

Safety Standards

of the
Nuclear Safety Standards Commission (KTA)

KTA 3903 (2020-12)

**Inspection, Testing and Operation of Lifting Equipment in
Nuclear Power Plants**

(Prüfung und Betrieb von Hebezeugen in Kernkraftwerken)

Previous versions of this Safety Standard
were issued 1982-11, 1993-06, 1999-06
and 2012-11

If there is any doubt regarding the information contained in this translation, the German wording shall apply.

Editor:

KTA-Geschäftsstelle c/o Bundesamt fuer die Sicherheit der nuklearen
Entsorgung (BASE) • Willy-Brandt-Strasse 5 • 38226 Salzgitter • Germany
Telephone +49-30-18-4321-2907 • E-Mail kta-gs@bfe.bund.de

KTA SAFETY STANDARD

December
2020

Inspection, Testing and Operation of Lifting Equipment
in Nuclear Power Plants

KTA 3903

CONTENTS

Basic principles	5	10 In-service inspections.....	20
1 Scope	5	10.1 General	20
2 Definitions.....	5	10.2 Documents.....	20
3 General provisions.....	5	10.3 Performance of tests and inspections.....	20
4 Special provisions.....	6	10.4 Requirements regarding test personnel.....	21
4.1 Lifts in reactor containments.....	6	10.5 Certification of in-service inspections.....	21
4.2 Lifting equipment in accordance with sections 4.2 to 4.4 of KTA 3902.....	6	11 Series-production parts and standardized components	24
5 Design approval.....	6	11.1 Series-production parts.....	24
5.1 Documents	6	11.2 Standardized components	25
5.2 Performance of design approval.....	8	12 Series-production electric hoists with rope and series-production hoist gear boxes	25
5.3 Certification of design approval	8	12.1 General	25
6 Materials	8	12.2 Design approval	25
6.1 General	8	12.3 Materials.....	26
6.2 Selection of materials	8	12.4 Final inspection	26
6.3 Materials testing	9	12.5 Acceptance testing.....	27
6.4 Identification marking of materials	9	12.6 Operation and maintenance.....	27
7 Final inspection.....	9	12.7 In-service inspection	27
7.1 General.....	9	12.8 Documentation	27
7.2 Documents	9	13 Documentation	27
7.3 Extent of tests and inspections.....	9	13.1 General	27
7.4 Certification of final inspection.....	10	13.2 Compilation of documents	27
8 Acceptance testing	15	13.3 Performance of documentation.....	27
8.1 General.....	15	Annex A: Materials test sheets (WPB).....	33
8.2 Documents	15	Annex B: Non-destructive testing (NDT).....	85
8.3 Extent of acceptance testing	15	Annex C: Forms for test records and qualification tests.....	95
8.4 Certification of acceptance testing.....	15	Annex D: Tests and inspections of hoist brakes	105
9 Operation, maintenance and repair	19	Annex E: Regulations and literature referred to in this Safety Standard	107
9.1 Requirements for operation	19	Annex F: Changes with respect to the edition 2012-11 and explanations (informative) ...	113
9.2 Organisation of transports	19		
9.3 Requirements for maintenance and repair	20		

PLEASE NOTE: Only the original German version of this safety standard represents the joint resolution of the 35-member Nuclear Safety Standards Commission (Kerntechnischer Ausschuss, KTA). The German version was made public in the Federal Gazette (Bundesanzeiger) of January 20th, 2021. Copies of the German versions of the KTA safety standards may be mail-ordered through the Wolters Kluwer Deutschland GmbH (info@wolterskluwer.de). Downloads of the English translations are available at the KTA website (<http://www.kta-gs.de>).

All questions regarding this English translation should please be directed to the KTA office:

KTA-Geschäftsstelle c/o BASE, Willy-Brandt-Str. 5, D-38226 Salzgitter, Germany or kta-gs@bfe.bund.de

Comments by the editor:

Taking into account the meaning and usage of auxiliary verbs in the German language, in this translation the following agreements are effective:

shall	indicates a mandatory requirement,
shall basically	is used in the case of mandatory requirements to which specific exceptions (and only those!) are permitted. It is a requirement of the KTA that these exceptions - other than those in the case of shall normally - are specified in the text of the Safety Standard,
shall normally	indicates a requirement to which exceptions are allowed. However, the exceptions used, shall be substantiated during the licensing procedure,
should	indicates a recommendation or an example of good practice,
may	indicates an acceptable or permissible method within the scope of this Safety Standard.

Basic principles

(1) The Safety Standards of the Nuclear Safety Standards Commission (KTA) have the objective to specify safety-related requirements, compliance of which provides the necessary precautions in accordance with the state of the art in science and technology against damage arising from the construction and operation of the facility (Sec. 7 para. 2 subpara. 3 Atomic Energy Act - AtG) in order to achieve the fundamental safety functions specified in the Atomic Energy Act, the Radiation Protection Act (StrlSchG) and the Radiological Protection Ordinance (StrlSchV) and further detailed in the Safety Requirements for Nuclear Power Plants (SiAnf) as well as in the Interpretations on the Safety Requirements for Nuclear Power Plants.

(2) Based on the Safety Requirements for Nuclear Power Plants (SiAnf) and the Interpretations on the Safety Requirements for Nuclear Power Plants, this Safety Standard lays down the requirements for inspection and testing of lifting equipment. In addition, lifting equipment shall be installed and operated in accordance with the general Federal and State Safety Regulations and the regulations of the statutory accident insurance institutions.

(3) Regarding the danger potential, the inspection, testing and operation shall be based on the

a) additional requirements or

b) increased requirements

for lifting equipment which exceed the general provisions, as well as

c) requirements for lifts in reactor containments and

d) requirements for refuelling machines

as specified in this Safety Standard in detail.

(4) The requirements for the design of lifting equipment are laid down in KTA 3902.

(5) General requirements regarding quality assurance are specified in Safety Standard KTA 1401. Quality assurance requirements exceeding those of KTA 1401 are laid down in KTA 3903 for each individual case.

1 Scope

This Safety Standard applies to the inspection, testing and operation of lifts, cranes, winches, trolleys, load carrying devices, refuelling machines of light-water reactors, hereinafter collectively called lifting equipment provided such equipment is used in nuclear power plants and has to meet the requirements of section 4.

2 Definitions

(1) Acceptance test

Acceptance test is a test of the component or system which, due to legal provisions, obligations imposed by the competent authorities or other specifications, shall be carried out before commissioning the component or system.

Note:

Acceptance tests may be performed in several parts; e.g. acceptance tests in the manufacturer's works and acceptance test in the power plant.

(2) Final inspection

Final inspection is the inspection of components or systems, finished or under construction, which is carried out at the manufacturer's works or on the site, to check for compliance of such components or systems with the documents submitted for design approval.

(3) Standardized components

Standardized components are components designed, manufactured, tested, and marked in accordance with German standards or equivalent other standards or rules.

(4) Parts in the load path

In this Safety Standard, parts shall be deemed to be "within the load path" if they

a) can directly lead to an inadmissible impairment of the lifting capacity of lifting equipment in case of their failure,

or

b) are welded on to a part as per a), where only the area of the welded on component that influences the stress curve within the component according to a) is considered to be within the load path.

(5) Maximum operational load

The maximum operational load is the load which is moved with the lifting equipment during specified normal operation.

(6) Load carrying device

Load carrying devices are supporting means, load suspension devices and lifting accessories. They are defined in DIN 15003.

Note:

Examples are given in the individual sections of KTA 3902.

(7) Authorized inspector

The authorized inspector for the tests and inspections to be conducted in accordance with this Safety Standard is the authorized inspector called in by the licensing or supervisory authority in accordance with § 20 of the Atomic Energy Act. The inspections/reviews required by this Safety Standard shall be performed on the basis of applications made by the competent authority.

(8) Weld seams in the load path

In this Safety Standard, weld seams shall be deemed to be "within the load path" if they can lead to an inadmissible impairment of the lifting capacity of lifting equipment

a) either directly (e.g. due to decrease of load bearing capacity of the structure as a result of failure of the weld)

or

b) indirectly (e.g. by decreasing the fatigue strength of a structural member due to the notch effect of the weld).

(9) Series-production parts

Series-production parts are standard designs with specified and guaranteed characteristic values.

(10) Design approval

Design approval is the review of documents on the basis of the plans, written instructions, drawings, and calculations prepared for manufacture, with respect to the requirements specified in statutory approval obligations and requirements of other rules and regulations.

(11) Materials testing

Materials testing comprises tests of the mechanical properties, which will be carried out on the basic material, the respective product forms, or on production test coupons.

(12) In-service inspections

In-service inspections are inspections usually performed at regular intervals with respect to legal provisions, obligations imposed by the competent authorities, other specifications or due to certain events.

3 General provisions

(1) Lifting equipment shall be inspected, tested and operated in accordance with the valid general safety regulations, especially the Ordinance on Industrial Safety and Health

(BetrSichV), the federal and state work protection regulations and the regulations of the official accident insurance institutions.

(2) Lifting equipment shall at least comply with the generally accepted engineering standards.

4 Special provisions

4.1 Lifts in reactor containments

Lifts in reactor containments shall be subjected to the inspections specified in sections 8 and 10 in addition to the tests and inspections laid down in the general provisions of section 3. The inspection shall be performed by a proved inspection body according to article 37 of the German Product Safety Act (ProdSG).

4.2 Lifting equipment in accordance with sections 4.2 to 4.4 of KTA 3902

Lifting equipment in acc. with sections 4.2 to 4.4 of KTA 3902 shall satisfy the tests and inspections and specifications of this Safety Standard in addition to the general provisions of section 3.

Lifting equipment according to KTA 3902, sections 4.2 to 4.4 shall be manufactured in due respect of the requirements of KTA 1401 and this Safety Standard KTA 3903.

The tests and inspections shall be performed by the authorized inspector, unless specifically stated otherwise.

5 Design approval

5.1 Documents

5.1.1 General

(1) The documents mentioned in clauses 5.1.2 to 5.1.12 shall be established to observe the quality assurance requirements of KTA 1401 and shall be submitted in a clearly arranged and reviewable form for design approval.

Note:

Annex A of KTA 3201.3 shows example forms for various documents to be established.

(2) The documents mentioned in clauses 5.1.4, 5.1.5, 5.1.6 and 5.1.7 shall only be established for parts in the load path.

(3) The documents according to clauses 5.1.8 and 5.1.9 shall be established for safety equipment or functions.

(4) For series-production parts and standardized components section 11 applies.

(5) Section 12 applies to series-production electric hoists with ropes and series-production hoist gear boxes.

5.1.2 Cover sheet

(1) A cover sheet shall list the individual design approval documents in addition to the exact designations of the parts, sub-units or components to be subjected to design approval.

(2) It shall also contain a table on the state of the latest revisions and a list of all KTA Safety Standards and specifications applicable to design, manufacture and testing as well as any testing, inspection and work instructions.

5.1.3 General arrangement and construction drawings, parts lists including data on materials

The general arrangement and construction drawings as well as the parts lists shall contain the following data:

a) position, arrangement, lifting capacity, lateral transport and hoist speeds, and starting distances of lifting equipment,

- b) access to control stands, platforms and walkways,
- c) working platforms,
- d) safety distances,
- e) dimensions for strength and stability calculations including tolerances as well as identification of dimensions to be subject to dimensional check,
- f) assignment of individual parts to materials test sheets,
- g) weld geometry and assignment to welding procedure specification,
- h) type of fasteners, specifications in the case of preloaded bolts,
- i) in case of connections with preloaded bolts which, after disassembly, have to be re-assembled again:
Indication of the number of disassembly and re-assembly operations and on intended tests and inspections prior to re-using them (e.g. visual inspection, check of load-bearing bolts and related nut threads by ring and plug gauges).
- j) weld quality
 - ja) weld quality according to DIN 15018-1 and quality levels according to DIN EN ISO 5817 or DIN EN ISO 13919-1
 - or
 - jb) execution classes (EXC) of weld seams specified according to DIN EN 1090-2.
- k) procedure and extent of non-destructive testing on weld seams as well as on weld-junction areas of parts under tensile stress in thickness direction.

5.1.4 Proof of strength and stability by way of calculation, stress and safety analyses

(1) These proofs and analyses shall be performed for:

- a) structures,
- b) running wheels incl. wheel bearings of lateral transport drives,
- c) all components of hoists in the load path incl. supporting means (except gear box housings and bearing housing); for motor shafts it shall only be proved if the braking moments of the service brake or auxiliary brake pass through the motor shaft and no qualification test according to **Form C-3** is available.

d) Load carrying devices and lifting accessories.

(2) Stress/strain measurements are permitted to supplement the calculations.

(3) Where calculations are performed by means of electronic data processing equipment, the printout of the results shall be accompanied by a program description, if required.

(4) Where materials are used for which no allowable stresses have been fixed in the generally accepted rules of technology, the allowable stresses for the stress analysis and the fatigue analysis shall be derived by means of reliable and justifiable stress calculations or sufficiently realistic experiments.

5.1.5 Materials test sheets

(1) Unless materials test sheets are provided in **Annex A**, material specification sheets shall contain the following data:

- a) number of the materials test sheet,
- b) part group and product form,
- c) material number or DIN designation,
- d) test requirements for the material incl. data on specimen orientation, location, and number,
- e) inspection certificate according to DIN EN 10204,
- f) identification marking.

(2) For standardized components no additional materials test sheets need be submitted beyond those specified in **Annex A**.

(3) Inspection certificates 3.2 shall be confirmed or be established by the authorized inspector according to § 20 of the Atomic Energy Act or by the technical inspecting agency tasked by him.

5.1.6 Test instructions

5.1.6.1 Test instructions for mechanical functions

(1) For the mechanical functional tests required in **Tables 8-1** und **10-1** test instructions shall be established where required due to the complexity of the test.

5.1.6.2 Test instructions for electrical and I&C functions

For the electrical and I&C functional tests required in den **Tables 8-1** and **10-1** test instructions shall be established.

