processing of the construction plan.

1410. STUK shall process the construction plan submitted by the licensee, which includes the documents defined in this Guide. Requirements pertaining to the submission of documents are given in Appendix B of Guide YVL A.1.

1411. The result of processing the construction plan shall be presented in a decision by STUK. Minor updates to an approved plan may be processed as received for information.

1412. The construction plan of the hoisting device unit, a component thereof or an auxiliary system shall have been approved prior to commencing the manufacturing of the hoisting device unit, its component or auxiliary system.

1413. For a justified reason, the manufacturing of the first subassemblies may be started before the entire construction plan is completed in case the manufacturing time is exceptionally long or when the component or structure must be replaced immediately to ensure safety. In such a case, approval shall be sought for those sections of the component's construction plan on the basis of which the fulfilment of a component's design bases and the acceptability of the component's dimensioning, design, manufacturing and inspection can be evaluated.

1414. The sections of the construction plan pertaining to the manufacturer and testing organisation shall always be approved before commencing any manufacturing.

14.4 Construction inspection

1415. STUK carries out or supervises the inspections and tests of the hoisting device unit that have been specified in the approved inspection plan or are otherwise required to be conducted. The licensee shall also submit to STUK for information the testing programme of the factory tests which STUK confirms it will supervise.

1416. STUK supervises, at its discretion, manufacture of the electrical and I&C systems and equipment that are within the scope of pre-inspection by means of inspection visits. For the purpose of any inspections on the manufacturer's or supplier's premises, the licensee shall submit the system testing schedules to STUK for information.

14.5 Installation

1417. An approved construction inspection shall be the prerequisite for installing the hoisting device unit.

1418. An approved installation construction plan of the hoisting device unit shall be the prerequisite for starting the installation.

1419. At its discretion, STUK controls the installation of safety class 3 electrical and I&C systems and equipment. For installation supervision purposes, STUK may request for information the installation schedule of safety class 3 electrical and I&C systems subject to pre-inspection prior to the commencement of installation.

1420. An approved installation construction inspection of the hoisting device unit shall be the prerequisite for commissioning the hoisting device unit.

14.6 Commissioning

1421. STUK shall perform the nuclear safety commissioning inspection of a safety-classified hoisting device unit as defined in this YVL Guide.

The commissioning inspection referred to in Government Decree 403/2008 [32] may be performed in the same connection or at some other time.

The approval of all commissioning inspections required by authorities shall be the prerequisite for using the hoisting device unit in a nuclear technology context.

14.7 Operation, condition monitoring, and maintenance

1422. STUK supervises the adequacy of and compliance with the instructions and plans concerning the operation, condition monitoring, and maintenance of safety-classified hoisting device units and load-lifting attachments as part of the periodic inspection programmes (KTO).

1423. STUK supervises the in-service inspections of hoisting device units and load-lifting attachments conducted in accordance with the approved in-service inspection programme in a scope it deems necessary.

1424. STUK shall process the repair plan submitted by the licensee, which includes the documents defined in this Guide. No repair plan shall be required for repair work that only includes replacing parts with approved spare parts and that involves no special processes.

1425. An approved repair plan shall be the prerequisite for the starting of the repair work.

1426. STUK shall perform the repair work construction inspection within the scope approved during the processing of the repair plan.

1427. An approved repair work construction inspection shall be a prerequisite for the operation of the repaired hoisting device unit or load-lifting attachment.

14.8 Modifications

1428. Inspections and supervision of modifications are carried out in the same manner as the inspections and supervision of a new hoisting device unit.

Definitions

Installation construction plan

Installation construction plan shall, in the context of Guide YVL E.11, refer to a construction plan describing how a hoisting device unit connects to a nuclear facility, including the electrical and I&C systems.

Dynamic analysis (hoisting equipment)

Dynamic analysis shall, in the context of Guide YVL E.11, refer to the definition of the eigenvalues, acceleration, displacement and hydraulic stresses of components and structures. The values calculated are used as input data for the strength analysis and dimensioning as well as to ascertain the durability of various parts under anticipated loading conditions.

Special process

Special processes shall refer to manufacturing processes, the results of which cannot be directly verified by means of a product inspection or testing after manufacture; instead, any shortcomings in the process may only appear later while the product is in use.

