

# Safety Standards

of the  
Nuclear Safety Standards Commission (KTA)

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**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.

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# KTA SAFETY STANDARD

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

KTA 3903

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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 20<sup>th</sup>, 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:

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### 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:

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

- a) assignment,
- b) weld geometry,
- c) base metals, weld filler metals and consumables,
- d) welding procedure,
- e) heat treatment,
- f) welder's qualification/qualification of operating personnel of fully mechanized and automatic welding units,
- g) quality level,
- h) welding data.

**Note:**

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

### 5.1.8 Documents regarding electrical equipment

- a) schematic diagrams,
- b) circuit diagrams,

- c) layout plans for control cabinets, control panels and control units,
- d) parts lists specifying technical data,
- e) data sheets of drive components and converters
- f) 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

- a) schematic diagrams,
- b) functional sequence plan,
- c) strength calculations,
- d) 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	<b>Structures, running wheels (incl. wheel bearing of lateral transport drives)</b>	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	<b>Hoists from the motor up to and incl. the carrying rope</b>			
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 ( <b>Form C-3 to C-9</b> )	X	X
2.4	Gear boxes			
2.4.1	General	a) Compliance of the design with the data in <b>Form C-1</b>	—	—
		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 <b>Form C-1</b>	X	X
		e) Trial run under part load (recording in acc. with <b>Form C-2</b> )	—	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 %
		e) Examination of repair welds in acc. with a design-approved repair welding procedure specification	X	X
2.4.4	Axles and shafts	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	<b>Load supporting means, load suspension devices and lifting accessories</b>	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 %
		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	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 <b>Annex A</b> as well as in areas where periodic surface inspections have to be performed in acc. with <b>Table 10-1</b> .	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	<b>Electrical, hydraulic and pneumatic equipment</b>	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
<p>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.</p> <p>— No inspection by the inspector.</p> <p>% Percentage share of inspection by the authorized inspector.</p>				

**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:

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

Note:  
For the establishment of operating and maintenance instructions see also DIN EN 82079-1.
- documentation and certification of tests and inspections performed in acc. with sections 5 and 7,
- 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	<b>Cranes, winches, trolleys and refuelling machines</b>	
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 derailing, 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 <ul style="list-style-type: none"> <li>a) Power supply Physical ambient and operating conditions</li> <li>b) Power supply to crane, trolleys or refuelling machines, wiring technique</li> <li>c) Switchgears and distribution panels: Accessibility, structure and marking</li> <li>d) Electric mains, electric main connection switch, crane disconnecting switch, crane switch</li> <li>e) Control stands, operating equipment, wireless controls, control stands interlocks, emergency stop devices</li> <li>f) Electric motor and related equipment</li> <li>g) Check of protection conditions by automatic switch-off of power supply</li> <li>h) Equipotential bonding</li> <li>i) Check of insulation resistances of main circuits</li> <li>j) Protection against direct or indirect contact</li> <li>k) Monitoring measures in auxiliary circuits and control circuits</li> <li>l) Overcurrent protective devices for main and control circuits</li> <li>m) Phase sequence monitoring</li> <li>n) User programmable or parameterizable systems performing functions classified into Performance Levels c, d or e as per Annex E of KTA 3902</li> <li>o) Identification marking, danger signs, protective devices</li> <li>p) Electromagnetic compatibility (field-excited and conducted electromagnetic interferences)</li> </ul>	DIN EN 60204-32, sections 4.3 and 4.4 DIN EN 60204-32, sections 12 and 13 DIN VDE 0100-520 DIN EN 60204-32, sections 11 and 16 DIN EN 60204-32, section 5 KTA 3902, clause 8.5 b) 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 DIN EN 60204-32, section 14 DIN EN 60204-32, section 18.2 DIN EN 60204-32, section 8 DIN EN 60204-32, section 18.3 DIN EN 60204-32 sections 6.2 and 6.3 DGUV 3 § 4 DIN EN 60204-32 section 9.1 DIN EN 60204-32, sections 7.2 to 7.4 DIN EN 60204-32, section 7.8 KTA 3902, sub-clause 6.5.2 (2) Comparison of software and parameters with the condition examined before DIN VDE 0105-100 DIN EN 60204-32, sections 9.3 and 16 DGUV 3 DIN EN 61000-6-4 DIN EN 61800-3
1.3	Functional testing <ul style="list-style-type: none"> <li>a) - drives - wireless controls - general functions - functions classified into Performance Levels a through e as per Annex E of KTA 3902</li> <li>b) Maximum speed of floor-operated cranes</li> <li>c) Safety distances</li> <li>d) Rope drives: safety windings, unimpeded movement of ropes</li> </ul>	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 DIN EN 13557, section 5.1.9 DGUV 53 § 17 DGUV 53 § 11 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	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	<b>Load suspension devices and lifting accessories</b>		
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 <b>Annex A</b> )	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:

- for hoists with double drive mechanism chain the completion of the already begun transport operation as specified,
- 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

- drop of load,
- overloading of transport equipment (oblique tensile loading) or load attachment points,
- damage to safety-relevant devices,
- 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	
<b>1</b>	<b>Lifts in reactor containments</b>	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
<b>2</b>	<b>Cranes, winches, trolleys and refuelling machines</b>		
2.1	<b>Mechanical components</b>		
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 <sup>1)</sup>
		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 <sup>1)</sup> . 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 <sup>2)</sup> 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 <b>Annex D</b> ) 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 <b>Annex D</b> . 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	<b>Electrical equipment</b>		
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 <sup>2)</sup> 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 <sup>2)</sup> 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 <sup>2)</sup> 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 <sup>2)</sup> 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 <sup>2)</sup> 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 <sup>2)</sup> 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
<p>1) In exceptional cases, if the reference diameter value is not known, the nominal diameter value may be used as reference diameter value.</p> <p>2) 6 years where it is proved in each individual case that for these parts utilization reserves</p> $\frac{D}{S} = \frac{\text{theoretical period of utilization}}{\text{consumed portion of theoretical period of utilization}} > 1.5$ <p>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.</p> <p>This does not apply to parts made of austenitic materials where the risk of stress corrosion cracking may occur.</p>		

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	<b>Running wheels (incl. wheel bearing of lateral transport drives) with related structures</b>	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	<b>Hoists from the motor up to and incl. the carrying rope</b>			
2.1	General	Check for compliance of complete assembly with the design approval documents	X	X
2.2	Motors	Recording in accordance with <b>Form C-10</b>	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 <b>Form C-5</b> b) Compliance of manufacturer's data in <b>Forms C-4</b> and <b>C-6</b> to <b>C-9</b> with the design data	X X	X X
2.4	Gear boxes			
2.4.1	General	a) Compliance of the design with the data in <b>Form C-1</b> b) Submission of inspection certificates according to section 12.3 c) Manufacturer's identification marks on antifriction bearings for compliance with the design approval documents d) Check for compliance of dimensions and assembly with design approval documents including the filled-in <b>Form C-1</b>	— X X X	— X 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 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 - Surface inspection of weld seams according to clause 12.4.2 (1) c) 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 - Surface inspection of weld seams according to clause 12.4.2 (2) bb) - Surface inspection of weld seams according to clause 12.4.2 (2) bc) e) Examination of repair welds in acc. with a design-approved repair welding procedure specification f) Surface inspection at machined bearings in acc. with <b>Annex B</b>	— — X — 25 % 10 % 25 % 25 % 10 % X X	— — X X 25 % 25 % 100 % 25 % X X
2.4.3	Gears and pinion shafts	a) Surface inspection of tooth flanks in finished condition 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 %	100 % — 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	<b>Bottom block with load hook</b>	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	<b>Electrical equipment</b>	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	<b>Series-production electric hoist</b>	Trial run on test bench at the manufacturer's works in accordance with <b>Form C-10</b>	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 <b>Form C-1</b>	—	—
		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 <b>Form C-1</b>	X	X
		e) Trial run under part load (recording in acc. with <b>Form C-2</b> )	—	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 <b>Annex B</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

<b>MATERIALS TEST SHEET</b>		<b>WPB 1.1</b>
Part group:	Structures	
Product form:	Hot rolled plates and sheets, strips, wide flats and steel sections	
Materials:	S235J0 <sup>1)</sup> (1.0114), S235J2 (1.0117), S235JR (1.0038), S355J2 (1.0577), S355K2 (1.0596)	
Requirements:	DIN EN 10025-1, DIN EN 10025-2 <sup>2)</sup> , 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 ac- cording 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 <sup>3)</sup> 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 <b>Table 7-1</b> ser. no. 1 c) regarding ultrasonic testing of parts under tensile stress in thickness direction.		
<p>Material identification:</p> <p>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</p>		
<p>1) For the material S235J0 inspection certificate 2.2 will suffice if the lifting equipment is classified under KTA 3902, section 4.2.</p> <p>2) Repair welding is not permitted.</p> <p>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.</p>		