5.1.6.3 Test instructions for non-destructive testing

(1) Test instructions shall be established for non-destructive testing, where required in section 7 (see Table 7-1 no. 3k) or in **Annex B** (see clause B 3.4.2.2).

(2) These instructions may be established for identical test objects in standardized form.

(3) The test instructions shall contain detailed information on:

- assignment to the individual test objects,
- time of testing as far as it influences the extent and performance of the test in accordance with the test and inspection sequence plan,
- test requirements, test methods and test facilities/equipment to be used, type of sensitivity adjustment for ultrasonic testing,
- if required, additional explanations regarding the performance of the test (e.g. drawing to scale),
- reference system and counting direction for a description of indications assigned to a test object,
- information for recording and evaluating of indications,
- intended substitute measures to be taken if the applicability of the requirements of **Annex B** is restricted.

5.1.7 Welding procedure specifications

Welding procedure specifications shall contain the following data:

- assignment,
- weld geometry,
- base metals, weld filler metals and consumables,
- welding procedure,
- heat treatment,
- welder's qualification/qualification of operating personnel of fully mechanized and automatic welding units,
- quality level,
- welding data.

Note:

As regards design approval documents required for welding production tests see section 7.1

5.1.8 Documents regarding electrical equipment

- schematic diagrams,
- circuit diagrams,

- layout plans for control cabinets, control panels and control units,
- parts lists specifying technical data,
- data sheets of drive components and converters
- for functions classified into Performance Levels c, d or e as per Annex E of KTA 3902:

- fa) data sheets of electrical operational means,
- fb) proof of the Performance Levels achieved,

- g) compilation, description and representation of the mode of operation of measuring, control, monitoring, and safety equipment,
- h) compilation of the measures intended and the related documents required to meet the DIN EN 61513 requirements as per KTA 3902, sub-clause 6.5.1 (5),
- i) where RAM programmable systems (e.g. stored program controls) are used for functions classified into Performance Levels c, d or e as per Annex E of KTA 3902:

- ia) description of all interlocks and operational sequences of the system for establishing the application program, as well as description of the application program (e.g. modularization concept) to meet the requirements of DIN EN ISO 13849-1, section 4.6.3,

- ib) software specifications according to DIN EN IEC 62138, section 6.4.4,

- ic) application program (printout and data carrier) as well as pertinent system manuals,

Note:

The documents required under ia) and ib) should be submitted in due time prior to establishing the documents required under ic) so that an evaluation of the basic design features of the software (e.g. software structure, modularization) can be made prior to establishing the application program.

- j) where software-based systems are used for functions classified into Performance Levels c, d or e as per Annex E of KTA 3902: proof of independence of the safety functions from the operational functions according to clause 6.5.1 (2) of KTA 3902

- ja) by means of a systematic method for identifying possible failures at the interfaces between operational and safety control system and for analysing the effects of such failures on the safety functions, e.g. by means of a failure mode and effects analysis (FMEA) for the interfaces

or

- jb) for devices that perform not only safety functions but also operational functions, using results from an application-independent type test of the device (certification), whereby the coverage of the specified requirements shall be demonstrated by a corresponding type test documentation,

Note:

Evidence could be provided, for example, by a SIL level 3 qualification according to DIN EN 61508.

- k) Configuration and identification documentation (KID) of hardware and software components used for functions classified into Performance Levels c, d or e as per Annex E of KTA 3902,

Note:

A configuration and identification documentation (KID) is a documentation of the related hardware and software components and the system structure so that they are clearly identifiable.

5.1.9 Documents regarding hydraulic and pneumatic equipment

- schematic diagrams,
- functional sequence plan,
- strength calculations,
- parts lists specifying technical data

5.1.10 Documents on ergonomic design

The measures taken to meet the ergonomics requirements of KTA 3902, section 4.7 shall be indicated and a respective document be submitted for design approval.

5.1.11 Test and inspection sequence plan for final inspection

(1) The test and inspection sequence plan for final inspection shall contain the following data:

- a) requirements and extent of the tests and inspections as per section 7,
- b) test and inspection sequence as well as type of tests and inspections and certificates,
- c) person performing the test or inspection (manufacturer, authorized inspector).

(2) As regards the sequence of performance of tests and inspections, the test and inspection sequence plan for final inspection shall be subdivided into test and inspections to be performed prior to, during and upon finalization of production.

(3) Where required due to the complexity of tests and inspections, the test and inspections listed under **Table 7-1** shall be subdivided into individual test and inspection steps in the test and inspection sequence plan for final inspection.

5.1.12 Test and inspection sequence plan for acceptance testing

(1) The test and inspection sequence plan for acceptance testing shall contain the following data:

- a) requirements and extent of the tests and inspections in accordance with section 8,
- b) test and inspection sequence.

(2) The test and inspection sequence plan for the partial acceptance test of mobile cranes, winches and trolleys shall contain the following data:

- a) requirements and extent of testing as per section 8 in dependence of the extent of assembly work
- b) test sequence.

5.2 Performance of design approval

(1) All documents submitted for design approval shall be reviewed for completeness, compliance of data with the specified values and fulfilment of statutory approval requirements and KTA 3902 rules.

(2) The documents submitted in acc. with clause 5.1.3 shall additionally be reviewed for:

- a) accessibility of lifting equipment for maintenance and repair work as well as for in-service inspections,
- b) compliance of the data given for the materials in the parts list and related materials test sheets,
- c) compliance with accident prevention regulations.

(3) The documents submitted in acc. with clause 5.1.4 shall additionally be reviewed for:

- a) correctness of design loads and classification of the structure, drive mechanisms, rope drives and the load carrying device,
- b) completeness and correctness of the calculation (compilation of all load-bearing parts and related fasteners, e.g. screws, bolts). This may also include a compilation of the assembly and setup conditions.

If a calculation is submitted which was performed by means of automatic data processing equipment, either a comparative calculation to verify the results or an exami-

nation of the program description as well as of the input and output data shall be performed.

- c) observance of allowable stresses and safety factors.

(4) The documents submitted in acc. with clause 5.1.8 shall additionally be reviewed for:

- a) observance of interlocking requirements,
- b) observance of the Performance Level required by KTA 3902, Annex E as regards the safety and monitoring functions,
- c) dimensioning of power cables and assignment of overcurrent protective devices,

(5) The documents submitted in acc. with clause 5.1.9 shall additionally be reviewed for:

- a) observance of interlocking requirements,
- b) design of safety and monitoring equipment,
- c) dimensioning of pressurized components,
- d) completeness of the functional description and sequence plan.

5.3 Certification of design approval

Upon completion, the inspector shall certify the design approval.

6 Materials

6.1 General

The materials used for members in the load path of lifting equipment according to KTA 3902, sections 4.2 to 4.4 shall be manufactured to meet the general requirements laid down in section 3 of KTA 1401.

Note:

The qualification of the materials manufacturer is deemed to have been proved e.g. if

- a) the manufacturer is approved according to VdTÜV technical leaflet MB WERK 1253/1,
- b) the product is a regulated construction product or a non-regulated construction product which bears the specimen mark of conformity (Ü mark of conformity).

6.2 Selection of materials

(1) The materials shall be selected in accordance with the applicable standards and rules for lifting equipment. The filler metals and consumables shall have been approved according to VdTÜV technical leaflet MB SCHW 1153.

(2) **Annex A** compiles materials test sheets for materials usually put to use.

(3) When further processing quenched and tempered steels according to materials test sheet (WPB) 2.4 or case-hardening steels according to material test sheet (WPB) 2.7 to produce gears according to DIN 3990-5, hardening and nitriding facilities shall be used that comply with the requirements of DIN 3990-5.

(4) Care shall be taken to ensure that suitable material combinations are used in bolted connections. The use of bolts of property class higher than 10.9 is not permitted. The following shall apply to corrosion protection coatings of ferritic bolts and nuts:

- a) In the case of electroplated corrosion protection coatings only bolts and nuts coated by electroplating shall be used together. In the case of corrosion protection coatings by hot dip galvanizing only complete bolting assemblies (bolts, nuts and washers) of one manufacturer shall be used.
- b) Hot dip galvanized bolts of property classes 8.8 and 10.9 as well as the associated nuts and washers shall be used

only if they were galvanized in the manufacturer's own factory or on the manufacturer's responsibility in an external factory.

- c) Electro-galvanized bolts and nuts may only be used if
 - ca) the electroplating is performed in accordance with DIN EN ISO 4042 and
 - cb) the risk of hydrogen embrittlement resulting from the manufacturing process is minimized by using the prevention measures according to Tables 3 and 4 of DIN EN ISO 4042, independent of the product standard.
 - d) Other metallic corrosion protection coatings may be used if
 - da) the compatibility with the steel is ensured and
 - db) hydrogen embrittlement is avoided and
 - dc) an adequate behaviour during tightening has been proved.
- (5) Hot dip galvanizing of fasteners shall meet the requirements of DIN EN ISO 10648 and of the guideline "Manufacture of hot dip galvanized bolts" [1].

6.3 Materials testing

Materials and dimensional limits other than those specified in the materials test sheets of Annex A are permitted only if materials test sheets in acc. with clause 5.1.5 have been established and been design-approved in acc. with section 5.2, and if the requirements laid down in these clauses regarding the mechanical properties, chemical composition and weldability, where required, have been met.

6.4 Identification marking of materials

- (1) The material identification marks on the product forms in the case of inspection certificates 3.1 and 3.2 according to DIN EN 10204 shall be preserved during processing.
- (2) The transfer of identification marks on product forms for further processing shall be carried out by the manufacturer's employee authorized to transfer identification marks by stamping in the case of inspection certificate 3.1 according to DIN EN 10204 and by the authorized inspector in the case of inspection certificate 3.2 according to DIN EN 10204.

7 Final inspection

7.1 General

- (1) Prior to the beginning of production, the observance of the following requirements regarding manufacture shall be proved:
 - a) confirmation of the manufacturer's ability to meet the quality assurance requirements according to KTA 1401,
 - b) attestation of welding qualification for weld seams in the load path
 - ba) attestation of qualification according to DIN 18800-7, class E, with extension to the requirements of DIN 15018-2, class D will suffice for welding of gear box housings
(the attestation of qualification shall be provided on the basis of welding procedure qualifications according to DIN EN ISO 15614-1),
 - or
 - bb) the manufacturer shall be certified for execution class EXC 4 according to DIN EN 1090-2, certification for execution class EXC 3 will suffice for welding of gear box housings,
 - c) qualification test certificate of welders/operating personnel of fully mechanized and automatic welding units,
 - d) certification of supervisory personnel and NDT personnel according to the provisions in section B 2.1,

- e) suitability of production, measuring and test facilities,
- f) validity of marking-transfer certificate,
- g) calibration of welding equipment and heat treatment facilities,
- h) suitability of the devices for measuring the tightening parameters of bolted connections.

(2) Where materials and welding procedures are used which are not part of the welder's qualification in accordance with clause (1) b), welding procedure qualifications according to DIN EN ISO 15614-1 shall be submitted. If no principal rules for the performance of welding procedure qualifications are available for welded joints between certain materials, production tests shall be performed according to design-approved documents within the scope of final inspection.

(3) Deviations from the design-approved documents are only permitted by agreement with the authorized inspector.

(4) For series-production parts and standardized components section 11 applies.

7.2 Documents

In addition to the test and inspection sequence plan for final inspection the following documents shall be submitted:

- a) construction drawings and parts list with data on materials,
- b) list of materials used and related certificates,
- c) welding procedure specifications,
- d) construction documents for electrical equipment (with pertinent certificates on the classification according to DIN EN ISO 13849-1),
- e) construction documents for hydraulic and pneumatic equipment,
- f) test instructions,
- g) proof of manufacturer's certification according to clause 11.1.1 (2) and qualification test according to clause 11.1.4.2 (1).

7.3 Extent of tests and inspections

7.3.1 General

(1) The extent of tests and inspections prior to the beginning of production is specified in section 7.1, the extent of final inspection on the components shall be taken from **Table 7-1**.

(2) The tests and inspections specified in **Table 7-1** for

- a) structures,
- b) running wheels incl. wheel bearing of lateral transport drives,
- c) hoists from motor up to and including carrying rope,
- d) supporting means, load suspension devices and lifting accessories,
- e) electrical, hydraulic and pneumatic equipment

shall be performed by the manufacturer to an extent of 100 % inspection, in which case the requirements of section 7.3.2 apply as regards the performance of non-destructive tests on weld seams.

The observance of the required quality features for the parts shall be ensured in which case traceability to the records, proofs and inspection reports shall be possible.

7.3.2 Non-destructive tests and inspections

(1) If the design was performed in accordance with the provisions of clauses 6.1.1 (1) a), 7.1.1 (1) a) or 8.1.1 (1) a) of KTA 3902 based on DIN 15018-1 and DIN 15018-2, the manufacturer shall perform non-destructive tests on weld seams to the following extent:

Each weld seam shall be subjected to a visual inspection. In addition, the following supplementary tests and inspections shall be performed:

- a) Butt welds of special and standard quality according to DIN 15018-1, Table 24 which lie in the load path shall be subjected to both
 - aa) a surface inspection and
 - ab) an ultrasonic or radiographic testing
 to an extent of 100 %. In the case of butt welds with standard quality and stresses occurring on the weld seam less than $0.8 \cdot \sigma_{zul}$ an extent of testing of 25 % will suffice.
- b) Other weld seams of special quality according to DIN 15018-1, Table 24, with full penetration at the root (e.g. double-bevel groove weld), which lie in the load path shall be subjected to an extent of 100 % to
 - ba) a surface inspection and
 - bb) an ultrasonic or radiographic testing.
- c) All other weld seams in the load path shall be subjected to a surface inspection to the following extent:
 - ca) 25 % if the lifting equipment is classified under KTA 3902, sections 4.3/4.4 and the stress occurring on the weld seam is equal to or greater than $0.8 \cdot \sigma_{zul}$,
 - cb) 10 % if the lifting equipment is classified under KTA 3902, section 4.2 and the stress occurring on the weld seam is equal to or greater than $0.8 \cdot \sigma_{zul}$.