Auxiliary welding material

Auxiliary welding materials shall refer to, for example, shielding gases and fluxes used in welding.

Welding consumable

Welding consumables shall refer to welding filler materials and auxiliary welding materials used in welding.

Welding filler material

Welding filler materials shall refer to the filler wires, covered electrodes and other similar welding consumables used in welding.

Stress analysis (hoisting equipment)

Stress analysis shall, in the context of Guide YVL E.11, refer to the calculation of stresses and displacement applying the rules of the strength theory so that external forces, displacement as well as pressure stresses and temperature stresses do not result in exceeding the allowable values.

Third party (hoisting equipment)

Third party shall refer to an individual or organisation that is independent of the individuals or organisations responsible for the design, manufacturing, supply or operation of the pressure equipment or assembly.

Repair work

Repair work shall refer to the restoration of a faulty component or structure to a state which conforms to the original designs.

Condition monitoring

Condition monitoring shall refer to the determining of the operability of a SSC.

Maintenance

Maintenance shall refer to the planned service of SSC to reduce the probability of failure in advance, or the overhaul or repair of a SSC undertaken on the basis of observed needs.

Loading test (hoisting equipment)

Loading test shall refer to a load test or overload test performed on a hoisting device in accordance with a chosen standard where the machinery and structures of the hoisting device are loaded.

Operability

Operability shall refer to the integrity and performance of SSC in conformance with its design bases.

Systems, structures and components (SSC)

Systems, structures and components (SSC) shall refer to any mechanical, electrical, I&C or civil system, structure or component in safety classes 1, 2 and 3 or in class EYT/STUK (non-nuclear).

Structural analyses

Structural analyses shall refer to dynamic analyses and stress analyses.

Licensee

Licensee shall refer to the holder of a licence entitling to the use of nuclear energy. The use of nuclear energy refers to the operations laid down in Sections 2(1) and 2(2) of the Nuclear Energy Act.

Material manufacturer

Material manufacturer shall refer to an individual or organisation producing material, in basic product form, used in the manufacturing of a component or structure.

Modification

Modification shall refer to introducing changes to a system, structure or component so that it no longer corresponds to previous specifications.

Load-lifting attachment

Load-lifting attachment shall refer to a device or structure used to assist in hoisting or transfer.

Load-handling device

Load-handling device shall refer to a part of the hoisting device unit to which the load to be moved is fixed directly or using a hoisting accessory.

Hoisting device unit

Hoisting device unit shall refer to hoisting and transfer devices, including the components that are part of their mechanical structure and rail track, instrumentation and control and electrical systems related to their operation, and other fixed auxiliary systems (hydraulic, pneumatic etc.).

Permanent joint

Permanent joint shall refer to a joint which can only be removed using destructive methods.

Strategic spare part (hoisting equipment)

Strategic spare parts shall refer to spare parts the availability of which ensures the operability of the hoisting device unit.

Inspection organisation approved by STUK

Inspection organisation approved by STUK shall refer to an inspection organisation that has been approved in accordance with Guide YVL E.1.

Testing body approved by STUK

Testing body approved by STUK shall refer to a testing body that has been approved in accordance with Guide YVL E.1.

Manufacturer approved by STUK

Manufacturer approved by STUK shall refer to a manufacturer approved under Guide YVL E.3.

Design basis

Design bases shall refer to all requirements, definitions and bases for normal operational conditions and accidents that pertain to the design and operation of a plant, system and component.

Factory test (hoisting equipment)

Factory test shall refer to the functional testing performed on a hoisting device unit, including load tests, which is extensive enough to ascertain the proper functioning of the product and which takes the restraints resulting from the physical size and factory conditions of the product into consideration.

Testing

Testing shall refer to determining one or more characteristics of an object evaluated for conformity to requirements (SFS-EN ISO/IEC 17000, 2005).

Testing organisation

Testing organisation shall refer to an organisation performing testing activities requiring special competence. (Nuclear Energy Act 990/1987)

Functional test (hoisting equipment)

Functional tests shall, in the context of Guide YVL E.11, refer to the functional tests and testing conducted in the latter stage of the commissioning inspection in accordance with an approved commissioning test programme at the location of use of the hoisting device unit.