**Materials test sheet 1.2:** Hot rolled bars made of structural carbon steels according to DIN EN 10025-2

<b>MATERIALS TEST SHEET</b>		<b>WPB 1.2</b>
Part group:	Structures	
Product form:	Hot-rolled bars	
Materials:	S235J0 (1.0114) <sup>1)</sup> , S235J2 (1.0117), S235JR (1.0038), S355J2 (1.0577), S355K2 (1.0596)	
Requirements:	DIN EN 10025-1, DIN EN 10025-2 <sup>2)</sup>	
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 ac- cording 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
4. Notched bar impact test at test temperature according to DIN EN 10025-2 and nominal dimensions according to DIN EN 10025-1:		
4.1 One test per lot delivered	3.1	—
4.2 One set of impact test specimen per tensile test speci- men as per no. 3.2	—	3.1
5. Visual inspection and dimensional check:		
Each part	—	3.1
<p>Material identification:</p> <p>Manufacturer's mark, steel grade, melt number, specimen number or identification number, inspector's mark; for lifting equipment according to KTA 3902 section 4.2 only manufacturer's mark and steel grade</p>		
<p>1) For the material S235J0 inspection certificate 2.2 will suffice if the lifting equipment is classified under KTA 3902, section 4.2.</p> <p>2) Repair welding is not permitted.</p>		

**Materials test sheet 1.3:** Forged bars and open-die forgings made of general structural steels according to DIN EN 10250-2

<b>MATERIALS TEST SHEET</b>		<b>WPB 1.3</b>
Part group:	Structures	
Product form:	Forged bars and open-die forgings	
Materials:	S235JRG2 (1.0038), S235J2G3 (1.0116), S355J2G3 (1.0570)	
Requirements:	DIN EN 10250-1, DIN EN 10250-2 <sup>1)</sup>	
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 ac- cording to section 4.3 or 4.4
1. Chemical composition: Ladle analysis	3.1	3.1
2. Attestation of heat treatment condition	3.1	3.1
3. Tensile test at room temperature: One specimen per melt and test unit	3.1	3.1
4. Notched bar impact test at test temperature according to DIN EN 10250-2: One set of impact test specimen per tensile test specimen as far as the nominal dimension is $\geq 15$ mm	3.1	3.1
5. Visual inspection and dimensional check: Each part	3.1	3.1
Material identification: Manufacturer's mark, steel grade, melt number, specimen number or identification number, inspector's mark		
<sup>1)</sup> Repair welding is not permitted.		

**Materials test sheet 1.4:** Welded tubes made of carbon steels according to DIN EN 10217-1

<b>MATERIALS TEST SHEET</b>		<b>WPB 1.4</b>	
Part group:	Structures		
Product form:	Welded tubes		
Materials:	P235TR1 <sup>1)</sup> (1.0254), P235TR2 (1.0255), P265TR1 (1.0258), P265TR2 (1.0259)		
Requirements:	DIN EN 10217-1 <sup>2)</sup>		
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 ac- cording 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 (base material):			
3.1 One test per lot delivered	3.1	—	
3.2 Lot size and extent of testing in acc. with DIN EN 10217-1 no. 10.1, Table 12 and Table 13	—	3.1	
4. Tensile test at room temperature transverse to the weld seam (at an outside diameter $D_A > 508$ mm):			
4.1 One test per lot delivered	3.1	—	
4.2 Lot size and extent of testing in acc. with DIN EN 10217-1 no.10.1, Table 12 and Table 13	—	3.1	
5. Notched bar impact test at test temperature of 0 °C (base material) in the case of materials no. 1.0255 and 1.0259: One set of impact test specimen per tensile test spec- imen	—	3.1	
6. Flattening test or drift-expanding test:			
6.1 One test per lot delivered	3.1	—	
6.2 Lot size and extent of testing in acc. with DIN EN 10217-1 no.10.1, Table 12 and Table 13	—	3.1	
7. Weld bend test on submerged-arc welded tubes:			
7.1 One test per lot delivered	3.1	—	
7.2 Lot size and extent of testing in acc. with DIN EN 10217-1 no. 10.1, Table 12 and Table 13	—	3.1	
8. Non-destructive testing of weld seam: In acc. with section 11.11 of DIN EN 10217-1	3.1	3.1	
9. Tightness test: Each tube in acc. with section 11.8 of DIN EN 10217-1	3.1	3.1	
10. Visual inspection and dimensional check: Each tube	3.1	3.1	
Material identification: Manufacturer's mark, steel grade, melt number, specimen number or identification number, inspector's mark, type of tube in acc. with DIN EN 10217-1 Table 1; for lifting equipment according to KTA 3902 section 4.2 only manufacturer's mark, steel grade and type of tube.			
1) For the materials P235TR1 and P265TR1 inspection certificate 2.2 will suffice if the lifting equipment is classified under KTA 3902, section 4.2.			
2) Repair welding in the base material is not permitted.			

**Materials test sheet 1.5:** Seamless tubes made of carbon steels according to DIN EN 10216-1

<b>MATERIALS TEST SHEET</b>		<b>WPB 1.5</b>	
Part group:	Structures		
Product form:	Seamless tubes		
Materials:	P235TR1 <sup>1)</sup> (1.0254), P235TR2 (1.0255), P265TR1 <sup>1)</sup> (1.0258), P265TR2 (1.0259)		
Requirements:	DIN EN 10216-1 <sup>2)</sup>		
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 ac- cording 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 Lot size and extent of testing in acc. with DIN EN 10216-1 no.10.1, Table 10 and Table 11	—	3.1	
4. Notched bar impact test at test temperature of 0 °C in the case of materials no. 1.0255 and 1.0259: One set of impact test specimen per tensile test speci- men	3.1	3.1	
5. Tightness test: Each tube in acc. with sec. 11.4 of DIN EN 10216-1	3.1	3.1	
6. Visual inspection and dimensional check: Each tube	3.1	3.1	
<p>Material identification:</p> <p>Manufacturer's mark, steel grade, melt number, specimen number or identification number, inspector's mark; for lifting equipment according to KTA 3902 section 4.2 only manufacturer's mark and steel grade</p>			
<p><sup>1)</sup> For the materials P235TR1 and P265TR1 inspection certificate 2.2 will suffice if the lifting equipment is classified under KTA 3902, section 4.2.</p> <p><sup>2)</sup> Repair welding is not permitted.</p>			

**Materials test sheet 1.6:** Seamless or welded hot finished hollow sections of structural carbon steels according to DIN EN 10210-1

<b>MATERIALS TEST SHEET</b>		<b>WPB 1.6</b>
Part group:	Structures	
Product form:	Hot finished hollow sections (seamless or welded)	
Materials:	S275J0H <sup>1)</sup> (1.0149), S355J0H (1.0547), S275J2H (1.0138), S355J2H 1.0576)	
Requirements:	DIN EN 10210-1 <sup>2)</sup>	
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 ac- cording 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, test unit and nominal dimen- sion each	—	3.1
4. Notched bar impact test at test temperature according to DIN EN 10210-1: One set of impact test specimen per tensile test speci- men as far as the nominal dimension is $\geq 6$ mm	—	3.1
5. Visual inspection and dimensional check: Each part	3.1	3.1
6. Non-destructive testing of weld seam: Each part over its full length in acc. with section 9.4 of DIN EN 10210-1	—	3.1
<p>Material identification:</p> <p>Manufacturer's mark, steel grade, melt number, specimen number or identification number, inspector's mark; for lifting equipment according to KTA 3902 section 4.2 only manufacturer's mark and steel grade</p>		
<p>1) For the materials S275J0H and S355J0H inspection certificate 2.2 will suffice if the lifting equipment is classified under KTA 3902, section 4.2.</p> <p>2) Repair welding in the base material is not permitted.</p>		