Here, the extent of testing shall cover equally the welding work done by all welders.

(2) If the design was performed in accordance with the provisions of clauses 6.1.1 (1) b), 7.1.1 (1) b) or 8.1.1 (1) b) of KTA 3902 based on DIN EN 13001-1-3, the following shall apply to the non-destructive tests and inspections to be performed by the manufacturer:

- a) The weld seams in the load path shall be subjected to the inspection after welding as specified in section 12.4.2 of DIN EN 1090-2 for execution class EXC 4, here the extent of supplementary NDT shall be in compliance with the following provisions:
 - aa) Transverse butt welds and partial penetration welds in butt joints under tensile stress or shear stress shall be subjected to an extent of 100 % to a surface inspection and to an extent of 100 % to an ultrasonic or radiographic testing.
 - ab) Transverse fillet welds under tensile stress or shear stress shall be subjected to an extent of 100 % to a surface inspection.
 - ac) Full penetration longitudinal welds between web and top flange of bridge structures as well as longitudinal welds of rope drums shall be subjected to an extent of 100 % to a surface inspection and to an extent of 100 % to an ultrasonic or radiographic testing.
 - ad) Other weld seams a local failure of which can lead to loss of load bearing capacity of the part shall be subjected to an extent of 100 % to a surface inspection and in the case of full penetration welds additionally to an extent of 20 % to an ultrasonic or radiographic testing.
 - ae) Other weld seams shall be subjected to an extent of 20 % to a surface inspection and in the case of full penetration welds additionally to an extent of 10 % to an ultrasonic or radiographic testing.

Note:

Longitudinal welds are those made parallel to the component axis. All the others are considered as transverse welds.

- b) In deviation from a) the following tests and inspections shall be performed on gear box housings:
 - ba) visual inspection of all weld seams to an extent of 100 %,
 - bb) surface inspection of the weld seams on bearing shells and main plates, torque supports as well as brake retainers to an extent of 100 %,
 - bc) surface inspection of all the other weld seams to an extent of 25 %.

Where it is proved that the utilization of weld strength is less than 50 %, the inspection specified in bc) may be waived.

- c) The weld seams that are not in the load path shall be subjected to the inspection after welding as specified in section 12.4.2 of DIN EN 1090-2 for the execution class as fixed in the design approval documents. On weld seams classified into execution class EXC 3 or EXC 4 an extent of testing of at least 10 % is required.

(3) The following shall apply to the ultrasonic or radiographic testing to be performed according to (1) or (2):

- a) For butt welds with wall thicknesses equal to or smaller than 15 mm radiography shall be used.
- b) For wall thicknesses greater than 15 mm and equal to or smaller than 40 mm ultrasonic testing shall preferably be used, alternatively radiography.
- c) For wall thicknesses exceeding 40 mm ultrasonic testing shall be used.
- d) For all wall thicknesses of austenitic butt welds radiography shall be used.

(4) Non-destructive testing shall be carried out according to **Annex B**.

(5) The authorized inspector shall attend the non-destructive tests and inspections as follows:

- a) Ultrasonic testing
 - aa) The manual ultrasonic testing shall be performed and be evaluated by the authorized inspector independently of the tests made by the manufacturer.
 - ab) In the case of mechanized testing the authorized inspector shall attend the sensitivity calibration of the test equipment, spot-check the performance of sensitivity calibration and evaluate the results obtained by the test.
- b) Radiography

The results obtained by radiography (images) to be performed by the manufacturer shall be evaluated by the authorized inspector. The performance of radiography shall be spot-checked by the authorized inspector.
- c) Surface inspection (magnetic particle and liquid penetrant methods)

The authorized inspector shall attend the inspection to be performed by the manufacturer and evaluate the results obtained.
- d) Visual inspection

Visual inspections shall be performed and be evaluated by the authorized inspector independently of the inspections made by the manufacturer.

The extent of tests and inspections to be performed by the authorized inspector is indicated in **Table 7-1** for the individual inspection stages.

7.4 Certification of final inspection

Upon completion, the final inspection shall be certified by the authorized inspector.

Ser. No.	Component	Tests and inspections	Extent of tests and inspections by authorized inspector in acc. with § 20 of the Atomic Energy Act for lifting equipment acc. to KTA 3902	
			section 4.2	section 4.3 or 4.4
1	Structures, running wheels (incl. wheel bearing of lateral transport drives)	a) Receiving inspection of identification marks and stampings, if any, on the product forms	—	—
		b) Material identification marks of the parts for compliance with list of material certificates or parts list, compliance of certificates with requirements specified in materials test sheet	X	X
		c) Ultrasonic testing for laminar imperfections in weld-junction areas on parts under tensile stress in thickness direction	25 %	25 %
		d) Check for compliance of dimensions and assembly with design approval documents	X	X
		e) Observance of welding data	25 %	25 %
		f) Non-destructive testing of weld seams specified in the test and inspection sequence plan for final inspection:		
		fa) If the design was performed in accordance with the provisions of clauses 6.1.1 (1) a), 7.1.1 (1) a) or 8.1.1 (1) a) - Visual inspection of weld surfaces	25 %	25 %
		- Surface inspection as well as ultrasonic or radiographic testing on weld seams according to clauses 7.3.2 (1) a) and 7.3.2 (1) b): Weld seams with particular quality acc. to DIN 15018-1: special quality	25 %	100 %
		standard quality		
		- existing stress in the weld seam $\geq 0.8 \cdot \sigma_{zul}$	25 %	100 %
		- existing stress in the weld seam $< 0.8 \cdot \sigma_{zul}$	10 %	25 %
		- Surface inspection of weld seams according to clause 7.3.2 (1) c)	10 %	25 %
		fb) If the design was performed in accordance with the provisions of clauses 6.1.1 (1) b), 7.1.1 (1) b) or 8.1.1 (1) b) - Visual inspection of weld surfaces	25 %	25 %
		- Tests and inspections on weld seams in the load path: • Testing of weld seams according to clause 7.3.2 (2) aa): - Surface inspection	25 %	100 %
		- Ultrasonic or radiographic testing	25 %	100 %
		• Surface inspection of weld seams according to clause 7.3.2 (2) ab)	25 %	100 %
		• Testing of weld seams according to clause 7.3.2 (2) ac): - Surface inspection	25 %	100 %
		- Ultrasonic or radiographic testing	25 %	100 %
		• Testing of weld seams according to clause 7.3.2 (2) ad): - Surface inspection	25 %	100 %
		- Ultrasonic or radiographic testing in the case of full penetration welds	10 %	20 %
		• Testing of weld seams according to clause 7.3.2 (2) ae): - Surface inspection	10 %	20 %
		- Ultrasonic or radiographic testing in the case of full penetration welds	10 %	10 %
		- Tests and inspections on weld seams not in the load path according to clause 7.3.2 (2) c) that are classified into execution class EXC3 or EXC4	10 %	10 %
		g) Examination of repair welds in acc. with a design-approved repair welding procedure specification	X	X

Table 7-1: Extent of final inspection (continued on next pages)

Ser. No.	Component	Tests and inspections	Extent of tests and inspections by authorized inspector in acc. with § 20 of the Atomic Energy Act for lifting equipment acc. to KTA 3902	
			section 4.2	section 4.3 or 4.4
		h) Observance of the design requirements and bolting torque of preloaded bolted connections for compliance with the design approval documents	10 %	10 %
		i) Fabrication tolerances of running wheels and their bearings as well as trolley travelling rails in acc. with tolerance class 2 of ISO 12488-1	—	—
		j) Fabrication tolerances of craneways in accordance with tolerance class 2 of VDI 3576	—	—
2	Hoists from the motor up to and incl. the carrying rope			
2.1	General	a) Receiving inspection of identification marks and stampings, if any, on the product forms	—	—
		b) Check for compliance of complete assembly with the design approval documents	X	X
2.2	Motors	Check of technical data (rating plate) for compliance with data sheet	X	X
2.3	Brakes, couplings, rope sheaves, rope terminations and motor shafts	Proof of suitability of individually fabricated parts for compliance with the design data (Form C-3 to C-9)	X	X
2.4	Gear boxes			
2.4.1	General	a) Compliance of the design with the data in Form C-1	—	—
		b) Material identification marks of the parts for compliance with list of material certificates or parts list	X	X
		c) Manufacturer's identification mark on antifriction bearings for compliance with design approval documents	X	X
		d) Check for compliance of dimensions and assembly with design approval documents including the filled-in Form C-1	X	X
		e) Trial run under part load (recording in acc. with Form C-2)	—	X
2.4.2	Gear box housings	a) Review of the design in acc. with the design approval documents	—	—
		In addition, on newly manufactured gear box housings in the case of welded design:		
		b) Adherence to dimensions for weld preparation	—	—
		c) Observance of welding data	X	X
		d) Non-destructive testing of weld seams		
		da) If the design was performed in accordance with the provisions of clauses 6.1.1 (1) a), 7.1.1 (1) a) or 8.1.1 (1) a)		
		- Visual inspection of weld surfaces	25 %	25 %
		- Surface inspection of weld seams according to clause 7.3.2 (1) c)	10 %	25 %
		db) If the design was performed in accordance with the provisions of clauses 6.1.1 (1) b), 7.1.1 (1) b) or 8.1.1 (1) b)		
		- Visual inspection of weld surfaces	25 %	25 %
		- Surface inspection of weld seams according to clause 7.3.2 (2) bb)	25 %	100 %
		- Surface inspection of weld seams according to clause 7.3.2 (2) bc)	10 %	25 %
		e) Examination of repair welds in acc. with a design-approved repair welding procedure specification	X	X

Table 7-1: Extent of final inspection (continued)

Ser. No.	Component	Tests and inspections	Extent of tests and inspections by authorized inspector in acc. with § 20 of the Atomic Energy Act for lifting equipment acc. to KTA 3902	
			section 4.2	section 4.3 or 4.4
2.4.3	Gears and pinion shafts	a) Surface inspection of tooth flanks in finished condition	—	100 %
		In addition, in the case of welded design:		
		b) Adherence to dimensions for weld preparation	—	—
		c) Observance of welding data	X	X
		d) Surface inspection of weld seams specified in the test and inspection sequence plan for final inspection	25 %	25 %
2.4.4	Axles and shafts	e) Examination of repair welds in acc. with a design-approved repair welding procedure specification	X	X
		Surface inspection in finished condition	25 %	100 %
2.5	Ropes and rope terminations	a) Rope identification mark for compliance with the data indicated on the certificate	X	X
		b) Rope dimensions and rope terminations for compliance of data with design approval documents	X	X
2.6	Rope drums	a) Material identification marks of the parts for compliance with list of material certificates or parts list	X	X
		b) Check for compliance of dimensions and assembly with design approval documents	X	X
		c) Observance of welding data	X	X
		d) Non-destructive testing of weld seams specified in the test and inspection sequence plan for final inspection:		
		da) If the design was performed in accordance with the provisions of clauses 6.1.1 (1) a), 7.1.1 (1) a) or 8.1.1 (1) a)		
		- Visual inspection of weld surfaces	25 %	25 %
		- Surface inspection as well as ultrasonic or radiographic testing on weld seams according to clauses 7.3.2 (1) a) and 7.3.2 (1) b):		
		Weld seams with particular quality acc. to DIN 15018-1: special quality	25 %	100 %
		standard quality		
		- existing stress in the weld seams $\geq 0.8 \cdot \sigma_{zul}$	25 %	100 %
		- existing stress in the weld seams $< 0.8 \cdot \sigma_{zul}$	10 %	25 %
		- Surface inspection of weld seams according to clause 7.3.2 (1) c)	10 %	25 %
		db) If the design was performed in accordance with the provisions of clauses 6.1.1 (1) b), 7.1.1 (1) b) or 8.1.1 (1) b)		
		- Visual inspection of weld surfaces	25 %	25 %
		- Tests and inspections on weld seams in the load path:		
		• Testing of weld seams according to clause 7.3.2 (2) aa):		
		- Surface inspection	25 %	100 %
		- Ultrasonic or radiographic testing	25 %	100 %
		• Surface inspection of weld seams according to clause 7.3.2 (2) ab)	25 %	100 %
		• Testing of weld seams according to clause 7.3.2 (2) ac):		
		- Surface inspection	25 %	100 %
		- Ultrasonic or radiographic testing	25 %	100 %
		• Testing of weld seams according to clause 7.3.2 (2) ad):		
		- Surface inspection	25 %	100 %
		- Ultrasonic or radiographic testing in the case of full penetration welds	10 %	20 %
		• Testing of weld seams according to clause 7.3.2 (2) ae):		
		- Surface inspection	10 %	20 %
		- Ultrasonic or radiographic testing in the case of full penetration welds	10 %	10 %

Table 7-1: Extent of final inspection (continued)