Production test

Production test shall refer to a test whereby a sample corresponding to a joint or coating is welded during welding work in order to ensure that the properties of the product meet the requirements set.

Safety-classified system/structure/component

Safety-classified system/structure /component shall refer to a system, structure or component assigned to safety classes on the basis of its safety significance.

Witness point

Witness point shall refer to an inspection for which advance invitations have been sent to the parties defined in the inspection plan but whose supervision is not a condition for proceeding with the work. Having received the invitation, the invited parties may, however, separately require that they be present in order for the work to be continued.

Manufacturer

Manufacturer shall refer to an individual or organisation responsible for the design, manufacture, testing, inspection and installation of equipment or sets of assemblies. A manufacturer may subcontract one or more of the said tasks under its responsibility.

Hold point

Hold point shall refer to an inspection for which advance invitations have been sent to the parties defined in the inspection plan and whose supervision is a condition for proceeding with the work unless the parties have given written permission to proceed without their presence.

References

1. Nuclear Energy Act (990/1987).
2. Government Decree on the Safety of Nuclear Power Plants (717/2013).
3. Nuclear Energy Decree (161/1988).
4. Government Decree (400/2008) on the Safety of Machinery.
5. SFS-EN ISO 9001, Quality management systems. Requirements.
6. SFS-EN 13001-1 Cranes. General design. Part 1: General principles and requirements.
7. SFS-EN 13001-2 Cranes. General design. Part 2: Load actions.
8. SFS-EN 13001-3-1 Cranes. General design. Part 3-1: Limit states and proof of competence of steel structures.
9. CEN/TS 13001-3-2 Cranes. General design. Part 3.2: Limit states and proof of competence of wire ropes in reeving systems.
10. CEN/TS 13001-3-5 Cranes. General design. Part 3.4: Limit states and proof of competence of forged hooks.
11. SFS-EN 13135 Cranes. Safety. Design. Requirements for equipment.
12. SFS-EN 13155 Cranes. Safety. Non-fixed load-lifting attachments.
13. SFS-EN 13557 Cranes. Controls and control stations.
14. SFS-EN 13586 Cranes. Access.
15. SFS-EN 15011 Cranes. Bridge and gantry cranes.
16. SFS-EN 1990 Eurocode. Basis of structural design.
17. SFS-EN 1993-6 Eurocode 3. Design of steel structures. Part 6: Crane supporting structures.
18. SFS-EN 60204-32 Safety of machinery. Electrical equipment of machines. Part 32: Requirements for hoisting machines.

19. ISO 6336-1, Calculation of load capacity of spur and helical gears – Part 1: Basic principles, introduction and general influence factors.
20. SFS-ISO 15513 Cranes. Competency requirements for crane drivers (operators), slingers, signallers and assessors.
21. SFS-EN ISO 12100 Safety of machinery. General principles for design. Risk assessment and risk reduction.
22. SFS EN ISO 13849-1 Safety of machinery. Safety-related parts of control systems. Part 1: General principles for design.
23. KTA 3902 Design of Lifting Equipment in Nuclear Power Plants.
24. NUREG-0554 Single-failure-proof Cranes for Nuclear Power Plants.
25. NUREG-0612 Control of Heavy Loads at Nuclear Power Plants. Resolution of Generic Technical Activity A36.
26. ASME NOG-1-2010 Rules for Construction of Overhead and Gantry Cranes.
27. SFS-EN ISO 15614-1 Specification and qualification of welding procedures for metallic materials. Welding procedure test. Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys.
28. SFS-EN 287-1 Qualification test of welders. Fusion welding. Part 1: Steels.
29. Decision 768/2008/EC of the European Parliament and of the Council on a common framework for the marketing of products, and repealing Decision 93/465/EEC.
30. SFS-EN 10204 Material certificates for metal products.
31. SFS-EN ISO 3834-2, Quality requirements for fusion welding of metallic materials. Part 2: Comprehensive quality requirements.
32. Government Decree on the Safe Use and Inspection of Work Equipment (403/2008).
33. SFS-EN ISO 9712 Non-destructive testing. Qualification and certification of NDT personnel.
34. SFS-EN ISO/IEC 17020, Conformity assessment. Requirements for the operation of various types of bodies performing inspection.
35. SFS-EN ISO/IEC 17025, Competence of testing and calibration laboratories. General requirements.
36. SFS-EN ISO/IEC 17065, Conformity assessment. Requirements for bodies certifying products, processes, and services.
37. Government Decree on the Safety of Disposal of Nuclear Waste (736/2008).
38. SFS-EN 1418 Welding personnel. Approval testing of welding operators for fusion welding and resistance weld setters for fully mechanized and automatic welding of metallic materials.
39. SFS-EN ISO 17663 Welding. Quality requirements for heat treatment in connection with welding and allied processes.
40. KTA 3903 Inspection, Testing and Operation of Lifting Equipment in Nuclear Power Plants