**Materials test sheet 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

<b>MATERIALS TEST SHEET</b>		<b>WPB 1.7</b>
Part group:	Structures	
Product form:	Bolts and nuts $\leq$ M 39	
Materials:	Property classes Bolts 4.6, 5.6, 6.8, 8.8 and 10.9 Nuts 5, 6, 8 and 10	
Requirements:	<p>Bolts: DIN EN ISO 898-1, DIN EN ISO 3269, DIN EN 26157-3 (Testing of mechanical properties in accordance with DIN EN ISO 898-1, test series MP1. Where test series MP1 is not practicable, test series FF1 plus retempering test may be performed on bolts of property classes 8.8 and 10.9.)</p> <p>Nuts: DIN EN ISO 898-2, DIN EN ISO 3269, DIN EN ISO 6157-2</p> <p>For high-strength bolted connections (10.9) additionally: bolts and nuts acc. to DIN EN 14399-4 washers acc. to DIN EN 14399-6, DIN 6917 and DIN 6918 hexagon fit bolting assemblies acc. to DIN EN 14399-8</p> <p>In the case of electroplated corrosion protection coatings additionally: DIN EN ISO 4042</p> <p>In the case of hot dip galvanizing additionally: DIN EN ISO 10684 and guideline "Manufacture of hot dip galvanized bolts" [1]</p>	
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
Proof (by continuous recording in the manufacturer's works) that the requirements regarding mechanical properties, surface condition, corrosion protection coating and dimensional accuracy have been met	2.2 <sup>1)</sup> or 3.1 <sup>2)</sup>	2.2 <sup>1)</sup> or 3.1 <sup>2)</sup>
<p>Material identification:</p> <p>Bolts in acc. with DIN EN ISO 898-1, for high-strength bolting additionally in acc. with DIN EN 14399-4 Nuts in acc. with DIN EN ISO 898-2, for high-strength bolting additionally in acc. with DIN EN 14399-4 Washers for high-strength bolting in acc. with DIN EN 14399-6, DIN 6917 and DIN 6918 Hexagon fit bolts and nuts for high-strength bolted connections according to DIN EN 14399-8</p>		
<p>1) In lieu of the inspection certificate 2.2 stamping will suffice if the manufacturer is approved in acc. with VdTÜV technical leaflet MB WERK 1253/4.</p> <p>2) For bolts of property classes 8.8 and 10.9 as well as for nuts of property classes 8 and 10 an inspection certificate 3.1 is required.</p>		

**Materials test sheet 1.8:** Plates, sheets and strips made of quenched and tempered steels according to DIN EN 10025-6

<b>MATERIALS TEST SHEET</b>		<b>WPB 1.8</b>
Part group:	Structures	
Product form:	Plates, sheets and strips	
Materials:	S460QL1 (1.8916), S500QL1 (1.8984), S690QL1 (1.8988)	
Requirements:	DIN EN 10025-1, DIN EN 10025-6 <sup>1)</sup> , DIN EN 10163-2 class B3, 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 ac- cording to section 4.3 or 4.4
1. Chemical composition: Ladle analysis	3.1	3.1
2. Attestation of heat treatment condition	3.1	3.1
3. Tensile test at room temperature:		
3.1 One specimen per melt and test unit	3.1	3.1
3.2 Three tensile specimens in thickness direction for product thicknesses > 15 mm and tensile stress in thickness direction: Test unit according to DIN EN 10164 Quality class Z 25 according to DIN EN 10164	3.1	3.1
4. Notched bar impact test at test temperature according to DIN EN 10025-6: One set of impact test specimen per tensile test specimen as per no. 3.1 as far as the nominal thickness is ≥ 6 mm	3.1	3.1
5. Visual inspection and dimensional check: Each part	3.1	3.1
See <b>Table 7-1</b> 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)		
1) Repair welding is not permitted.		

**Materials test sheet 2.1:** Hot rolled plates and sheets, strips, wide flats and steel sections of structural carbon steel according to DIN EN 10025-2

<b>MATERIALS TEST SHEET</b>		<b>WPB 2.1</b>
Part group:	Gear boxes and drive parts for hoists (machine parts between motor coupling and load supporting means)	
Product form:	Hot rolled plates and sheets, strips, wide flats and steel sections	
Materials:	S235J0 (1.0114), S235J2 (1.0117), S235JR (1.0038), S355J2 (1.0577), S355K2 (1.0596)	
Requirements:	DIN EN 10025-1, DIN EN 10025-2 <sup>1)</sup> , 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 specimen per melt, test unit and thickness range each	3.1	3.1
3.2 Three tensile specimens in thickness direction for product thicknesses > 20 mm and tensile stress in thickness direction: Test unit according to DIN EN 10164 <sup>2)</sup> Quality class Z 25 according to DIN EN 10164	3.1	3.1
4. Notched bar impact test at test temperature to DIN EN 10025-2: One set of impact test specimen per tensile test specimen as per no. 3.1 as far as the nominal dimension is ≥ 6 mm	3.1	3.1
5. Visual inspection and dimensional check: Each part	3.1	3.1
<p>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)</p>		
<p><sup>1)</sup> Repair welding is not permitted.  <sup>2)</sup> 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. 3.2.</p>		

**Materials test sheet 2.2:** Hot rolled bars made of structural carbon steels according to DIN EN 10025-2

<b>MATERIALS TEST SHEET</b>		<b>WPB 2.2</b>
Part group:	Gear boxes and drive parts for hoists (machine parts between motor coupling and load supporting means)	
Product form:	Hot rolled bars	
Materials:	S235J0 (1.0114), S235J2 (1.0117), S235JR (1.0038), S355J2 (1.0577), S355K2 (1.0596)	
Requirements:	DIN EN 10025-1, DIN EN 10025-2 <sup>1)</sup>	
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 ac- cording 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: One specimen per melt, test unit and thickness range each	3.1	3.1
4. Notched bar impact test at test temperature according to DIN EN 10025-2 and nominal dimensions according to DIN EN 10025-1: One set of impact test specimens per tensile test specimen	3.1	3.1
5. Visual inspection and dimensional check: Each part	3.1	3.1
6. Ultrasonic testing: For bar steel with product thicknesses $\geq 30$ mm each part subject to 100 % in acc. with <b>Annex B</b>	3.1	3.1
Material identification: Manufacturer's mark, steel grade, melt number, specimen number or identification number, inspector's mark		
<sup>1)</sup> Repair welding is not permitted.		

**Materials test sheet 2.3:** Forged bars and open-die forgings made of general structural steels according to DIN EN 10250-2

<b>MATERIALS TEST SHEET</b>		<b>WPB 2.3</b>	
Part group:	Gear boxes and drive parts for hoists (machine parts between motor coupling and load supporting means)		
Product form:	Forged bars and open-die forgings		
Materials:	S235JRG2 (1.0038), S235J2G3 (1.0116), S355J2G3 (1.0570)		
Requirements:	DIN EN 10250-1, DIN EN 10250-2 <sup>1)</sup>		
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 ac- cording to section 4.3 or 4.4	
1. Chemical composition: Ladle analysis	3.1	3.1	
2. Attestation of heat treatment condition	3.1	3.1	
3. Tensile test at room temperature: One specimen per melt, test unit and thickness range each	3.1	3.1	
4. Notched bar impact test at test temperature to DIN EN 10250-2: One set of impact test specimens per tensile test specimen, as far as the nominal dimension is $\geq 15$ mm	3.1	3.1	
5. Visual inspection and dimensional check: Each part	3.1	3.1	
6. Ultrasonic testing: For bar steel with product thicknesses $\geq 30$ mm and forgings with a weight in final heat treatment condition $\geq 300$ kg, each part subject to 100 % in acc. with <b>An- nex B</b>	3.1	3.1	
Material identification: Manufacturer's mark, steel grade, melt number, specimen number or identification number, inspector's mark			
<sup>1)</sup> Repair welding is not permitted.			

**Materials test sheet 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

<b>MATERIALS TEST SHEET</b>		<b>WPB 2.4</b>
Part group:	Gear boxes and drive parts for hoists (machine parts between motor coupling and load supporting means)	
Product form:	Bars and forgings <sup>1)</sup>	
Materials:	Quenched and tempered steels according to DIN EN ISO 683-1, DIN EN ISO 683-2 or SEW 550	
Requirements:	DIN EN ISO 683-1 <sup>2)</sup> , DIN EN ISO 683-2 <sup>2)</sup> or SEW 550 <sup>2)</sup>	
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 ac- cording to section 4.3 or 4.4
1. Chemical composition: Ladle analysis	3.1	3.1
2. Attestation of heat treatment condition	3.1	3.1
3. Hardness test for verification of uniform heat treatment: On one end of each part three measuring points each	3.1	3.1
4. Tensile test at room temperature: One specimen per melt, dimensional range and heat treatment batch each	3.1	3.1
5. Notched bar impact test at room temperature: One set of impact test specimens per tensile test specimen, as far as the nominal dimension is $\geq 15$ mm	3.1	3.1
6. Visual inspection and dimensional check: Each part	3.1	3.1
7. Materials identification check for alloyed steels: Each part, e.g. by spectroscopy	3.1	3.1
8. Ultrasonic testing: For bar steel with product thicknesses $\geq 30$ mm and forgings with a weight in final heat treatment condition $\geq 300$ kg, each part subject to 100 % in acc. with <b>Annex B</b>	3.1	3.1
Material identification: Manufacturer's mark, steel grade, melt number, specimen number or identification number, inspector's mark		
<p>1) The product forms acc. to this materials test sheet also serve as initial material for gears and pinions acc. to NIEMANN (see KTA 3902 Table B 1-5) as well as acc. to DIN 3990-5 in acc. with material test sheets WPB 2.5 and WPB 2.6 (see KTA 3902 Table B 1-3).</p> <p>2) Repair welding is not permitted.</p>		