Ser. No.	Component	Tests and inspections	Extent of tests and inspections by authorized inspector in acc. with § 20 of the Atomic Energy Act for lifting equipment acc. to KTA 3902	
			section 4.2	section 4.3 or 4.4
		e) Examination of repair welds in acc. with a design-approved repair welding procedure specification	X	X
		f) Manufacturer's identification marks on antifriction bearings for compliance with the design approval documents	X	X
3	Load supporting means, load suspension devices and lifting accessories	a) Receiving inspection of identification marks and stampings, if any, on the product forms	—	—
		b) Material identification marks of the parts for compliance with list of material certificates or parts list	X	X
		c) Ultrasonic testing for laminar imperfections in weld-junction areas on parts under tensile stress in thickness direction	25 %	25 %
		d) Check for compliance of dimensions and assembly with design approval documents	X	X
		e) Observance of welding data	25 %	25 %
		f) Non-destructive testing of weld seams specified in the test and inspection sequence plan for final inspection:		
		fa) If the design was performed in accordance with the provisions of clauses 6.1.1 (1) a), 7.1.1 (1) a) or 8.1.1 (1) a)		
		- Visual inspection of weld surfaces	25 %	25 %
		- Surface inspection as well as ultrasonic or radiographic testing on weld seams according to clauses 7.3.2 (1) a) and 7.3.2 (1) b): Weld seams with particular quality acc. to DIN 15018-1: special quality	25 %	100 %
		- existing stress in the weld seam $\geq 0.8 \cdot \sigma_{zul}$	25 %	100 %
		- existing stress in the weld seam $< 0.8 \cdot \sigma_{zul}$	10 %	25 %
		- Surface inspection of weld seams according to clause 7.3.2 (1) c)	10 %	25 %
		fb) If the design was performed in accordance with the provisions of clauses 6.1.1 (1) b), 7.1.1 (1) b) or 8.1.1 (1) b)		
		- Visual inspection of weld surfaces	25 %	25 %
		- Tests and inspections on weld seams in the load path:		
		• Testing of weld seams according to clause 7.3.2 (2) aa):		
		- Surface inspection	5 %	100 %
		- Ultrasonic or radiographic testing	25 %	100 %
		• Surface inspection of weld seams according to clause 7.3.2 (2) ab)	25 %	100 %
		• Testing of weld seams according to clause 7.3.2 (2) ac):		
		- Surface inspection	25 %	100 %
		- Ultrasonic or radiographic testing	25 %	100 %
		• Testing of weld seams according to clause 7.3.2 (2) ad):		
		- Surface inspection	25 %	100 %
		- Ultrasonic or radiographic testing in the case of full penetration welds	10 %	20 %
		• Testing of weld seams according to clause 7.3.2 (2) ae):		
		- Surface inspection	10 %	20 %
		- Ultrasonic or radiographic testing in the case of full penetration welds	10 %	10 %
		- Tests and inspections on weld seams not in the load path according to clause 7.3.2 (2) c) that are classified into execution class EXC3 or EXC4	10 %	10 %
		g) Examination of repair welds in acc. with a design-approved repair welding procedure specification	X	X

Table 7-1: Extent of final inspection (continued)

Ser. No.	Component	Tests and inspections	Extent of tests and inspections by authorized inspector in acc. with § 20 of the Atomic Energy Act for lifting equipment acc. to KTA 3902	
			section 4.2	section 4.3 or 4.4
		h) Surface inspection within the area of machined surfaces in finished condition on parts, for which an ultrasonic test is required in the material test sheets of Annex A as well as in areas where periodic surface inspections have to be performed in acc. with Table 10-1 .	25 %	100 %
		i) Surface inspection of load hook saddle	100 %	100 %
		j) Manufacturer's identification marks on antifriction bearings for compliance with the design approval documents	X	X
		k) Where ultrasonic testing is to be carried out as in-service inspection on non-redundant parts in lieu of surface inspection, a baseline ultrasonic test shall additionally be carried out on axles, bolts, tie-rods, load hook lifting beams, and similar parts in their finished condition. The type and extent of this baseline test shall be fixed in a test instruction.		X
		l) Check of threads on bolts and nuts in the load path with additional tensile load using thread ring gage and thread plug gage according to DIN ISO 965-2	—	X
		m) Observance of the design requirements and bolting torque of preloaded bolted connections for compliance with the design approval documents	10 %	10 %
4	Electrical, hydraulic and pneumatic equipment	a) Check for compliance of the construction with the design approval documents	X	X
		b) Check of identification marking of electrical components (rating plate) for compliance with design approval documents	X	X
		c) Check of wiring, connections, line penetrations, and fuse protection	X	X
X Partial inspection by authorized inspector, i.e. inspection to enable the inspector to confirm that the objectives of the respective inspection stage have been attained. — No inspection by the inspector. % Percentage share of inspection by the authorized inspector.				

Table 7-1: Extent of final inspection (continued)

8 Acceptance testing

8.1 General

- (1) The acceptance test is intended to prove that the commissioning as per KTA 1401 has been concluded.
- (2) All tests required for acceptance testing shall be fixed in the test and inspection sequence plan.

8.2 Documents

In addition to the test and inspection sequence plan for acceptance testing the following documents shall be submitted:

- a) test instructions,
- b) compilation of monitoring and safety equipment according to clauses 5.1.8 g), i) and j),
- c) for cranes, inspection documents in acc. with DIN 15030, section 7,
- d) operating and maintenance instructions,

Note:

For the establishment of operating and maintenance instructions see also DIN EN 82079-1.

- e) documentation and certification of tests and inspections performed in acc. with sections 5 and 7,
- f) for lifts, documents in acc. with Annex B of DIN EN 81-20 (Technical documents).

8.3 Extent of acceptance testing

8.3.1 General

- (1) The acceptance test shall be performed on the ready-to-operate lifting equipment with the authorized inspector being involved. The extent of acceptance testing shall be taken from **Table 8-1**.

- (2) In the case of mobile cranes, winches, trolleys a partial inspection shall additionally be performed upon any assembly to cover the respective extent of assembly work, in which case the authorized inspector shall be involved.

8.3.2 Lifts

The acceptance test shall be performed according to article 15 of the BetrSichV (test before commissioning). In addition the fulfilment of the requirements of section 5 of KTA 3902 regarding completeness, effectiveness and function shall be verified.

8.4 Certification of acceptance testing

Upon completion, the acceptance test shall be certified by the authorized inspector.

Ser. No.	Tests and inspections of	Requirements to
1	Cranes, winches, trolleys and refuelling machines	
1.1	Mechanical parts	
	a) Rating plate	Directive 2006/42/EC Annex I § 1.7.3 DGUV 53 § 4 DGUV 55 § 3
	b) Loading data	Directive 2006/42/EC Annex I § 4.3.3 DGUV 53 § 5 DGUV 55 § 3
	c) Control stands, control panels, platforms, walkways, access routes, and prohibiting signs	DGUV 55 §§ 8 and 9 DGUV 53 §§ 6, 7, 8 and 9 DIN EN 13557 DIN EN 13586 KTA 3902, clause 6.5.4
	d) Escape and rescue routes	ASR A1.3 section 6
	e) Operating and working platforms	DGUV 53 § 10
	f) Protection against derailling, tilting and dropping	Directive 2006/42/EC Annex I § 4.1.2.2 DGUV 53 § 12 KTA 3902 clause 6.3.3
	g) Protective devices against the effects of external events	Design approval documents
	h) Rail sweepers	DGUV 53 § 13
	i) Track system (crane runway), runway limiters	DGUV 53 §§ 18 and 19
	j) Braking devices, protection against unintentional movements	DIN 15434-2 DGUV 55 § 14 DGUV 53 § 14 KTA 3902 clauses 6.2.1.3.3, 7.2.1.3.3 and 8.2.1.3.3
	k) Protective devices on mobile parts	Directive 2006/42/EC Annex I § 1.3.8 and § 1.4 DGUV 53 § 11 (safety distances)
	l) Slack rope protection	Directive 2006/42/EC Annex I § 4.2.3 DIN 15020-1, section 7.3 KTA 3902 clause 8.2.1.3.1 (7)
	m) Load hooks	DIN 15405-1 sections 4 and 7 KTA 3902 clauses 6.4.1.1 and 7.4.1.1
	n) Protection against unintentional lifting of load, safeguarding of detachable parts, safeguarding devices	KTA 3902 clauses 6.4.1.3, 7.4.1.3 and 8.4.3
	o) Grabs in refuelling machines	KTA 3902 clause 8.4.3
	p) Alarm devices	Directive 2006/42/EC Annex I § 3.6.1 DGUV 53 § 20
	q) Safeguarding of operating and travelling areas in the case of program-controlled cranes and refuelling machines	Directive 2006/42/EC Annex I § 4.1.2.7 DGUV 53 § 23
	r) Position indicators for the various positions of the load carrying device	KTA 3902 clause 8.5 c)
	s) Safety marking	Directive 92/58/EEC ASR A1.3 section 5

Table 8-1: Extent of acceptance testing (continued on next pages)

Ser. No.	Tests and inspections of		Requirements to
1.2	Electrical components	a) Power supply Physical ambient and operating conditions	DIN EN 60204-32, sections 4.3 and 4.4
		b) Power supply to crane, trolleys or refuelling machines, wiring technique	DIN EN 60204-32, sections 12 and 13 DIN VDE 0100-520
		c) Switchgears and distribution panels: Accessibility, structure and marking	DIN EN 60204-32, sections 11 and 16
		d) Electric mains, electric main connection switch, crane disconnecting switch, crane switch	DIN EN 60204-32, section 5 KTA 3902, clause 8.5 b)
		e) Control stands, operating equipment, wireless controls, control stands interlocks, emergency stop devices	DIN EN 60204-32, sections 9.2.5, 9.2.7 and 10 DIN EN 13557 DGUV 53 §7, §8 KTA 3902, sections 6.5, 7.5 and 8.5
		f) Electric motor and related equipment	DIN EN 60204-32, section 14
		g) Check of protection conditions by automatic switch-off of power supply	DIN EN 60204-32, section 18.2
		h) Equipotential bonding	DIN EN 60204-32, section 8
		i) Check of insulation resistances of main circuits	DIN EN 60204-32, section 18.3
		j) Protection against direct or indirect contact	DIN EN 60204-32 sections 6.2 and 6.3 DGUV 3 § 4
		k) Monitoring measures in auxiliary circuits and control circuits	DIN EN 60204-32 section 9.1
		l) Overcurrent protective devices for main and control circuits	DIN EN 60204-32, sections 7.2 to 7.4
		m) Phase sequence monitoring	DIN EN 60204-32, section 7.8 KTA 3902, sub-clause 6.5.2 (2)
		n) User programmable or parameterizable systems performing functions classified into Performance Levels c, d or e as per Annex E of KTA 3902	Comparison of software and parameters with the condition examined before
		o) Identification marking, danger signs, protective devices	DIN VDE 0105-100 DIN EN 60204-32, sections 9.3 and 16 DGUV 3
		p) Electromagnetic compatibility (field-excited and conducted electromagnetic interferences)	DIN EN 61000-6-4 DIN EN 61800-3
1.3	Functional testing	a) - drives - wireless controls - general functions - functions classified into Performance Levels a through e as per Annex E of KTA 3902	DIN 15030, section 8 c) DIN EN 60204-32, sections 9.2, 9.3 and 18.6 DIN EN 13557 DGUV 55 §8 and 9 DGUV 53 §15 DGUV 309-001 Design approval documents
		b) Maximum speed of floor-operated cranes	DIN EN 13557, section 5.1.9 DGUV 53 § 17
		c) Safety distances	DGUV 53 § 11
		d) Rope drives: safety windings, unimpeded movement of ropes	DIN 15020-1, sections 5 to 7 Design approval documents regarding number of safety windings required

Table 8-1: Extent of acceptance testing (continued)

Ser. No.	Tests and inspections of		Requirements to
1.4	Movements under test load	e) Work areas, speeds	Design approval documents DIN 15030 clause 8 d)
		f) Ergonomic design	Design approval documents
		a) Structures, hoists incl. overload protection - operating condition Test load: 1.25 times the maximum operational load; if the weight of the load supporting mean (P_0) exceeds 5% of the maximum operational load (P_B), the test load shall be $1.25 \cdot P_B + 0.25 \cdot P_0$	DIN 15030, sections 9 and 10 KTA 3902, clauses 6.2.1.3.1, 6.2.1.3.3, 6.5.2 (4) and 7.5 h) KTA 3903 Annex D
		- assembly condition Test load: 1.1 times the maximum erection load P_M	DIN 15030, sections 9 and 10
		b) Work areas	DIN 15030, section 10 (b)
1.5	Movements under maximum operational load	Lateral transport drives, hoists	DIN 15030, section 11 Design approval documents with regard to performance record and speeds
1.6	Surface inspection following the inspections in acc. with Ser. No. 1.4: weld seams in zones of load application of non-redundant load supporting means for lifting equipment acc. to KTA 3902 section 4.3 or 4.4		KTA 3903, Annex B
1.7	Bolting torque check on rope terminations at the rope drum following the inspections in acc. with Ser. No. 1.4.		Design approval documents
2	Load suspension devices and lifting accessories		
2.1	Mechanical parts	a) Inscriptions	DGUV 100-500, chapter 2.8, § 3.4 KTA 3903 clause 9.1 (2)
		b) Operating instruction	DGUV 100-500, chapter 2.8, § 3.1.1 and § 3.1.2
		c) Protection against unintentional detachment of loads	KTA 3902, clauses 6.4.1.3, 6.4.2.3, 6.4.3.2, 7.4.1.3, 7.4.2.3 and 8.4.3
		d) Safeguarding of detachable parts, safety devices	KTA 3902, clauses 6.4.2.3, 6.4.3.2, 7.4.2.3
		e) Protection against damage	KTA 3902, clauses 6.4.2.3 and 7.4.2.3
		f) Sling ropes according to DIN EN 13414-1 and DIN EN 13414-2	DIN EN 13414-1 § 6 KTA 3902, clause 6.4.3 and section 7.4
		g) Sling chains according to DIN EN 818-4 and components for lifting accessories according to DIN EN 1677-1, DIN EN 1677-2, DIN EN 1677-3 and DIN EN 1677-4	KTA 3902, clause 6.4.3 and section 7.4
		h) Load hooks, grabs	DIN 15405-1, sections 4 and 7 KTA 3902 section 6 and clause 8.4.3
2.2	Electrical components	a) Control and signalling functions	DIN EN 60204-32 section 9.2 KTA 3902, clauses 6.5.4 and 8.5 a)
		b) Power supply and wiring technique	DIN EN 60204-32, sections 5, 12 and 13 DIN VDE 0100-520
		c) Switch gears (boxes) Accessibility, structure and marking	DIN EN 60204-32, sections 11 and 16
		d) Check of protection conditions by automatic switch-off of power supply	DIN EN 60204-32, section 18.2

Table 8-1: Extent of acceptance testing (continued)

Ser. No.	Tests and inspections of	Requirements to
	e) Check of insulation resistances of main circuits	DIN EN 60204-32 section 18.3
	f) Protection against direct or indirect contact	DIN EN 60204-32 sections 6.2 and 6.3 DGUV 3 § 4
	g) Monitoring measures in auxiliary and control circuits	DIN EN 60204-32 section 9.1
	h) Overcurrent protective devices for main and control circuits	DIN EN 60204-32 sections 7.2 to 7.4
	i) Identification marking, danger signs, protective devices	DIN VDE 0105-100 DIN EN 60204-32 sections 9.3 and 16
2.3	Functional testing a) - Interlocks, actuating and operating equipment - general functions - functions classified into Performance Levels a through e as per Annex E of KTA 3902	KTA 3902 clauses 6.4.1.3, 6.4.2.3, 6.4.3.2, 7.4.1.3, 7.4.2.3 and 8.4.3 KTA 3902 sections 6.5, 7.5 and 8.5 Design approval documents
	b) Ergonomic design	Design approval documents
2.4	Loading under test load (not required for sling ropes and sling chains as well as shackles tested in accordance with materials test sheets 3.19 or 3.20 of Annex A)	1.25 times the operational load. Where it is impossible to simulate dynamic influences, the test load shall be 1.5 times the operational load.
2.5	Surface inspection following the inspections in acc. with Ser. No. 2.4: weld seams in zones of non-redundant load application of load suspension devices and lifting accessories for lifting equipment acc. to KTA 3902 section 4.3 or 4.4	Annex B
2.6	Bolting torque of bolts additionally loaded in tension following the inspections in acc. with Ser. No. 2.4.	Design approval documents

Table 8-1: Extent of acceptance testing (continued)

9 Operation, maintenance and repair

9.1 Requirements for operation

(1) Only trained crane operators are allowed to operate lifting equipment as per KTA 3902, sections 4.2 to 4.4. VDI 2194 or DGUV 309-003 applies with regard to the selection and training of such operators. In addition, special instructions for the lifting equipment to be operated shall be provided, and the operator's knowledge shall be kept up-to-date.