APPENDIX A Implementation of the construction inspection

A.1 Manufacturing and quality inspection result documentation

A01. The result documentation submitted for inspection shall be systematically drafted and shall contain the result reports laid down in the quality control plan and quality instructions as well as those required by other regulations.

A02. The result documentation shall contain reports on the qualification of the persons who make permanent joints and carry out non-destructive testing.

A03. The result documentation shall demonstrate that

- the manufacturer has been evaluated in accordance with this Guide,
- the testing organisations that test equipment or structures have been approved or evaluated in accordance with Guide YVL E.12,
- the equipment or structure has been manufactured in accordance with the construction plan and the conditions relating to manufacture,
- the materials and welding consumables used have been selected and tested as required in the construction plan; the results have been validated by means of conforming material certificates; and the results of materials testing fulfil the requirements of the material standard and the construction plan,
- the persons making load-bearing permanent joints have a valid qualification meeting the requirements set forth in this Guide, and the joints have been made following the instructions given in the approved construction plan,
- the manufacturer's testers carrying out testing during manufacturing have valid qualifications in accordance with the requirements set,
- the control of manufacturing performed by the manufacturer and the licensee has been conducted as required by the approved quality inspection programme and this Guide.

A04. The manufacturing documents shall contain the documentation on any deviations and repairs.

A.2 Inspection and dimensional check of equipment or structures

A05. The inspection shall be performed on completed equipment or structures before any coating.

A06. In the inspection of structures, the manufacturer shall demonstrate that

- the main dimensions of the equipment or structure conform to the manufacturing drawings,
- the material of the equipment or structure can be identified and verified to conform to the approved construction plan, and that the markings of materials correspond to the test reports of manufacture and testing,
- the material has not been damaged during manufacture,
- the traceability of permanent joints and non-destructive testing can be verified,
- the weld joints meet the requirements laid down in the construction plan; special attention shall be paid to surface smoothness, weld excessivity, any undercuts, root concavity and arc strikes,
- any temporary supports and brackets used during manufacturing and installation have been removed properly,
- there are no imperfect shapes,
- the equipment's main structures and nameplate carry the markings required by regulations.

A.3 Loading tests

A07. Loading tests shall be performed in accordance with the construction plan requirements. The loading tests part of the construction inspection are conducted after test reports have been reviewed and the structure inspected when an inspector has verified the readiness for testing. Test loading of hoisting and transfer device units can also be performed as part of the commissioning inspection.

A.4 Factory test

A08. The factory test shall be performed in a scope specified in the approved construction plan or in a separately approved factory test plan.

A09. The equipment factory test shall demonstrate the equipment's design-basis operability in the operation range under operating parameters.

A10. If electrical and instrumentation and control systems and equipment essential from the point of view of testing are connected to the equipment tested, the licensee shall demonstrate before the factory test that their final suitability assessment has been processed as required by Guide YVL E.7.

A11. The factory test shall be performed using the installation assembly of the equipment.

A12. If the construction inspection of the equipment tested is planned to be completed during a single inspection visit, the inspection shall take place on such an occasion that it is possible to supervise the factory test and thereafter to visually inspect the equipment.

A13. If the equipment or parts thereof that have a significant effect on the integrity or operability of the equipment are modified or replaced after the factory test, the test shall be retaken so that the conformity to requirements of the equipment can be demonstrated unambiguously.