**Materials test sheet 2.5:** Induction or flame hardened gears and pinion shafts of material quality MQ according to DIN 3990-5

<b>MATERIALS TEST SHEET</b>		<b>WPB 2.5</b>
Part group:	Gear boxes and drive parts for hoists (only gears and pinion shafts according to DIN 3990-5)	
Product form:	Gears and pinion (material quality MQ) <sup>1)</sup>	
Materials:	C45E+N (1.1191), 42CrMo4 +QT (1.7225) according to WPB 2.4	
Requirements:	DIN EN ISO 683-1 <sup>2)</sup> , DIN EN ISO 683-2 <sup>2)</sup> , SEW 550 <sup>2)</sup> , DIN 3990-5	
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 ac- cording to section 4.3 or 4.4
1. Tests on production control test specimens (part of gear or pinion)		
1.1 Hardness depth	3.1	3.1
1.2 Decrease in hardness to core	2.1	2.1
1.3 Drop in hardness to edge	3.1	3.1
1.4 Hardness traverse	3.1	3.1
1.5 Edge structure	3.1	3.1
1.6 Percentage of ferrite in core structure	3.1	3.1
1.7 Tensile test at room temperature <sup>3)</sup>	3.1	3.1
1.8 Notched bar impact test at room temperature <sup>3)</sup>	3.1	3.1
2. Tests on finished part		
2.1 Surface hardness	3.1	3.1
2.2 Surface inspection Each part 100 % for hardness cracks in acc. with <b>An- nex B</b>	3.1	3.1
2.3 Visual inspection and dimensional check by using <b>Form C-1</b> of KTA 3903	3.1	3.1
Material identification: Manufacturer's mark, steel grade, melt number, specimen number or identification number, inspector's mark		
<sup>1)</sup> See materials test sheet WPB 2.4 regarding requirements for initial materials. <sup>2)</sup> Repair welding is not permitted. <sup>3)</sup> Only for pinion shafts; characteristic values acc. to manufacturer's specification.		

**Materials test sheet 2.6:** Gas nitrided gears and pinion shafts of material quality MQ according to DIN 3990-5

<b>MATERIALS TEST SHEET</b>		<b>WPB 2.6</b>
Part group:	Gear boxes and drive parts for hoists (only gears and pinion shafts according to DIN 3990-5)	
Product form:	Gears and pinion (material quality MQ) <sup>1)</sup>	
Materials:	42CrMo4+QT (1.7225) according to WPB 2.4	
Requirements:	DIN EN ISO 683-2 <sup>2)</sup> , SEW 550, DIN 3990-5	
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. Attestation of pre-treatment / Attestation of heat treatment condition	3.1	3.1
2. Check for surface condition after finishing prior to nitriding	3.1	3.1
3. Tests on production control test specimens		
3.1 Nitriding hardness depth	3.1	3.1
3.2 Surface hardness	3.1	3.1
3.3 Decrease in hardness to core	3.1	3.1
3.4 Edge zone	3.1	3.1
3.5 Tensile test at room temperature	3.1	3.1
3.6 Notched bar impact test at room temperature	3.1	3.1
4. Tests on finished part		
4.1 Surfaced condition after nitriding	3.1	3.1
4.2 Surface hardness	3.1	3.1
4.3 Surface inspection Each part 100 % in acc. with <b>Annex B</b>	3.1	3.1
4.4 Visual inspection and dimensional check by using <b>Form C-1</b> of KTA 3903	3.1	3.1
Material identification: Manufacturer's mark, steel grade, melt number, specimen number or identification number, inspector's mark		
<sup>1)</sup> See materials test sheet WPB 2.4 regarding requirements for initial materials. <sup>2)</sup> Repair welding is not permitted.		



**Materials test sheet 2.7:** Bars and forgings made of case-hardened steels according to DIN EN ISO 683-3

<b>MATERIALS TEST SHEET</b>		<b>WPB 2.7</b>
Part group:	Gear boxes and drive parts for hoists (machine parts between motor coupling and load supporting means)	
Product form:	Bars and forgings <sup>1)</sup>	
Materials <sup>2)</sup> :	16MnCr5+HH+FP (1.7131), 20MnCr5+HH+FP (1.7147), 18CrNiMo7-6+HH+FP (1.6587)	
Requirements:	DIN EN ISO 683-3 <sup>2)</sup> and supplementary sheet to this materials test sheet	
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 of blank-hardened test bar	3.1	3.1
3. Tensile test at room temperature: One specimen per melt and dimensional range each on blank-hardened test bar (see suppl. sheet to this materials test sheet)	3.1	3.1
4. Visual inspection and dimensional check: Each part	3.1	3.1
5. Material identification check: Each part, e.g. by spectroscopy	3.1	3.1
6. Ultrasonic testing: For bar steel with product thicknesses $\geq 30$ mm and forgings with a weight in final heat treatment condition $\geq 300$ kg, each part subject to 100 % in acc. with <b>An-nex B</b>	3.1	3.1
Material identification: Manufacturer's mark, steel grade, melt number, specimen number or identification number, inspector's mark		
1) The product forms acc. to this materials test sheet also serve as initial material for gears and pinions acc. to NIEMANN (see KTA 3902, Table B 1-5) as well as acc. to DIN 3990-5 in acc. with material test sheet WPB 2.8 (see KTA 3902, Table B 1-3).		
2) Repair welding is not permitted.		

**Supplementary sheet to materials test sheet WPB 2.7**

Steel grade	Diameter <sup>1)</sup> mm	Yield stress $R_e$ N/mm <sup>2</sup> min.	Tensile strength $R_m$ , N/mm <sup>2</sup>	Elongation at fracture A, % min. value	Reduction of area Z, % min. value	Blank hardening temperature °C $\pm$ 10 K
16MnCr5+HH+FP	11	630	900 to 1200	9	35	870
	30	600	800 to 1100	10	40	870
	63	450	650 to 950	11	40	870
20MnCr 5+HH+FP	11	730	1100 to 1400	7	30	870
	30	680	1000 to 1300	8	35	870
	63	550	800 to 1100	10	35	870
18CrNiMo7-6+HH+FP	11	830	1150 to 1450	7	30	860
	30	780	1050 to 1350	8	35	860
	63	680	950 to 1250	8	35	860

1) Specimen location: Diameter 11 mm and 30 mm : Specimen taken from core in longitudinal direction  
Diameter 63 mm : Specimen taken in longitudinal direction at a distance of 12.5 mm from the surface of the product  
Other sections or greater dimensions shall be rolled or forged down to these diameters before hardening.

**Materials test sheet 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

<b>MATERIALS TEST SHEET</b>		<b>WPB 2.8</b>
Part group:	Gear boxes and drive parts for hoists (only gears and pinion shafts according to DIN 3990-5)	
Product form:	Gears and pinion (material quality MQ) <sup>1)</sup>	
Materials:	16MnCr5+HH+FP (1.7131), 20MnCr5+HH+FP (1.7147), 18CrNiMo7-6+HH+FP (1.6587) to WPB 2.7	
Requirements:	DIN EN ISO 683-3 <sup>2)</sup> , DIN 3990-5	
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 ac- cording to section 4.3 or 4.4
1. Tests on production control test specimens		
1.1 Edge hardness	3.1	3.1
1.2 Core hardness	3.1	3.1
1.3 Core structure	3.1	3.1
1.4 Case-hardening depth	3.1	3.1
1.5 Surface zone in finished condition	3.1	3.1
a) surface structure		
b) surface decarbonisation		
c) carbide precipitation		
d) residual austenite		
e) surface oxidation		
1.6 Tensile test at room temperature <sup>3)</sup>	3.1	3.1
1.7 Notched bar impact test at room temperature <sup>3)</sup>	3.1	3.1
2. Tests on finished part		
2.1 Edge hardness on part Type and extent of testing according to DIN 3990-5, Table 5 ser. no. 7	3.1	3.1
2.2. Test for overheating Type and extent of testing according to DIN 3990-5, Table 5 ser. no. 14	3.1	3.1
2.3 Surface inspection of tooth flanks in finished condition Each part 100 % magnetic particle testing Performance: according to <b>Annex B</b> ; Acceptance criteria: indications which suggest the pre- sence of crack-like defects are not permitted	3.1	3.1
2.4 Visual inspection and dimensional check by using <b>Form C-1</b> of KTA 3903	3.1	3.1
Material identification: Manufacturer's mark, steel grade, melt number, specimen number or identification number, inspector's mark		
<sup>1)</sup> See materials test sheet WPB 2.7 regarding requirements for initial materials. <sup>2)</sup> Repair welding is not permitted. <sup>3)</sup> Only for pinion shafts; characteristic values acc. to manufacturer's specification.		