(2) Load tables for all lifting accessories shall be provided and be made available for inspection at the location of operation.

(3) During operation of refuelling machines an adequately instructed person shall be present at the reactor control room or at an equivalent location as long as the key-operated switch is in the operating position.

(4) For the accident case "Failure of a part of a double drive mechanism chain or a single drive mechanism chain with safety brake", the operating instructions for hoists acc. to section 4.3 or 4.4 of KTA 3902 shall specify measures for safe continued operation of the hoist. Where the evaluation of the accident shows that safe continued operation is possible only the following transport operations may be performed:

- a) for hoists with double drive mechanism chain the completion of the already begun transport operation as specified,
- b) for hoists with single drive mechanism chain with safety brake the transport of the load to a suitable position.

9.2 Organisation of transports

For transports where load chains have to meet the additional or increased requirements of KTA 3902 section 4 or KTA 3905 section 4, the following requirements shall be met by respective plant-related stipulations (e.g. in the operating manual, in processing step and sequence plans, in operating instructions):

(1) The responsibilities for the respective transport sequences shall be defined.

(2) It shall be ensured that only handling equipment and load attachment points are used, that meet the requirements of KTA 3902 and KTA 3905.

(3) It shall be ensured that the handling sequences are logical and the transport ways are suited.

(4) In addition to technical measures taken in acc. with KTA 3902, section 4.7 (e.g. automation, interlocks, visualization) administrative measures shall be taken (e.g. use of the "four-eyes principle", use of checklists) to prevent misactions which lead to

- a) drop of load,
- b) overloading of transport equipment (oblique tensile loading) or load attachment points,
- c) damage to safety-relevant devices,
- d) irregular set-down of load or non-conformance with the prescribed transport sequences,

- e) irregular load detachment,
- f) radiological exposure due to non-observance of prescribed distances.

Note :

(1) Misactions may e.g. be:

- a) maloperation,
- b) use of wrong or unsuitable components
- c) erroneous reading,
- d) misinterpretation,
- e) omission of handling steps.

(2) Misactions may e.g. occur due to

- a) lack of communication (shift change-over),
- b) inadequate ergonomic design,
- c) lack of knowledge,
- d) inattentiveness.

(5) The procedural steps in case of troubles on handling equipment and deviations from the intended sequence of handling activities shall be laid down.

(6) Personnel engaged in transport activities shall be trained before the transport begins.

(7) For non-plant related handling equipment the following checks and inspections shall be performed which the inspector shall attend

- a) a receiving inspection (identity check),
- b) a check of documentation (among others with respect to in-service inspections),
- c) an examination of orderly functioning (compatibility) in connection with power plant equipment.

(8) The transports shall be continuously supervised by the operating personnel in which case suitable equipment supporting the personnel's perception (e.g. spot lights or camera) shall be used.

(9) The working conditions shall be such that the operating personnel is able at any time to monitor the transport with the necessary care.

Note :

These cover, e.g.

- a) sufficient visibility (brightness, non-glare condition, avoidance of inadmissible streaking),
- b) adequate preventive measures in case of difficult working conditions (e.g. noise, radiological exposure temperature, narrow spaces).

(10) Transport operations where misactions of the crane operator may lead to load drop or collision so that consequently the dangers described in KTA 3902, clause 4.2 (1) or 4.3 (1) are to be expected shall additionally be supervised by another person. Where the transport operation requires that the supervising person must be able to stop the lifting equipment in case of crane operator misactions without delay, a switch-off device as per KTA 3902 sub-clause 6.5.4.1 (6) shall be used.

9.3 Requirements for maintenance and repair

(1) The licensee shall take care to ensure that the tests and inspections laid down in the operating and maintenance instructions are performed orderly and on schedule by an expert as per DGUV 53 nominated by him. The individual test results shall be laid down in writing, kept on file and be submitted to the authorized inspector at the time of in-service inspections acc. to section 10.

(2) Records shall be kept on all maintenance and repair work carried out, and shall contain at least the following data:

- a) clear indication of the lifting equipment,
- b) incident and reason for maintenance and repair work,
- c) work carried out and type and number of replaced components as well as reasons for doing so,
- d) date and detailed designation of certificates or attestations required for the installed new components,

- e) date of maintenance or repair,
- f) signature of expert as per DGUV 53.

(3) The records on maintenance and repair work shall be kept on file and be submitted to the authorized inspector at the time of in-service inspections acc. to section 10.

(4) The records on disassembly and re-assembly work done on connections with preloaded bolts and on the tests and inspections performed prior to re-using such bolts, shall be added to the documentation and be submitted to the authorized inspector during the in-service inspections according to section 10.

(5) The design approval as per section 5 may be waived for new components to be installed, if the components are exclusively fabricated according to design approval documents established for first-time manufacture and new editions of standards used in the design approval documents don't give reason to doubt the validity of the design approval documents. The materials testing shall be performed in acc. with section 6, the final inspection in acc. with section 7 and the acceptance test in acc. with section 8.

10 In-service inspections

10.1 General

(1) Unless specifically stated otherwise, in-service inspections shall be performed yearly. The inspection dates shall be agreed in time between the licensee and the authorized inspector. Where lifting equipment is not used beyond the date of the next regular in-service inspections, the next in-service inspection shall be performed at the latest prior to using such lifting equipment.

(2) Where defects are detected during in-service inspections, a repeated inspection is required upon removal of such defects referring to the extent of the defects removed. The authorized inspector shall propose the period of time required for removing the defects.

10.2 Documents

The following documents shall be submitted:

- a) testing instructions according to KTA 1202,
- b) inspection log for cranes and refuelling machines acc. to DGUV 53,
- c) inspection certificate for load carrying devices,
- d) records on all maintenance and repair work as well as in-service inspections carried out,
- e) in case of connections made with preloaded bolts: records on disassembly and re-assembly and on the inspections performed prior to re-using such bolts.
- f) for lifts documents in acc. with TRBS 1201-4 and the directive 2014/33/EU Annex I no. 6.

10.3 Performance of tests and inspections

(1) In its essentials, visual inspections and functional tests shall be performed as in-service inspections.

(2) The extent of inspection shall be taken from **Table 10-1**.

(3) The following requirements apply to inspections for ascertaining the condition:

- a) Visual inspections shall be performed according to DIN EN 13018, preferably as direct visual testing.
- b) On load carrying devices the inspections shall be performed acc. to DIN EN 13018 as local visual testing. For the other test objects, it shall be laid down in the test instructions whether the inspection is to be performed as local or general visual testing.

- c) Deviations from the specified conditions shall be documented as conspicuous indications and be evaluated.
- d) Crack-like conspicuous indications on load-bearing parts are not permitted. Where conspicuous indications cannot be clearly identified they shall be subjected to a surface inspection to **Annex B**.
- (4) Non-destructive tests and inspections shall be performed in acc. with **Annex B**.
- (5) The inspections for ascertaining the condition, surface inspections and functional tests shall be performed in the presence of the authorized inspector.
- (6) In-service inspections on lifts in reactor containments shall be performed in compliance with article 16 of the Ordinance on Industrial Safety and Health (BetrSichV) taking the design requirements according to section 5 of KTA 3902 into account.

10.4 Requirements regarding test personnel

- (1) The test personnel for ascertaining the condition shall have the knowledge required to perform their tasks and shall meet the requirements of DIN EN 13018.
- (2) The test personnel for local visual testing shall have been qualified and certified according to DIN EN ISO 9712.
- (3) For non-destructive tests and inspections (except visual testing), the stipulations in section B 2.1 apply.
- (4) The test personnel for functional tests shall have the specialist knowledge required to perform their tasks.

10.5 Certification of in-service inspections

Upon completion, in-service tests and inspections shall be certified by the authorized inspector.

Ser. No.	Item of tests and inspections		Tests and inspections
1	Lifts in reactor containments	a) Lift	TRBS 1201-4
		b) Emergency power unit, alarm system, intercom system, emergency exit of lift cage	Condition, functioning
		c) Pressure equalization openings, emergency exit (steps, rungs, identification) of lift shaft	Unimpeded movement, condition, fastening
		d) Landing entrance door	Condition, functioning
		e) Emergency lighting	Condition, functioning
2	Cranes, winches, trolleys and refuelling machines		
2.1	Mechanical components		
2.1.1	Runway systems	Supports, beams, bars, joints, concrete	Condition, fastening
2.1.2	Ascents and walkways	Steps, rungs, strings, platforms etc., safeguarding against fall (e.g. railings, balusters, safety hoops)	Presence, fastening, condition
2.1.3	Crane and trolley runways	a) Rails, runway	Fastening, condition, track gauge, distortion
		b) Runway limiters, locking devices, interlocks	Presence, fastening, condition, functioning
2.1.4	Bridge and trolleys assembly	Beams, bars, joints, buffers, limit stops, bracing	Presence, fastening, condition
2.1.5	Hoists from the motor up to and incl. the carrying rope	a) Shafts, couplings, gears	Condition, protective cover
		b) Gear boxes, shift transmissions	Noise, temperature, oil level, leak tightness, engagement of shift transmissions, condition of wear parts (with gear box inspection cover opened)
		c) Ropes	Condition, discard criteria according to DIN ISO 4309 for the classes M5 to M8 ¹⁾
		d) In addition for ropes according to KTA 3902, section 4.3 or 4.4	The discard criteria for visible wire breakage are 50 % of the values indicated in DIN ISO 4309 for the classes M5 to M8 ¹⁾ . Where 70 % of the usage factor under combined loading (cubic average value) of the rope drive mechanism group according to KTA 3902, clause 7.2.2.1 or 8.2.2.1 are reached, the rope shall be removed even if no breakage is visible; alternately, it is permitted for ferritic ropes to extend the usage up to 100 % by means of additional examinations (e.g. examination for internal defects).
		e) Rope drums, rope sheaves, rope terminations and safety devices against rope extraction	Condition, wear

Table 10-1: Extent of in-service inspections (continued on next pages)

Ser. No.	Item of tests and inspections	Tests and inspections
	f) Bearing of rope sheaves and rope compensation of lifting equipment according to KTA 3902, section 4.3 or 4.4, unless provided redundantly	Every three years ²⁾ surface inspection on axles, bolts and similar parts. At locations where surface inspection is impossible, an examination using another procedure of non-destructive testing shall be performed. The test procedure shall be laid down in the test instruction according to KTA 1202.
	g) Systems to take up or dampen load shifting pulses	Condition, functioning, alarm signal at control station (only if auxiliary media are used)
	h) Service brake and auxiliary brake	Braking test (see Annex D) under test load (1.0 times the operational load) and full lowering speed for each brake separately. Condition, functioning, sufficient releasing of the brake in acc. with operating instructions, indication of non-opening or non-closing as a warning signal to the control station, wear, wear indication for service brake as a warning signal to the control station, delayed actuation of the auxiliary brake. Sliding rotor motors with integral brake are excluded from indication of non-opening or non-closing. When monitoring the braking effect at each brake by in-service braking torque measurements or an automatic braking torque monitoring system, the brake test with test load may be omitted if the suitability of the system has been proved in accordance with Annex D. In such case, the functional tests shall be performed yearly with a load of at least 50 % of the nominal lifting capacity (maximum operational load), however, at least once within 4 years with the maximum operational load.
	i) Safety brake according to KTA 3902, section 4.3 or 4.4	Condition, functioning, wear, sufficient releasing in acc. with operating instructions, monitoring of non-opening, braking test in acc. with test instructions. When monitoring the braking effect by in-service braking torque measurements or an automatic braking torque monitoring system, the brake test with test load may be omitted if the suitability of the system has been proved in accordance with Annex D . In such case, the functional tests shall be performed yearly with a load of at least 50 % of the nominal lifting capacity (maximum operational load), however, at least once within 4 years with the maximum operational load.
	j) Overload protection	Condition, functioning, shutdown at 1.1 times the operational load, response tolerance $\pm 5\%$, alarm signal at the control station
	k) Load indication for lifting equipment according to KTA 3902, section 4.4	Continuous load indication at the control station
	l) Drives	Functional test under operational load, uniform change of speed when actuating the controls. When the brake test with test load is omitted in accordance with Ser. No. 2.1.5 h) and 2.1.5 i), the functional tests shall be performed yearly with a load of at least 50 % of the nominal lifting capacity (maximum operational load), however, at least once within 4 years with the maximum operational load.
	m) Mechanical warning devices, limit stop devices	Condition, functioning
	n) Operating hours or load cycles counter, counter for the number of engagements of the safety brake	Reading, evaluation with respect to the observance of design data

Table 10-1: Extent of in-service inspections (continued)

Ser. No.	Item of tests and inspections		Tests and inspections
2.1.6	Drive mechanisms of travelling and slewing gears	o) Monitoring device for detecting failure of a part within a double drive mechanism chain or a drive mechanism chain with safety brake	Condition, functioning, alarm signal at the control station
		p) Brakes with braking torque measurement equipment or an automatic braking torque monitoring system	Condition, functioning, point in time of measurement, comparison of required/actual braking torque, switch-off in the case of a braking torque value less than 0.9 times the required braking torque, alarm signal at the control station
		a) Wheel-brake supports, travelling wheels, guide rollers, rail sweeps, gears, worm wheels, couplings	Wear, condition, functioning, bearings, drive mechanism protection
		b) Drives	Uniform change of speed when actuating the controls
		c) Brakes	Condition, functioning, braking test
2.1.7	Lubrication	d) Limit stop devices	Condition, functioning
		Lubricating devices and lubricating points	Accessibility, marking
2.1.8	Safety distances, access routes, working platforms, marking, signs		Observance, accessibility, presence, condition, readability
2.1.9	Foundations, anchoring		Condition, fastening
2.1.10	Drives (power and hand operated) for lifting equipment according to KTA 3902 section 4.4		Condition, functioning, interlocks between hand and power operation
2.2	Electrical equipment		
2.2.1	Control units	Main connection switch, disconnectors, crane switches, control switches, contactors, overcurrent protection, travel limiters, interlock switches, wireless control units	Condition, functioning, marking, settings, protection against direct or indirect contact
2.2.2	Lines	Flexible connecting lines, collecting lines, insulators, current collectors, permanent lines	Fastening, condition, protection against direct or indirect contact
2.2.3	Consumers	Motors, brake release devices, resistors, heating, lighting, alarm and signalling installations	Condition, functioning, marking
2.2.4	Protective measures and devices		Protection against direct contact, protection in the case of indirect contact, incorporation of grounded conductors, insulators in control circuits
2.2.5	Measuring, control, monitoring and safety equipment	a) Functions that have been classified into Performance Levels a to e as per Annex E of KTA 3902	Condition, functioning, marking, observance of the requirements according to KTA 3902, sections 6.5, 7.5, 8.5.
		b) Alarm system, emergency lighting	Condition, functioning
		c) User-programmable or parametrizable systems performing functions that have been classified into Performance Levels c, d or e as per Annex E of KTA 3902	Comparison of the software and the parameters with the last state approved
3	Load carrying devices	a) Structure: bottom block, lifting beam; hanger, hoist guide	Condition, deformations, wear, protection against unintentional disengagement
		b) Load hook, grab	Condition, functioning, deformations, local work hardening and crushing in the saddle region, wear, rust, securing of hook nut, protection against unintentional load disengagement. For load hooks see also DIN 15405-1
		c) In addition, for load hooks	Every three years ²⁾ surface inspection in the load hook saddle region

Table 10-1: Extent of in-service inspections (continued)

Ser. No.	Item of tests and inspections	Tests and inspections
	d) In addition, for load hooks for lifting equipment according to KTA 3902, section 4.3	Every three years ²⁾ surface inspection of the thread at the load hook shank
	e) In addition, for grabs for lifting equipment according to KTA 3902, section 4.3 or 4.4	Every three years ²⁾ surface inspection within the area of the handles
	f) Load hook lifting beam for lifting equipment according to KTA 3902, section 4.3	Every three years ²⁾ surface inspection. At locations where surface inspection is impossible, an examination using another method of non-destructive testing shall be performed. The test procedure shall be laid down in the test instruction according to KTA 1202.
	g) Load hook nut for lifting equipment according to KTA 3902, section 4.3	Every three years ²⁾ surface inspection of the thread
	h) Non-redundant axles, bolts, tie-rods, and similar parts as well as weld seams of non-redundant load application zones on load carrying devices for lifting equipment according to KTA 3902, section 4.3 or 4.4	Every three years ²⁾ surface inspection. For tie-rods the surface inspection shall be performed in the threaded and weld junction areas. At locations where surface inspection is impossible, an examination using another method of non-destructive testing shall be performed. The test procedure shall be laid down in the test instruction according to KTA 1202.
	i) Drives	Condition, functioning
	j) Ropes	Condition, observance of discard criteria according to DIN EN 13414-2 Annex A.2.3
	k) Chains	Condition, observance of discard criteria according to DIN EN 818-6 Annex A.2. Every three years a surface inspection.
	l) Bolted connections under additional tensile loading	Check of the bolting torque for compliance with the design approval documents
1) In exceptional cases, if the reference diameter value is not known, the nominal diameter value may be used as reference diameter value. 2) 6 years where it is proved in each individual case that for these parts utilization reserves $\frac{D}{S} = \frac{\text{theoretical period of utilization}}{\text{consumed portion of theoretical period of utilization}} > 1.5$ are available for the intended service life. See DGUV 55 – Accident Prevention Regulations - Performance instruction Annex A for the determination of D and S. When determining D and S the same load shall always be used as reference load. This does not apply to parts made of austenitic materials where the risk of stress corrosion cracking may occur.		

Table 10-1: Extent of in-service inspections (continued)

11 Series-production parts and standardized components

This section comprises series-production parts and standardized components to be used for hoists and load carrying devices.

11.1 Series-production parts

11.1.1 General

(1) The tests and inspections for series-production parts in the load path shall be performed and documented in accordance with this section.

(2) The manufacturer of series-production parts shall have been certified according to DIN EN ISO 9001 or shall have a quality management system proved in conformance with the requirements of KTA 1401, section 13. This proof shall be submitted along with the confirmed qualification test according to clause 11.1.4.2 for final inspection. This requirement also applies to hoist motors if proof has to be rendered for its motor shaft to meet the requirements of sub-clause 5.1.4 (1) c).

11.1.2 Design approval

11.1.2.1 Documents

The design data required for dimensioning shall be submitted. **Forms C-4 to C-9** contain notices on the extent of the design data for brakes, couplings (excluding brake disks), rope drum hinge connections, rope sheaves, rope terminations (e.g. wedge sockets). For rope drum hinge connections the design calculation shall be additionally contained in the documents. For motor shafts the requirements of sub-clause 5.1.4 (1) c) apply. For other series-production parts in the load path, forms analogous to **Forms C-4 to C-9** shall be established for the qualification test according to clause 11.1.4.2 shall be established and be submitted for design approval.

11.1.2.2 Performance

The documents submitted in accordance with clause 11.1.2.1 shall be examined for correctness of the design loads, taking the drive mechanisms and rope drives classification into account. For rope drum hinge connections the design calculation shall be additionally reviewed.

11.1.3 Materials

The manufacturer's quality department shall confirm that the materials specified in the design calculation have been used.

11.1.4 Final inspection

11.1.4.1 Documents

The documents subjected to design approval in accordance with clause 11.1.2.2 shall be submitted.

11.1.4.2 Qualification test

(1) The manufacturer shall confirm that the series-production part to be used complies with specified design data. The measuring results obtained in the tests and recorded accordingly shall be submitted to the inspector. **Forms C-4 to C-9** contain relevant information for brakes, couplings (excluding brake disks), rope drum hinge connections, rope sheaves, rope terminations (e.g. wedge sockets). For motor shafts the requirements of sub-clause 5.1.4 (1) c) apply. The manufacturer shall ensure the uniform quality of series-production parts.

(2) In the case of type-approved series-production parts it will suffice to confirm that the series-production part to be used has been manufactured in the same way as the type-approved part.

(3) The assessment of the suitability of the safety brake shall be effected by the authorized inspector on the basis of the submitted design approval and qualification documents.

11.2 Standardized components

11.2.1 General

The tests and inspections for standardized components, such as pins, sleeves, bolts, feather keys, turnbuckles shall be performed in accordance with this section.

11.2.2 Design approval

11.2.2.1 Documents

(1) For standardized components it will suffice to indicate standard designations and dimensions.

(2) The design data relevant to dimensioning shall be submitted for design approval.

(3) Design calculations shall be submitted for standardized components without specification of allowable loadings in the standards.

11.2.2.2 Performance

The documents submitted in acc. with clause 11.2.2.1 shall be examined for correctness of the design loads as well as for completeness and correctness of the calculation.

Note:

The correct loadings assumed shall be those loads obtained from 6.1.1, 7.1.1 or 8.1.1 of KTA 3902 in consideration of the appropriate dynamic factor.

11.2.3 Materials

(1) The materials shall be selected with respect to the standards for standardized components.

(2) As far as materials tests sheets for standardized components are available in **Annex A**, the materials tests and examinations shall be performed in acc. with these sheets.

(3) The manufacturer shall confirm that the materials specified by the standards have been used. The materials tests

and examinations required by these standards shall be performed, and the certificates specified in these standards shall be submitted.

11.2.4 Final inspection

The manufacturer shall confirm that the standardized component to be used has been manufactured in compliance with the requirements of the respective standard.

12 Series-production electric hoists with rope and series-production hoist gear boxes

12.1 General

(1) The design approval, final inspection, acceptance tests, and in-service inspections shall be performed and documented in acc. with this section.

(2) The scope of this section comprises, for series-production electric hoists with rope, their lateral transport drives incl. related structures, hoists and bottom block with load hook. This section does not apply to bottom blocks incl. load hooks for lifting equipment according to KTA 3902, section 4.3 or 4.4.

(3) The manufacturer of series-production electric hoists and series-production hoist gear boxes shall have been certified according to DIN EN ISO 9001. Proof of certification shall be submitted for design approval.

12.2 Design approval

12.2.1 Documents

The following documents shall be submitted in a clearly arranged and reviewable form for design approval. The documents mentioned in clauses 12.2.1.1 to 12.2.1.3 shall only be established for parts in the load path, and the documents mentioned in clause 12.2.1.5 shall be established for safety equipment or functions.

12.2.1.1 General arrangement and construction drawings, parts lists incl. data on materials

The requirements of clause 5.1.3 subpara. a) to e) as well as g) to i) shall be taken into consideration.

12.2.1.2 Strength calculations

The requirements of clause 5.1.4 shall be taken into consideration.

12.2.1.3 Welding data

The data required for the production and assessment of welded connections shall be contained in the construction drawings or in the welding procedure specification and weld location sheet.

12.2.1.4 Welder's and welding procedure qualification

The requirements of clause 5.1.7 shall be taken into consideration.

12.2.1.5 Electrical equipment

The requirements of clause 5.1.8 shall be taken into consideration.

12.2.1.6 Operating and maintenance instructions

Operating and maintenance instructions shall be submitted at the latest at commencement of acceptance testing.

Note:

For the establishment of operating and maintenance instructions see also DIN EN 82079-1.

12.2.1.7 Test and inspection sequence plan for final inspection

The test and inspection sequence plan for final inspection shall contain the following data:

- a) requirements and extent of inspection as per section 12.4,
- b) inspection sequence as well as type of inspection and certificates,
- c) inspector (manufacturer, authorized inspector).

12.2.1.8 Test and inspection sequence plan for acceptance testing

The test and inspection sequence plan for acceptance testing shall contain the following data:

- a) requirements and extent of testing as per section 12.5,
- b) test sequence.

12.2.1.9 Test and inspection sequence plan for in-service inspections

The test and inspection sequence plan for in-service inspections shall contain the following data:

- a) requirements and extent of inspections as per section 12.7,
- b) inspection intervals.

12.2.2 Performance of design approval

The requirements of section 5.2 shall be taken into consideration.

12.3 Materials

(1) The manufacturer's quality department shall confirm (QA certificate) that the materials specified by the design calculation have been used. For parts in the load path (except for the gear box housing) the tests and examinations required by the material test sheets according to **Annex A** shall be performed and be certified with inspection certificate 3.1 according to DIN EN 10204.

(2) For load hooks only materials according to DIN 15400 are permitted. The materials shall be certified in acc. with DIN 15404-1.

(3) The requirements of clause 6.2 (3) shall apply to gears according to DIN 3990-5.

(4) For ropes **Annex A**, materials test sheet WPB 3.18 shall apply.

12.4 Final inspection

12.4.1 General

(1) All stages of inspection as well as the certificates required shall be laid down in the test and inspection sequence plan for final inspection.

(2) The tests and inspections specified in **Tables 12-1 and 12-2** for

- a) running wheels incl. wheel bearing of lateral transport drives with related structures,

- b) series-production electric hoists with rope incl. bottom block with load hook,
- c) series-production hoist gear boxes,
- d) electrical equipment

shall be performed by the manufacturer to an extent of 100 %, in which case the requirements of clause 12.4.2 apply as regards the performance of non-destructive tests on weld seams.

12.4.2 Non-destructive tests and inspections

(1) If the design was performed in accordance with the provisions of clauses 6.1.1 (1) a), 7.1.1 (1) a) or 8.1.1 (1) a) of KTA 3902 based on DIN 15018-1 and DIN 15018-2, the manufacturer shall perform non-destructive tests on weld seams to the following extent:

Each weld seam shall be subjected to a visual inspection. In addition, the following supplementary tests and inspections shall be performed:

- a) Butt welds of special and standard quality according to DIN 15018-1, Table 24 which lie in the load path shall be subjected to both
 - aa) a surface inspection and
 - ab) an ultrasonic or radiographic testing
 to an extent of 100 %. In the case of butt welds with standard quality and stresses occurring on the weld seam less than $0.8 \cdot \sigma_{zul}$ an extent of testing of 25 % will suffice.
- b) Other weld seams of special quality according to DIN 15018-1, Table 24, with full penetration at the root (e.g. double-bevel groove weld), which lie in the load path shall be subjected to an extent of 100 % to
 - ba) a surface inspection and
 - bb) an ultrasonic or radiographic testing.
- c) All other weld seams in the load path shall be subjected to a surface inspection to the following extent:
 - ca) 25 % if the lifting equipment is classified under KTA 3902, sections 4.3/4.4 and the stress occurring on the weld seam is equal to or greater than $0.8 \cdot \sigma_{zul}$,
 - cb) 10 % if the lifting equipment is classified under KTA 3902, section 4.2 and the stress occurring on the weld seam is equal to or greater than $0.8 \cdot \sigma_{zul}$.