**Materials test sheet 2.9:** Bars and forgings made of nitrided steels according to DIN EN 10085

<b>MATERIALS TEST SHEET</b>		<b>WPB 2.9</b>	
Part group:	Gear boxes and drive parts for hoists (machine parts between motor coupling and load supporting means)		
Product form:	Bars and forgings		
Materials:	Nitrided steels to DIN EN 10085		
Requirements:	DIN EN 10085 <sup>1)</sup>		
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 ac- cording to section 4.3 or 4.4	
1. Chemical composition: Ladle analysis	3.1	3.1	
2. Attestation of heat treatment condition	3.1	3.1	
3. Tensile test at room temperature: One specimen per melt, heat treatment and dimensional range each	3.1	3.1	
4. Notched bar impact test at room temperature: One set of impact test specimens per tensile test specimen, as far as the nominal dimension is $\geq 15$ mm	3.1	3.1	
5. Visual inspection and dimensional check: Each part	3.1	3.1	
6. Material identification check: Each part, e.g. by spectroscopy	3.1	3.1	
7. Ultrasonic testing: For bar steel with product thicknesses $\geq 30$ mm and forgings with a weight in final heat treatment condition $\geq 300$ kg, each part subject to 100 % in acc. with <b>Annex B</b>	3.1	3.1	
Material identification: Manufacturer's mark, steel grade, melt number, specimen number or identification number, inspector's mark			
<sup>1)</sup> Repair welding is not permitted.			

**Materials test sheet 2.10:** Plates, sheets and strips made of austenitic steels according to DIN EN 10088-2

<b>MATERIALS TEST SHEET</b>		<b>WPB 2.10</b>	
Part group:	Gear boxes and drive parts for hoists (machine parts between motor coupling and load supporting means)		
Product form:	Plates, sheets and strips		
Materials:	Austenitic steels according to DIN EN 10088-2		
Requirements:	DIN EN 10088-2 <sup>1)</sup>		
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	3.1		3.1
3. Check for intergranular corrosion <sup>2)</sup> : One specimen per melt and heat treatment batch each	3.1		3.1
4. Tensile test at room temperature: One specimen according to DIN EN 10088-2 Table 21	3.1		3.1
5. Visual inspection and dimensional check: Each part; surface condition in acc. with purchaser's specification	3.1		3.1
6. Material identification check: Each part, e.g. by spectroscopy	3.1		3.1
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			
<sup>1)</sup> Repair welding is not permitted. <sup>2)</sup> According to DIN EN ISO 3651-2 procedure A sensitisation T1 or T2 and only if the parts are being welded and are in contact with water.			

**Materials test sheet 2.11:** Bars and forgings made of austenitic steels according to DIN EN 10088-3 or DIN EN 10250-4

<b>MATERIALS TEST SHEET</b>		<b>WPB 2.11</b>	
Part group:	Gear boxes and drive parts for hoists (machine parts between motor coupling and load supporting means)		
Product form:	Bars and forgings		
Materials:	Austenitic steels according to DIN EN 10088-3 or DIN EN 10250-4		
Requirements:	DIN EN 10088-3 <sup>1)</sup> or DIN EN 10250-4 <sup>1)</sup>		
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. Heat treatment condition	3.1		3.1
3. Check for intergranular corrosion <sup>2)</sup> : One specimen per melt and heat treatment batch each	3.1		3.1
4. Tensile test at room temperature: One specimen according to DIN EN 10088-3 Table 26 or DIN EN 10250-1 section 11	3.1		3.1
5. Visual inspection and dimensional check: Each part; surface condition in acc. with purchaser's specification	3.1		3.1
6. Material identification check: Each part, e.g. by spectroscopy	3.1		3.1
7. Ultrasonic testing: For bar steel with product thicknesses $\geq 30$ mm and forgings with a weight in final heat treatment condition $\geq 300$ kg, each part subject to 100 % in acc. with <b>Annex B</b>	3.1		3.1
Material identification: Manufacturer's mark, steel grade, melt number, specimen number or identification number, inspector's mark			
<sup>1)</sup> Repair welding is not permitted. <sup>2)</sup> According to DIN EN ISO 3651-2 procedure A, sensitisation T1 or T2 and only if the parts are being welded and are in contact with water.			

**Materials test sheet 2.12:** Bars and forgings made of stainless martensitic steels according to DIN EN 10088-3 or DIN EN 10250-4

<b>MATERIALS TEST SHEET</b>		<b>WPB 2.12</b>
Part group:	Gear boxes and drive parts for hoists (machine parts between motor coupling and load supporting means)	
Product form:	Bars and forgings	
Materials:	X17CrNi16-2 - QT800 (1.4057), X39CrMo17-1 - QT750 (1.4122), X3CrNiMo13-4 - QT780 (1.4313)	
Requirements:	DIN EN 10088-3 <sup>1)</sup> or DIN EN 10250-4 <sup>1)</sup>	
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 ac- cording to section 4.3 or 4.4
1. Chemical composition: Ladle analysis	3.1	3.1
2. Attestation of heat treatment condition (for 1.4313 indication of strength grade)	3.1	3.1
3. Tensile test at room temperature: Test lot and extent of testing according to DIN EN 10088-3 Table 26 or section 11 of DIN EN 10250-1	3.1	3.1
4. Notched bar impact test at room temperature: Test lot and extent of testing as for tensile test (only for nominal dimension $\geq 15$ mm)	3.1	3.1
5. Visual inspection and dimensional check: Each part, surface quality and dimensions in acc. with purchaser's specification	3.1	3.1
6. Material identification check: Each part, e.g. by spectroscopy	3.1	3.1
7. Ultrasonic testing: For bar steel with product thicknesses $\geq 30$ mm and forgings with a weight in final heat treatment condition $\geq 300$ kg, each part subject to 100 % in acc. with <b>An- nex B</b>	3.1	3.1
Material identification: Manufacturer's mark, steel grade, melt number, specimen number or identification number, inspector's mark		
1) Repair welding is not permitted.		

**Materials test sheet 3.1:** Hot rolled plates and sheets, strips, wide flats and steel sections of structural carbon steel according to DIN EN 10025-2

<b>MATERIALS TEST SHEET</b>		<b>WPB 3.1</b>
Part group:	Supporting means, load suspension devices and lifting accessories	
Product form:	Hot rolled plates and sheets, strips, wide flats and steel sections	
Materials:	S235J0 (1.0114), S235J2 (1.0117), S235JR (1.0038), S355J2 (1.0577), S355K2 (1.0596)	
Requirements:	DIN EN 10025-1, DIN EN 10025-2 <sup>1)</sup> , 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 specimen per melt and test unit	3.1	3.2
3.2 Three tensile specimens in thickness direction for product thicknesses > 20 mm and tensile stress in thickness direction: Test unit according to DIN EN 10164 <sup>2)</sup> Quality class Z 25 according to DIN EN 10164	3.1	3.2
4. Notched bar impact test at test temperature according to DIN EN 10025-2: One set of impact test specimen per tensile test specimen as per no. 3.1 as far as the nominal dimension is ≥ 6 mm	3.1	3.2
5. Visual inspection and dimensional check: Each part	3.1	3.2
See <b>Table 7-1</b> ser. no. 3 c) regarding ultrasonic testing of parts under tensile stress in thickness direction.		
Products with thicknesses ≥ 6 mm shall at least meet the requirements of quality class S <sub>1</sub> according to DIN EN 10160 for the body and E <sub>1</sub> for the edge zone.		
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)		
<sup>1)</sup> Repair welding is not permitted. <sup>2)</sup> 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. 3.2.		

**Materials test sheet 3.2:** Hot rolled bars made of structural carbon steels according to DIN EN 10025-2

<b>MATERIALS TEST SHEET</b>		<b>WPB 3.2</b>
Part group:	Supporting means, load suspension devices and lifting accessories	
Product form:	Hot rolled bars	
Materials:	S235J0 (1.0114), S235J2 (1.0117), S235JR (1.0038), S355J2 (1.0577), S355K2 (1.0596)	
Requirements:	DIN EN 10025-1, DIN EN 10025-2 <sup>1)</sup>	
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 ac- cording 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: One specimen per melt and test unit	3.1	3.2
4. Notched bar impact test at test temperature according to DIN EN 10025-2 and nominal dimensions according to DIN EN 10025-1: One set of impact test specimens per tensile test specimen	3.1	3.2
5. Visual inspection and dimensional check: Each part	3.1	3.2
6. Ultrasonic testing: For bar steel with product thicknesses $\geq 30$ mm each part subject to 100 % in acc. with <b>Annex B</b>	3.1	3.2
Material identification: Manufacturer's mark, steel grade, melt number, specimen number or identification number, inspector's mark		
<sup>1)</sup> Repair welding is not permitted.		



**Materials test sheet 3.3:** Forged bars and open-die forgings made of general structural steels according to DIN EN 10250-2

<b>MATERIALS TEST SHEET</b>		<b>WPB 3.3</b>	
Part group:	Supporting means, load suspension devices and lifting accessories		
Product form:	Forged bars and open-die forgings		
Materials:	S235JRG2 (1.0038), S235J2G3 (1.00116), S355J2G3 (1.0570)		
Requirements:	DIN EN 10250-1, DIN EN 10250-2 <sup>1)</sup>		
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 ac- cording to section 4.3 or 4.4	
1. Chemical composition: Ladle analysis	3.1	3.1	
2. Attestation of heat treatment condition	3.1	3.1	
3. Tensile test at room temperature: One specimen per melt and test unit	3.1	3.2	
4. Notched bar impact test at test temperature according to DIN EN 10250-2: One set of impact test specimens per tensile test specimen, as far as the nominal dimension is $\geq 15$ mm	3.1	3.2	
5. Visual inspection and dimensional check: Each part	3.1	3.2	
6. Ultrasonic testing: For bar steel with product thicknesses $\geq 30$ mm and forgings with a weight in final heat treatment condition $\geq 300$ kg, each part subject to 100 % in acc. with <b>An- nex B</b>	3.1	3.2	
Material identification: Manufacturer's mark, steel grade, melt number, specimen number or identification number, inspector's mark			
<sup>1)</sup> Repair welding is not permitted.			

**Materials test sheet 3.4:** Welded tubes made of carbon steels according to DIN EN 10217-1

<b>MATERIALS TEST SHEET</b>		<b>WPB 3.4</b>
Part group:	Supporting means, load suspension devices and lifting accessories	
Product form:	Welded tubes	
Materials:	P235TR1 (1.0254), P235TR2 (1.0255), P265TR1 (1.0258), P265TR2 (1.0259)	
Requirements:	DIN EN 10217-1 1)	
Tests and inspections	Inspection certificate according to DIN EN 10204 Classification of lifting equipment in acc. with KTA 3902 section 4.2	
1. Chemical composition: Ladle analysis	3.1	
2. Attestation of heat treatment condition or of as-delivered condition	3.1	
3. Tensile test at room temperature (base material): Lot size and extent of testing in acc. with DIN EN 10217-1 no. 10.1, Table 12 and Table 13	3.1	
4. Tensile test at room temperature transverse to the weld seam (at an outside diameter $D_A > 508$ mm): Lot size and extent of testing in acc. with DIN EN 10217-1 no.10.1, Table 12 and Table 13	3.1	
5. Notched bar impact test at test temperature of 0 °C (base material) in the case of materials no. 1.0255 and 1.0259: One set of impact test specimen per tensile test speci- men	3.1	
6. Flattening test or drift-expanding test: Lot size and extent of testing in acc. with DIN EN 10217-1 no.10.1, Table 12 and Table 13	3.1	
7. Weld bend test on submerged-arc welded tubes: Lot size and extent of testing in acc. with DIN EN 10217-1 no.10.1, Table 12 and Table 13	3.1	
8. Non-destructive testing of weld seam: In acc. with section 11.11 of DIN EN 10217-1	3.1	
9. Tightness test: Each tube in acc. with section 11.8 of DIN EN 10217-1	3.1	
10. Visual inspection and dimensional check: Each tube	3.1	
Material identification: Manufacturer's mark, steel grade, melt number, specimen number or identification number, inspector's mark, type of tube in acc. with DIN EN 10217-1 Table 1		
1) Repair welding in the base material is not permitted.		

**Materials test sheet 3.5:** Seamless tubes made of carbon steels according to DIN EN 10216-1

<b>MATERIALS TEST SHEET</b>		<b>WPB 3.5</b>
Part group:	Supporting means, load suspension devices and lifting accessories	
Product form:	Seamless tubes	
Materials:	P235TR1 (1.0254), P235TR2 (1.0255), P265TR1 (1.0258), P265TR2 (1.0259)	
Requirements:	DIN EN 10216-1 <sup>1)</sup>	
Tests and inspections	Inspection certificate according to DIN EN 10204 Classification of lifting equipment in acc. with KTA 3902 section 4.2	
1. Chemical composition: Ladle analysis	3.1	
2. Attestation of heat treatment condition or of as-delivered condition	3.1	
3. Tensile test at room temperature: Lot size and extent of testing in acc. with DIN EN 10216-1 no.10.1, Table 10 and Table 11	3.1	
4. Notched bar impact test at test temperature of 0 °C in the case of materials no. 1.0255 and 1.0259: One set of impact test specimen per tensile test speci- men	3.1	
5. Tightness test: Each tube in acc. with section 11.4 of DIN EN 10216-1	3.1	
6. Visual inspection and dimensional check: Each tube	3.1	
Material identification: Manufacturer's mark, steel grade, melt number, specimen number or identification number, inspector's mark		
<sup>1)</sup> Repair welding is not permitted.		

**Materials test sheet 3.6:** Seamless or welded hot finished hollow sections of structural carbon steels according to DIN EN 10210-1

<b>MATERIALS TEST SHEET</b>		<b>WPB 3.6</b>
Part group:	Supporting means, load suspension devices and lifting accessories	
Product form:	Hot finished hollow sections (seamless or welded)	
Materials:	S275J0H (1.0149), S275J2H (1.0138), S355J0H (1.0547), S355J2H 1.0576)	
Requirements:	DIN EN 10210-1 <sup>1)</sup>	
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 ac- cording 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: One specimen per melt, test unit and nominal dimen- sion each	3.1	3.2
4. Notched bar impact test at test temperature according to DIN EN 10210-1: One set of impact test specimens per tensile test specimen, as far as the nominal dimension is $\geq 6$ mm	3.1	3.2
5. Visual inspection and dimensional check: Each part	3.1	3.2
6. Non-destructive testing of weld seam: Each part over its full length in acc. with section 9.4 of DIN EN 10210-1	3.1	3.2
Material identification: Manufacturer's mark, steel grade, melt number, specimen number or identification number, inspector's mark		
<sup>1)</sup> Repair welding in the base material is not permitted.		

**Materials test sheet 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

<b>MATERIALS TEST SHEET</b>		<b>WPB 3.7</b>
Part group:	Supporting means, load suspension devices and lifting accessories	
Product form:	Bars and forgings	
Materials:	Quenched and tempered steels according to DIN EN ISO 683-1, DIN EN ISO 683-2 or SEW 550	
Requirements:	DIN EN ISO 683-1 <sup>1)</sup> , DIN EN ISO 683-2 <sup>1)</sup> or SEW 550 <sup>1)</sup>	
Tests and inspections	Inspection certificate according to DIN EN 10204 Classification of lifting equipment in acc. with KTA 3902:	
The performance of the following tests and inspections shall be verified for the quenched and tempered condition	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	3.1	3.1
3. Hardness test for verification of uniform heat treatment: On one end of each part three measuring points each	3.1	3.1
4. Tensile test at room temperature: One specimen per melt, dimensional range and heat treatment batch each	3.1	3.2
5. Notched bar impact test at room temperature: One set of impact test specimens per tensile test specimen, as far as the nominal dimension is $\geq 15$ mm	3.1	3.2
6. Visual inspection and dimensional check: Each part	3.1	3.2
7. Materials identification check for alloyed steels: Each part, e.g. by spectroscopy	3.1	3.1
8. Ultrasonic testing: For bar steel with product thicknesses $\geq 30$ mm and forgings with a weight in final heat treatment condition $\geq 300$ kg each part subject to 100 % in acc. with <b>An-nex B</b>	3.1	3.2
Material identification: Manufacturer's mark, steel grade, melt number, specimen number or identification number, inspector's mark		
<sup>1)</sup> Repair welding is not permitted.		