Here, the extent of testing shall cover equally the welding work done by all welders.

(2) If the design was performed in accordance with the provisions of clauses 6.1.1 (1) b), 7.1.1 (1) b) or 8.1.1 (1) b) of KTA 3902 based on DIN EN 13001-1-3, the following shall apply to the non-destructive tests and inspections to be performed by the manufacturer:

- a) The weld seams in the load path shall be subjected to the inspection after welding as specified in section 12.4.2 of DIN EN 1090-2 for execution class EXC 4, here the extent of supplementary NDT shall be in compliance with the following provisions:
 - aa) Transverse butt welds and partial penetration welds in butt joints under tensile stress or shear stress shall be subjected to an extent of 100 % to a surface inspection and to an extent of 100 % to an ultrasonic or radiographic testing.
 - ab) Transverse fillet welds under tensile stress or shear stress shall be subjected to an extent of 100 % to a surface inspection.
 - ac) Full penetration longitudinal welds between web and top flange of bridge structures as well as longitudinal welds of rope drums shall be subjected to an extent of 100 % to a surface inspection and to an extent of 100 % to an ultrasonic or radiographic testing.

- ad) Other weld seams a local failure of which can lead to loss of load bearing capacity of the part shall be subjected to an extent of 100 % to a surface inspection and in the case of full penetration welds additionally to an extent of 20 % to an ultrasonic or radiographic testing.
- ae) Other weld seams shall be subjected to an extent of 20 % to a surface inspection and in the case of full penetration welds additionally to an extent of 10 % to an ultrasonic or radiographic testing.

Note:

Longitudinal welds are those made parallel to the component axis. All the others are considered as transverse welds.

- b) In deviation from a) the following tests and inspections shall be performed on gear box housings:
 - ba) visual inspection of all weld seams to an extent of 100 %,
 - bb) surface inspection of the weld seams on bearing shells and main plates, torque supports as well as brake retainers to an extent of 100 %,
 - bc) surface inspection of all the other weld seams to an extent of 25 %.

Where it is proved that the utilization of weld strength is less than 50 %, the inspection specified in bc) may be waived.
- c) The weld seams that are not in the load path shall be subjected to the inspection after welding as specified in section 12.4.2 of DIN EN 1090-2 for the execution class as fixed in the design approval documents. On weld seams classified into execution class EXC 3 or EXC 4 an extent of testing of at least 10 % is required.
- (3) The following shall apply to the ultrasonic or radiographic testing to be performed according to (1) or (2):
 - a) For butt welds with wall thicknesses equal to or smaller than 15 mm radiography shall be used.
 - b) For wall thicknesses greater than 15 mm and equal to or smaller than 40 mm ultrasonic testing shall preferably be used, alternatively radiography.
 - c) For wall thicknesses exceeding 40 mm ultrasonic testing shall be used.
 - d) For all wall thicknesses of austenitic butt welds radiography shall be used.
- (4) The extent of tests and inspections to be performed by the authorized inspector is indicated in **Tables 12-1** and **12-2** with regard to the various inspection stages.

12.4.3 Documents for final inspection

In addition to the test and inspection sequence plan for final inspection the following documents shall be submitted:

- a) construction drawings with welding data and parts lists with data on materials in acc. with clauses 12.2.1.1 and 12.2.1.3,
- b) materials certificates and quality department certificate on the materials used in acc. with clause 12.3,
- c) welder's and welding procedure qualification. in acc. with clause 12.2.1.4,
- d) construction documents for electrical equipment in acc. with clause 12.2.1.5.

12.4.4 Extent of inspection

The extent of final inspection shall be taken from **Tables 12-1** and **12-2**. Non-destructive testing shall be performed in acc. with **Annex B**.

12.4.5 Final test at the manufacturer's works

(1) The series-production electric hoists shall be subjected to a final test on a load test bench of the manufacturer in the presence of the authorized inspector. During this test the following shall be tested:

- a) operation without load,
- b) operation under nominal load or with the respective rope traction force,
- c) operation under maximum test load or with the respective rope traction force,
- d) determination of motor power consumption,
- e) check of the braking and limit stop devices.

(2) Recording of the tests shall be effected in accordance with **Form C-10**.

12.5 Acceptance testing

(1) Acceptance testing shall be performed in accordance with section 8.

(2) A repetition of the tests already performed during the final test at the manufacturer's works in acc. with clause 12.4.5 can be waived within acceptance testing.

12.6 Operation and maintenance

The requirements of section 9 shall be taken into account.

12.7 In-service inspection

In-service inspections shall be performed in acc. with section 10. The check for "condition of wear parts" in acc. with Table 10-1, ser. no. 2.1.5 b) is omitted.

12.8 Documentation

The documentation shall be effected in acc. with section 13 including the documents required.

13 Documentation

13.1 General

The documentation shall make it possible to trace back all manufacturing processes and test/inspection procedures, maintenance measures as well as in-service tests and inspections to be supervised acc. to sections 5 to 12, respectively.

13.2 Compilation of documents

- (1) The documents shall be compiled in due consideration of requirements in KTA 1404.
- (2) The compiled documents shall contain the design approved documents as well as all proofs, records and attestations certifying the actual condition and the tests and inspections performed.

13.3 Performance of documentation

- (1) Documentation of manufacturing documents shall accompany the manufacturing process. The manufacturer shall ensure that the documentation, including that of sub-contractors, is complete.
- (2) The licensee is responsible for continuing the documentation with regard to maintenance measures and in-service inspections.

Ser. No.	Component	Tests and inspections	Tests and inspections by authorized inspector in acc. with § 20 of the Atomic Energy Act for lifting equipment acc. to KTA 3902	
			section 4.2	section 4.3 or 4.4
1	Running wheels (incl. wheel bearing of lateral transport drives) with related structures	a) Material identification marks of the parts for compliance with list of material certificates or parts list	—	—
		b) Ultrasonic testing for laminar imperfections in weld-junction areas on parts under tensile stress in thickness direction	—	—
		c) Check for compliance of dimensions and assembly with design approval documents	X	X
		d) Observance of welding data	—	—
		e) Non-destructive testing of weld seams specified in the test and inspection sequence plan for final inspection:		
		ea) If the design was performed in accordance with the provisions of clauses 6.1.1 (1) a), 7.1.1 (1) a) or 8.1.1 (1) a) The weld seams subject to non-destructive testing shall be fixed in acc. with DIN 15018-1, Table 24.		
		- Visual inspection of weld surfaces	25 %	25 %
		- Surface inspection as well as ultrasonic or radiographic testing on weld seams according to clauses 12.4.2 (1) a) and 12.4.2 (1) b): Weld seams with particular quality acc. to DIN 15018-1:		
		special quality	25 %	100 %
		standard quality		
		- existing stress in the weld seam $\geq 0.8 \cdot \sigma_{zul}$	25 %	100 %
		- existing stress in the weld seam $< 0.8 \cdot \sigma_{zul}$	10 %	25 %
		- Surface inspection of weld seams according to clause 12.4.2 (1) c)	10 %	25 %
		eb) If the design was performed in accordance with the provisions of clauses 6.1.1 (1) b), 7.1.1 (1) b) or 8.1.1 (1) b)		
		- Visual inspection of weld surfaces	25 %	25 %
		- Tests and inspections on weld seams in the load path:		
		• Testing of weld seams according to clause 12.4.2 (2) aa):		
		- Surface inspection	25 %	100 %
		- Ultrasonic or radiographic testing	25 %	100 %
		• Surface inspection of weld seams according to clause 12.4.2 (2) ab)	25 %	100 %
		• Testing of weld seams according to clause 12.4.2 (2) ac):		
		- Surface inspection	25 %	100 %
		- Ultrasonic or radiographic testing	25 %	100 %
		• Testing of weld seams according to clause 12.4.2 (2) ad):		
		- Surface inspection	25 %	100 %
		- Ultrasonic or radiographic testing in the case of full penetration welds	10 %	20 %
		• Testing of weld seams according to clause 12.4.2 (2) ae):		
		- Surface inspection	10 %	20 %
		- Ultrasonic or radiographic testing in the case of full penetration welds	10 %	10 %
		- Tests and inspections on weld seams not in the load path according to clause 12.4.2 (2) c) that are classified into execution class EXC3 or EXC4	10 %	25 %
		f) Examination of repair welds in acc. with a design-approved repair welding procedure specification	X	X
		g) Observance of the design requirements and bolting torque of preloaded bolted connections	10 %	10 %

Table 12-1: Extent of final inspection for series-production electric hoists with rope (continued on next pages)

Ser. No.	Component	Tests and inspections	Tests and inspections by authorized inspector in acc. with § 20 of the Atomic Energy Act for lifting equipment acc. to KTA 3902	
			section 4.2	section 4.3 or 4.4
		h) Fabrication tolerances of running wheels and their bearings as well as trolley travelling rails in acc. with tolerance class 2 of ISO 12488-1	—	—
		i) Fabrication tolerances of craneways in accordance with tolerance class 2 of VDI 3576	—	—
2	Hoists from the motor up to and incl. the carrying rope			
2.1	General	Check for compliance of complete assembly with the design approval documents	X	X
2.2	Motors	Recording in accordance with Form C-10	X	X
2.3	Brakes, couplings, rope sheaves and rope terminations	Proof of suitability of individually fabricated parts for compliance with the design data		
		a) Recording according to Form C-5	X	X
		b) Compliance of manufacturer's data in Forms C-4 and C-6 to C-9 with the design data	X	X
2.4	Gear boxes			
2.4.1	General	a) Compliance of the design with the data in Form C-1	—	—
		b) Submission of inspection certificates according to section 12.3	X	X
		c) Manufacturer's identification marks on antifriction bearings for compliance with the design approval documents	X	X
		d) Check for compliance of dimensions and assembly with design approval documents including the filled-in Form C-1	X	X
2.4.2	Gear box housings	a) Review of the design in accordance with the design approved documents	—	—
		In addition, on newly manufactured gear box housings in the case of welded design:		
		b) Adherence to dimensions for weld preparation	—	—
		c) Observance of welding data	X	X
		d) Non-destructive testing of weld seams		
		da) If the design was performed in accordance with the provisions of clauses 6.1.1 (1) a), 7.1.1 (1) a) or 8.1.1 (1) a)		
		- Visual inspection of weld surfaces	25 %	25 %
		- Surface inspection of weld seams according to clause 12.4.2 (1) c)	10 %	25 %
		db) If the design was performed in accordance with the provisions of clauses 6.1.1 (1) b), 7.1.1 (1) b) or 8.1.1 (1) b)		
		- Visual inspection of weld surfaces	25 %	25 %
		- Surface inspection of weld seams according to clause 12.4.2 (2) bb)	25 %	100 %
		- Surface inspection of weld seams according to clause 12.4.2 (2) bc)	10 %	25 %
		e) Examination of repair welds in acc. with a design-approved repair welding procedure specification	X	X
		f) Surface inspection at machined bearings in acc. with Annex B	X	X
2.4.3	Gears and pinion shafts	a) Surface inspection of tooth flanks in finished condition	—	100 %
		In addition, in the case of welded design:		
		b) Observance of welding data	—	—
		c) Surface inspection of weld seams specified in the test and inspection sequence plan for final inspection	25 %	25 %
2.4.4	Axles and shafts	Surface inspection in finished condition	25 %	100 %

Table 12-1: Extent of final inspection for series-production electric hoists with rope (continued)

Ser. No.	Component	Tests and inspections	Tests and inspections by authorized inspector in acc. with § 20 of the Atomic Energy Act for lifting equipment acc. to KTA 3902	
			section 4.2	section 4.3 or 4.4
2.5	Interference fits	Attestation that the design of interference fits conforms to the state-of-the-art	—	—
2.6	Ropes and rope terminations	a) Rope identification mark for compliance with the data indicated on the certificate	X	X
		b) Rope dimensions and rope terminations for compliance of data with design approval documents	X	X
2.7	Rope drums	a) Check for compliance of dimensions and assembly with design approval documents	X	X
		b) Submission of inspection certificates according to section 12.3	X	X
		c) Observance of welding data	—	—
		d) Non-destructive testing of weld seams specified in the test and inspection sequence plan for final inspection:		
		da) If the design was performed in accordance with the provisions of clauses 6.1.1 (1) a), 7.1.1 (1) a) or 8.1.1 (1) a) The weld seams subject to non-destructive testing shall be fixed in acc. with DIN 15018-1, Table 24.		
		- Visual inspection of weld surfaces	25 %	25 %
		- Surface inspection as well as ultrasonic or radiographic testing on weld seams according to clauses 12.4.2 (1) a) and 12.4.2 (1) b): Weld seams with particular quality acc. to DIN 15018-1:		
		special quality	25 %	100 %
		standard quality		
		- existing stress in the weld seam $\geq 0.8 \cdot \sigma_{zul}$	25 %	100 %
		- existing stress in the weld seam $< 0.8 \cdot \sigma_{zul}$	10 %	25 %
		- Surface inspection according to clause 12.4.2 (1) c)	10 %	25 %
		db) If the design was performed in accordance with the provisions of clauses 6.1.1 (1) b), 7.1.1 (1) b) or 8.1.1 (1) b)		
		- Visual inspection of weld surfaces	25 %	25 %
		- Tests and inspections on weld seams in the load path:		
		• Testing of weld seams according to clause 12.4.2 (2) aa):		
		- Surface inspection	25 %	100 %
		- Ultrasonic or radiographic testing	25 %	100 %
		• Surface inspection of weld seams according to clause 12.4.2 (2) ab)	25 %	100 %
		• Testing of weld seams according to clause 12.4.2 (2) ac):		
		- Surface inspection	25 %	100 %
		- Ultrasonic or radiographic testing	25 %	100 %
		• Testing of weld seams according to clause 12.4.2 (2) ad):		
		- Surface inspection	25 %	100 %
		- Ultrasonic or radiographic testing in the case of full penetration welds	10 %	20 %
		• Testing of weld seams according to clause 12.4.2 (2) ae):		
		- Surface inspection	10 %	20 %
		- Ultrasonic or radiographic testing in the case of full penetration welds	10 %	10 %
		e) Manufacturer's identification marks on antifriction bearings for compliance with the design approval documents	X	X