**Materials test sheet 3.8** Forged load hooks according to DIN 15400

<b>MATERIALS TEST SHEET</b>		<b>WPB 3.8</b>
Part group:	Supporting means, load suspension devices and lifting accessories	
Product form:	Forged load hooks	
Materials:	DIN 15400	
Requirements:	DIN 15400 <sup>1)</sup> , DIN 15404-1	
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 ac- cording to section 4.3 or 4.4
1. Basic material (rough-forging)		
1.1 Chemical composition: Ladle analysis	3.1	3.1
1.2 Ultrasonic testing: For die-forged single load hooks volumetric testing: performance and evaluation in acc. with <b>Annex B</b>	3.1	3.1
2. Upon finish forging		
2.1 Attestation of heat treatment condition and indication of tempering temperature	3.1	3.1
2.2 Tensile test at room temperature: One specimen for each part	3.1	3.2
2.3 Notched bar impact test at test temperatures accord- ing to DIN 15400: One set of impact test specimens per tensile test specimen	3.1	3.2
2.4 Visual inspection and dimensional check: Each part	3.1	3.2
2.5 Ultrasonic testing:		
2.5.1 Each ramshorn load hook in acc. with <b>Annex B</b>	3.1	3.2
2.5.2 Each open-die forged single load hook in acc. with <b>Annex B</b>	—	3.2
2.5.3 Each open-die forged single load hook (only hook shaft) in acc. with <b>Annex B</b>	3.1	—
2.6 Surface inspection: Each part in acc. with <b>Annex B</b>	3.1	3.2
Material identification: Acc. to DIN 15404-1, additionally: melt number, inspector's mark		
<sup>1)</sup> Repair welding is not permitted.		

**Materials test sheet 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

<b>MATERIALS TEST SHEET</b>		<b>WPB 3.9</b>
Part group:	Supporting means, load suspension devices and lifting accessories	
Product form:	Bars and forgings for load hook nuts according to DIN 15413	
Materials:	Quenched and tempered steels according to DIN EN ISO 683-1, DIN EN ISO 683-2 or SEW 550	
Requirements:	DIN EN ISO 683-1 <sup>1)</sup> , DIN EN ISO 683-2 <sup>1)</sup> or SEW 550 <sup>1)</sup>	
Tests and inspections	Inspection certificate according to DIN EN 10204 Classification of lifting equipment in acc. with KTA 3902:	
The performance of the following tests and inspections shall be verified for the quenched and tempered condition	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 and indication of tempering temperature	3.1	3.1
3. Hardness test for verification of uniform heat treatment: On both ends of each part three measuring points each	3.1	3.1
4. Tensile test at room temperature: One specimen per melt, dimensional range and heat treatment batch each	3.1	3.2
5. Notched bar impact test at room temperature: One set of impact test specimens per tensile test specimen	3.1	3.2
6. Visual inspection and dimensional check: Each part	3.1	3.2
7. Materials identification check for alloyed steels: Each part, e.g. by spectroscopy	3.1	3.1
8. Ultrasonic testing: Each part subject to 100 % in acc. with <b>Annex B</b>	3.1	3.2
Material identification: Manufacturer's mark, steel grade, melt number, specimen number or identification number, inspector's mark		
<sup>1)</sup> Repair welding is not permitted.		

**Materials test sheet 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

<b>MATERIALS TEST SHEET</b>		<b>WPB 3.10</b>
Part group:	Supporting means, load suspension devices and lifting accessories	
Product form:	Bars and forgings for load hook lifting beams	
Materials:	Quenched and tempered steels according to DIN EN ISO 683-1, DIN EN ISO 683-2 or SEW 550	
Requirements:	DIN EN ISO 683-1 <sup>1)</sup> , DIN EN ISO 683-2 <sup>1)</sup> or SEW 550 <sup>1)</sup>	
Tests and inspections	Inspection certificate according to DIN EN 10204 Classification of lifting equipment in acc. with KTA 3902:	
The performance of the following tests and inspections shall be verified for the quenched and tempered condition	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 and indication of tempering temperature	3.1	3.1
3. Hardness test for verification of uniform heat treatment: On both ends of each part three measuring points each	3.1	3.1
4. Tensile test at room temperature: One specimen per melt, dimensional range and heat treatment batch each	3.1	3.2
5. Notched bar impact test at room temperature: One set of impact test specimens per tensile test specimen	3.1	3.2
6. Visual inspection and dimensional check: Each part	3.1	3.2
7. Materials identification check for alloyed steels: Each part, e.g. by spectroscopy	3.1	3.1
8. Ultrasonic testing: Each part subject to 100 % in acc. with <b>Annex B</b>	3.1	3.2
Material identification: Manufacturer's mark, steel grade, melt number, specimen number or identification number, inspector's mark		
1) Repair welding is not permitted.		



**Materials test sheet 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

<b>MATERIALS TEST SHEET</b>		<b>WPB 3.11</b>
Part group:	Supporting means, load suspension devices and lifting accessories	
Product form:	Plates, sheets and strips	
Materials:	Austenitic steels according to DIN EN 10088-2, X2CrNiMoN22-5-3 (1.4462) according to DIN EN 10028-7	
Requirements:	DIN EN 10088-2 <sup>1)</sup> , DIN EN 10028-7 <sup>1)</sup>	
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	3.1	3.1
3. Check for intergranular corrosion resistance <sup>2)</sup> : One specimen per melt and heat treatment batch each	3.1	3.1
4. Tensile test at room temperature: One specimen according to DIN EN 10088-2 Table 21, in the case of X2CrNiMoN22-5-3 (1.4462) lot size and extent of testing in acc. with DIN EN 10028-7 Table 16	3.1	3.2
5. Notched bar impact test at room temperature: One set of impact test specimen per tensile test specimen <sup>3)</sup>	3.1	3.2
6. Visual inspection and dimensional check: Each part; surface condition in acc. with purchaser's specification	3.1	3.2
7. Material identification check: Each part, e.g. by spectroscopy	3.1	3.1
<p>See <b>Table 7-1</b> ser. no. 3 c) regarding ultrasonic testing of parts under tensile stress in thickness direction.</p> <p>Products with thicknesses <math>\geq 6</math> mm shall at least meet the requirements of quality class S<sub>1</sub> according to DIN EN 10307 for the body and E<sub>1</sub> for the edge zone.</p>		
<p>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</p>		
<p><sup>1)</sup> Repair welding is not permitted. <sup>2)</sup> According to DIN EN ISO 3651-2 procedure A sensitisation T1 or T2 (in the case of material 1.4462 also procedures B and C) and only if the parts are being welded and are in contact with water. <sup>3)</sup> Only for steel X2CrNiMoN22-5-3 (1.4462) as far as thickness of plate/sheet <math>s \geq 10</math> mm.</p>		

**Materials test sheet 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

<b>MATERIALS TEST SHEET</b>		<b>WPB 3.12</b>
Part group:	Supporting means, load suspension devices and lifting accessories	
Product form:	Bars and forgings	
Materials:	Austenitic steels according to DIN EN 10088-3 or DIN EN 10250-4 as well as X2CrNiMoN22-5-3 (1.4462) according to DIN EN 10222-5 or DIN EN 10272	
Requirements:	DIN EN 10088-3 <sup>1)</sup> , DIN EN 10250-4 <sup>1)</sup> , DIN EN 10222-5 <sup>1)</sup> or DIN EN 10272 <sup>1)</sup>	
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	3.1	3.1
3. Check for intergranular corrosion resistance <sup>2)</sup> : One specimen per melt and heat treatment batch each	3.1	3.1
4. Tensile test at room temperature: One specimen according to DIN EN 10088-3 Table 26 or section 11 of DIN EN 10250-1 or section 7 of DIN EN 10222-1 or DIN EN 10272 Table 14	3.1	3.2
5. Visual inspection and dimensional check: Each part; surface condition in acc. with purchaser's specification	3.1	3.2
6. Material identification check: Each part, e.g. by spectroscopy	3.1	3.1
7. Ultrasonic testing: For bar steel with product thicknesses $\geq 30$ mm and forgings with a weight in final heat treatment condition $\geq 300$ kg, each part subject to 100 % in acc. with <b>Annex B</b>	3.1	3.2
Material identification: Manufacturer's mark, steel grade, melt number, specimen number or identification number, inspector's mark		
<sup>1)</sup> Repair welding is not permitted. <sup>3)</sup> According to DIN EN ISO 3651-2 procedure A sensitisation T1 or T2 (in the case of material 1.4462 also procedures B and C) and only if the parts are being welded and are in contact with water.		

**Materials test sheet 3.13:** Seamless tubes made of austenitic steels according to DIN EN 10216-5

<b>MATERIALS TEST SHEET</b>		<b>WPB 3.13</b>	
Part group:	Supporting means, load suspension devices and lifting accessories		
Product form:	Seamless tubes		
Materials:	Austenitic stainless steels according to DIN EN 10216-5		
Requirements:	DIN EN 10216-5 (test category 2) <sup>1)</sup>		
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 ac- cording to section 4.3 or 4.4	
1. Chemical composition: Ladle analysis	3.1	3.1	
2. Attestation of heat treatment condition	3.1	3.1	
3. Check for intergranular corrosion resistance <sup>2)</sup> : One specimen per melt and heat treatment batch each	3.1	3.1	
4. Tensile test at room temperature: Lot size and extent of testing in acc. with DIN EN 10216-5 Table 15	3.1	3.2	
5. Technological test procedures: Type and extent of testing in acc. with DIN EN 10216-5 Table 15 and Table 16	3.1	3.2	
6. Visual inspection and dimensional check: Each tube, surface condition in acc. with purchaser's specification	3.1	3.2	
7. Material identification check: Each tube, e.g. by spectroscopy	3.1	3.1	
8. Non-destructive testing: Type and extent of testing in acc. with DIN EN 10216-5 Table 15	3.1	3.1	
9. Tightness test: Each tube in acc. with DIN EN 10216-5 Table 15	3.1	3.1	
Material identification: Manufacturer's mark, steel grade, melt number, specimen number or identification number, inspector's mark			
<sup>1)</sup> Repair welding is not permitted. <sup>2)</sup> According to DIN EN ISO 3651-2 procedure A sensitisation T1 or T2 and only if the parts are being welded and are in contact with water.			