Table 12-1: Extent of final inspection for series-production electric hoists with rope (continued)

Ser. No.	Component	Tests and inspections	Tests and inspections by authorized inspector in acc. with § 20 of the Atomic Energy Act for lifting equipment acc. to KTA 3902	
			section 4.2	section 4.3 or 4.4
3	Bottom block with load hook	a) Receiving inspection of identification marks and stampings, if any, on the product forms	—	
		b) Submission of inspection certificates according to clause 12.3	X	
		c) Load hook identification for compliance with the data in the certificate	X	
		d) Check for compliance of dimensions and assembly with design approval documents	X	
		e) Observance of welding data	X	
		f) Non-destructive testing of weld seams specified in the test and inspection sequence plan for final inspection:		
		fa) If the design was performed in accordance with the provisions of clauses 6.1.1 (1) a), 7.1.1 (1) a) or 8.1.1 (1) a) The weld seams subject to non-destructive testing shall be fixed in acc. with DIN 15018-1, Table 24. - Visual inspection of weld surfaces	25 %	
		- Surface inspection as well as ultrasonic or radiographic testing on weld seams according to clauses 12.4.2 (1) a) and 12.4.2 (1) b): Weld seams with particular quality acc. to DIN 15018-1: special quality	25 %	
		standard quality		
		- existing stress in the weld seam $\geq 0.8 \cdot \sigma_{zul}$	25 %	
		- existing stress in the weld seam $< 0.8 \cdot \sigma_{zul}$	10 %	
		- Surface inspection according to clause 12.4.2 (1) c)	10 %	
		fb) If the design was performed in accordance with the provisions of clauses 6.1.1 (1) b), 7.1.1 (1) b) or 8.1.1 (1) b) - Visual inspection of weld surfaces	25 %	
		- Tests and inspections on weld seams in the load path according to clause 12.4.2 (2) a): • Surface inspection as well as ultrasonic or radiographic testing of transverse butt welds and partial penetration welds in butt joints	25 %	
		• Surface inspection of transverse fillet welds	10 %	
		• Surface inspection as well as ultrasonic or radiographic testing of other longitudinal welds in the load path	10 %	
		- Tests and inspections on weld seams not in the load path according to clause 12.4.2 (2) c)	10 %	
		g) Surface inspection within the area of machined surfaces in finished condition	25 %	
		h) Surface inspection of load hook saddle	100 %	
		i) Manufacturer's identification marks on antifriction bearings for compliance with the design approval documents	X	

Table 12-1: Extent of final inspection for series-production electric hoists with rope (continued)

Ser. No.	Component	Tests and inspections	Tests and inspections by authorized inspector in acc. with § 20 of the Atomic Energy Act for lifting equipment acc. to KTA 3902	
			section 4.2	section 4.3 or 4.4
4	Electrical equipment	a) Check for compliance of the construction with the design approval documents	X	X
		b) Check of identification marking of electrical components (rating plate) for compliance with design approval documents, cabling	X	X
		c) Check of wiring, connections, line penetrations, and fuse protection	X	X
5	Series-production electric hoist	Trial run on test bench at the manufacturer's works in accordance with Form C-10	X	X
X Partial inspection by authorized inspector, i.e. inspection to enable the inspector to confirm that the objectives of the respective inspection stage have been attained. — No inspection by the inspector. % Percentage share of inspection by the authorized inspector.				

Table 12-1: Extent of final inspection for series-production electric hoists with rope (continued)

Ser. No.	Component	Tests and inspections	Tests and inspections by authorized inspector in acc. with § 20 of the Atomic Energy Act for lifting equipment acc. to KTA 3902	
			section 4.2	section 4.3 or 4.4
1	General	a) Compliance of the design with the data in Form C-1	—	—
		b) Submission of inspection certificates according to section 12.3	X	X
		c) Manufacturer's identification marks on antifriction bearings for compliance with the design approval documents	X	X
		d) Check for compliance of dimensions and assembly with the design approval documents including the filled-in Form C-1	X	X
		e) Trial run under part load (recording in acc. with Form C-2)	—	X
2	Gear box housings	a) Review of the design in acc. with the design approval documents	—	—
		b) Surface inspection at machined bearings according to Annex B	X	X
3	Gears and pinion shafts	a) Surface inspection of tooth flanks in finished condition	—	100 %
		In addition, in the case of welded design:	—	—
		b) Adherence to dimensions for weld preparation	—	—
		c) Surface inspection of weld seams specified in the test and inspection sequence plan for final inspection	25 %	25 %
4	Axles and shafts	Surface inspection in finished condition	25 %	100 %
5	Interference fits	Confirmation that interference fits have been designed to the state of technology	—	—
X inspection by authorized inspector, i.e. inspection to enable the inspector to confirm that the objectives of the respective inspection stage have been attained. — No inspection by the inspector. % Percentage share of inspection by the authorized inspector.				

Table 12-2: Extent of final inspection for series-production hoist gear boxes

Annex A

Materials test sheets (WPB)

List of material test sheets

WPB Part group 1: Structures	
1.1	Hot rolled plates and sheets, strips, wide flats and steel sections of structural carbon steel according to DIN EN 10025-2
1.2	Hot rolled bars made of structural carbon steels according to DIN EN 10025-2
1.3	Forged bars and open-die forgings made of general structural steels according to DIN EN 10250-2
1.4	Welded tubes made of carbon steels according to DIN EN 10217-1
1.5	Seamless tubes made of carbon steels according to DIN EN 10216-1
1.6	Seamless or welded hot finished hollow sections of structural carbon steels according to DIN EN 10210-1
1.7	Bolts and nuts $\leq$ M 39 according to DIN EN ISO 898-1, DIN EN ISO 898-2 and DIN EN ISO 3269 as well as for high-strength bolted connections
1.8	Plates, sheets and strips made of quenched and tempered steels according to DIN EN 10025-6

WPB Part group 2: Gear boxes and drive parts for hoists (machine parts between motor coupling and load supporting means)	
2.1	Hot rolled plates and sheets, strips, wide flats and steel sections of structural carbon steel according to DIN EN 10025-2
2.2	Hot rolled bars made of structural carbon steels according to DIN EN 10025-2
2.3	Forged bars and open-die forgings made of general structural steels according to DIN EN 10250-2
2.4	Bars and forgings made of quenched and tempered steels according to DIN EN ISO 683-1, DIN EN ISO 683-2 or SEW 550
2.5	Induction or flame hardened gears and pinion shafts of material quality MQ according to DIN 3990-5
2.6	Gas nitrided gears and pinion shafts of material quality MQ according to DIN 3990-5
2.7	Bars and forgings made of case-hardened steels according to DIN EN ISO 683-3
2.8	Gears and pinion shafts of material quality MQ according to DIN 3990-5 made of case-hardened steels according to DIN EN ISO 683-3
2.9	Bars and forgings made of nitrided steels according to DIN EN 10085
2.10	Plates, sheets and strips made of austenitic steels according to DIN EN 10088-2
2.11	Bars and forgings made of austenitic steels according to DIN EN 10088-3 or DIN EN 10250-4
2.12	Bars and forgings made of stainless martensitic steels according to DIN EN 10088-3 or DIN EN 10250-4

WPB Part group 3: Supporting means, load suspension devices and lifting accessories	
3.1	Hot rolled plates and sheets, strips, wide flats and steel sections of structural carbon steel according to DIN EN 10025-2
3.2	Hot rolled bars made of structural carbon steels according to DIN EN 10025-2
3.3	Forged bars and open-die forgings made of general structural steels according to DIN EN 10250-2
3.4	Welded tubes made of carbon steels according to DIN EN 10217-1
3.5	Seamless tubes made of carbon steels according to DIN EN 10216-1
3.6	Seamless or welded hot finished hollow sections of structural carbon steels according to DIN EN 10210-1
3.7	Bars and forgings made of quenched and tempered steels according to DIN EN ISO 683-1, DIN EN ISO 683-2 or SEW 550
3.8	Forged load hooks according to DIN 15400
3.9	Bars and forgings for load hook nuts according to DIN 15413 made of quenched and tempered steels according to DIN EN ISO 683-1, DIN EN ISO 683-2 or SEW 550
3.10	Bars and forgings for load hook lifting beams made of quenched and tempered steels according to DIN EN ISO 683-1, DIN EN ISO 683-2 or SEW 550
3.11	Plates, sheets and strips made of austenitic steels according to DIN EN 10088-2 and of ferritic-austenitic steels according to DIN EN 10028-7
3.12	Bars and forgings made of austenitic steels according to DIN EN 10088-3 or DIN EN 10250-4 and of ferritic-austenitic steels according to DIN EN 10222-5 or DIN EN 10272
3.13	Seamless tubes made of austenitic steels according to DIN EN 10216-5
3.14	Forged load hooks made of austenitic steels according to DIN EN 10250-4
3.15	Bars and forgings for load hook nuts made of austenitic steels according to DIN EN 10088-3 or DIN EN 10250-4
3.16	Bars and forgings for load hook lifting beams made of austenitic steels according to DIN EN 10088-3 or DIN EN 10250-4
3.17	Bolts and studs, thread rolled, head bolts with forged-on head, and subsequently heat-treated
3.18	Steel wire ropes according to DIN EN 12385-1 and DIN EN 12385-2 as well as non-standard ropes
3.19	Wire rope slings according to DIN EN 13414-1, DIN EN 13414-2 and DIN EN 13414-3
3.20	Chain slings according to DIN EN 818-4 as well as components for lifting accessories according to DIN EN 1677-1, DIN EN 1677-2, DIN EN 1677-3 and DIN EN 1677-4
3.21	Welded tubes made of austenitic steels according to DIN EN 10217-7
3.22	Bars and forgings made of stainless martensitic steels according to DIN EN 10088-3 or DIN EN 10250-4
3.23	Bolts and nuts $\leq$ M 39 according to DIN EN ISO 898-1, DIN EN ISO 898-2 and DIN EN ISO 3269
3.24	Bolts and nuts made of austenitic steels according to DIN EN ISO 3506-1, DIN EN ISO 3506-2 and DIN EN ISO 3269
3.25	Terminations with ferrules according to DIN EN 13411-3 for steel wire ropes
3.26	Terminations with ferrules for wire rope slings according to DIN EN 13414-1
3.27	Plates, sheets and strips made of quenched and tempered steels according to DIN EN 10025-6

WPB Part group 4: Running wheels and their axles and shafts	
4.1	Hot rolled parts made of structural carbon steels according to DIN EN 10025-2
4.2	Forged parts made of structural carbon steels according to DIN EN 10250-2
4.3	Forged or rolled parts made of quenched and tempered steels according to DIN EN ISO 683-1, DIN EN ISO 683-2 or SEW 550
4.4	Bright steel made of carbon steels according to DIN EN 10277
4.5	Running wheels made of cast steel according to DIN EN 10293 or cast steel for pressure vessels according to DIN EN 10213

WPB Part group 5: Other parts for hoists	
5.1	Brake disks made of spheroidal graphite cast iron according to DIN EN 1563
5.2	Hot rolled plates and sheets of structural carbon steel according to DIN EN 10025-2 for brake drums and brake disks

Materials test sheet 1.1: Hot rolled plates and sheets, strips, wide flats and steel sections of structural carbon steel according to DIN EN 10025-2

MATERIALS TEST SHEET		WPB 1.1
Part group:	Structures	
Product form:	Hot rolled plates and sheets, strips, wide flats and steel sections	
Materials:	S235J0 ¹⁾ (1.0114), S235J2 (1.0117), S235JR (1.0038), S355J2 (1.0577), S355K2 (1.0596)	
Requirements:	DIN EN 10025-1, DIN EN 10025-2 ²⁾ , DIN EN 10164	
Tests and inspections	Inspection certificate according to DIN EN 10204 Classification of lifting equipment in acc. with KTA 3902: additional requirements according to section 4.2 increased requirements according to section 4.3 or 4.4	
1. Chemical composition: Ladle analysis	3.1	3.1
2. Attestation of heat treatment condition or of as-delivered condition	3.1	3.1
3. Tensile test at room temperature:		
3.1 One test per lot delivered	3.1	—
3.2 One specimen per melt and test unit	—	3.1
3.3 Three tensile specimens in thickness direction for product thicknesses > 20 mm and tensile stress in thickness direction: Test unit according to DIN EN 10164 ³⁾ Quality class Z 25 according to DIN EN 10164	—	3.1
4. Notched bar impact test at test temperature according to DIN EN 10025-2:		
4.1 One test per lot delivered	3.1	—
4.2 One set of impact test specimen per tensile test specimen as per no. 3.2 as far as the nominal dimension is ≥ 6 mm	—	3.1
5. Visual inspection and dimensional check: Each part	—	3.1
See Table 7-1 ser. no. 1 c) regarding ultrasonic testing of parts under tensile stress in thickness direction.		
Material identification: Manufacturer's mark, steel grade, melt number, specimen number or identification number (the plate, sheet or strip number may also be used as specimen number), inspector's mark, Z 25 (if demonstrated); for lifting equipment according to KTA 3902 section 4.2 only manufacturer's mark and steel grade		
1) For the material S235J0 inspection certificate 2.2 will suffice if the lifting equipment is classified under KTA 3902, section 4.2. 2) Repair welding is not permitted. 3) Where the materials S235J0 and S235JR are loaded in thickness direction, the test shall be performed on each rolled panel in acc. with test no. 3.3.		