**Materials test sheet 3.14:** Forged load hooks made of austenitic steels according to DIN EN 10250-4

<b>MATERIALS TEST SHEET</b>		<b>WPB 3.14</b>
Part group:	Supporting means, load suspension devices and lifting accessories	
Product form:	Forged load hooks	
Materials:	Austenitic steels according to DIN EN 10250-4	
Requirements:	DIN EN 10250-4 <sup>1)</sup>	
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 ac- cording to section 4.3 or 4.4
1. Basic material (rough-forging)		
1.1 Chemical composition: Ladle analysis	3.1	3.1
1.2 Ultrasonic testing: For die-forged single load hooks volumetric testing: performance and evaluation in acc. with <b>Annex B</b>	3.1	3.1
2. Upon finish forging		
2.1 Attestation of heat treatment condition	3.1	3.1
2.2 Tensile test at room temperature: One specimen for each part Specimen location: longitudinal direction	3.1	3.2
2.3 Visual inspection and dimensional check: Each part	3.1	3.2
2.4 Material identification check: Each part, e.g. by spectroscopy	3.1	3.1
2.5 Ultrasonic testing:		
2.5.1 Each ramshorn load hook in acc. with <b>Annex B</b>	3.1	3.2
2.5.2 Each open-die forged single load hook in acc. with <b>Annex B</b>	—	3.2
2.5.3 Each open-die forged single load hook (only hook shaft) in acc. with <b>Annex B</b>	3.1	—
2.6 Surface inspection: Liquid penetrant testing on each load hook in acc. with <b>Annex B</b>	3.1	3.2
Material identification: Manufacturer's mark, steel grade, melt number, specimen number or identification number, inspector's mark		
<sup>1)</sup> Repair welding is not permitted.		

**Materials test sheet 3.15:** Bars and forgings for load hook nuts made of austenitic steels according to DIN EN 10088-3 or DIN EN 10250-4

<b>MATERIALS TEST SHEET</b>		<b>WPB 3.15</b>
Part group:	Supporting means, load suspension devices and lifting accessories	
Product form:	Bars and forgings for load hook nuts	
Materials:	Austenitic steels according to DIN EN 10088-3 or DIN EN 10250-4	
Requirements:	DIN EN 10088-3 <sup>1)</sup> or DIN EN 10250-4 <sup>1)</sup>	
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 ac- cording to section 4.3 or 4.4
1. Chemical composition: Ladle analysis	3.1	3.1
2. Attestation of heat treatment condition	3.1	3.1
3. Tensile test at room temperature: One specimen according to DIN EN 10088-3 Table 26 or section 11 of DIN EN 10250-1	3.1	3.2
4. Visual inspection and dimensional check: Each part; surface condition in acc. with purchaser's specification	3.1	3.2
5. Material identification check: Each part, e.g. by spectroscopy	3.1	3.1
6. Ultrasonic testing: Each part subject to 100 % in acc. with <b>Annex B</b>	3.1	3.2
Material identification: Manufacturer's mark, steel grade, melt number, specimen number or identification number, inspector's mark		
<sup>1)</sup> Repair welding is not permitted.		

**Materials test sheet 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

<b>MATERIALS TEST SHEET</b>		<b>WPB 3.16</b>
Part group:	Supporting means, load suspension devices and lifting accessories	
Product form:	Bars and forgings for load hook lifting beams	
Materials:	Austenitic steels according to DIN EN 10088-3 or DIN EN 10250-4	
Requirements:	DIN EN 10088-3 <sup>1)</sup> or DIN EN 10250-4 <sup>1)</sup>	
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 ac- cording to section 4.3 or 4.4
1. Chemical composition: Ladle analysis	3.1	3.1
2. Attestation of heat treatment condition	3.1	3.1
3. Tensile test at room temperature: One specimen according to DIN EN 10088-3 Table 26 or section 11 of DIN EN 10250-1	3.1	3.2
4. Visual inspection and dimensional check: Each part, surface quality and dimensions in acc. with purchaser's specification	3.1	3.2
5. Material identification check: Each part, e.g. by spectroscopy	3.1	3.1
6. Ultrasonic testing: Each part subject to 100 % in acc. with <b>Annex B</b>	3.1	3.2
Material identification: Manufacturer's mark, steel grade, melt number, specimen number or identification number, inspector's mark		
<sup>1)</sup> Repair welding is not permitted.		

**Materials test sheet 3.17:** Bolts and studs, thread rolled, head bolts with forged-on head, and subsequently heat-treated

<b>MATERIALS TEST SHEET</b>		<b>WPB 3.17</b>	
Part group:	Supporting means, load suspension devices and lifting accessories		
Product form:	Bolts and studs, thread rolled, head bolts with forged-on head, heat-treated		
Materials:	DIN EN ISO 683-1, DIN EN ISO 683-2, creep-resisting and heat resisting materials according to DIN EN 10269, 1.4313 + QT780 according to DIN EN 10088-3 or DIN EN 10250-4		
Requirements:	DIN EN ISO 683-1, DIN EN ISO 683-2, DIN EN 10269, DIN EN ISO 3269, DIN EN 26157-1, DIN EN ISO 898-1, DIN EN 10088-3, DIN EN 10250-4 and supplementary sheet to this materials test sheet In the case of electroplated corrosion protection coatings additionally: DIN EN ISO 4042 In the case of hot dip galvanizing additionally: DIN EN ISO 10684 and guideline "Manufacture of hot dip galvanized bolts" [1]		
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. Tests on basic material (bar)			
1.1 Chemical composition: Ladle analysis	2.2	3.1	
1.2 Materials identification check for alloyed steels: Each bar	2.2	3.1	
1.3 Ultrasonic testing: For bars with thicknesses $\geq 30$ mm each part in acc. with <b>Annex B</b>	3.1	3.2	
2. Tests on finished parts based on DIN EN ISO 898-1 test series MP1:			
2.1 Heat treatment condition including confirmation of dephosphorization	3.1	3.1	
2.2 Hardness test for verification of uniform heat treatment on 10 % of all bolts and studs	3.1	3.1	
2.3 Tensile test at room temperature: Number of test specimen sets according to DIN EN ISO 3269 and supplementary sheet to this materials test sheet <sup>1)</sup>	3.1	3.2	
2.4 Notched bar impact test at room temperature: In the case of bolts and studs $\geq$ M16 one set of impact test specimen per tensile test specimen	3.1	3.2	
2.5 Surface inspection: Procedure and evaluation based on DIN EN 26157-1	3.1	3.2	
2.6 Visual inspection and dimensional check: In acc. with DIN EN ISO 3269 (number of random samples: 20) <sup>1)</sup>	3.1	3.2	
2.7 Test of edge decarburization and carburization <sup>2)</sup> : Based on DIN EN ISO 898-1 Number of specimens according to DIN EN ISO 3269 and supplementary sheet to this materials test sheet <sup>1)</sup>	3.1	3.1	
3. Compliance with the requirements of DIN EN ISO 4042 regarding electroplated corrosion protection coatings as well as the requirements of DIN EN ISO 10684 and the guideline "Manufacture of hot dip galvanized bolts" [1]	3.1	3.1	
Material identification: Manufacturer's mark, steel grade, melt number, inspector's mark			
<sup>1)</sup> All specimens shall meet the requirements (acceptance number $A_c = 0$ ).			
<sup>2)</sup> Not required for material 1.4313 +QT780.			

**Supplementary sheet to materials test sheet WPB 3.17:** Sampling plan for destructive testing of mechanical properties

Number of pieces	Number of specimen sets for mechanical testing
$\leq 200$	1
$> 200$ up to $\leq 400$	2
$> 400$ up to $\leq 800$	3
$> 800$ up to $\leq 1200$	4
$> 1200$ up to $\leq 1600$	5
$> 1600$ up to $\leq 3000$	6
$> 3000$ up to $\leq 3500$	7
$> 3500$	DIN EN ISO 3269
If it is proved that the bolts and studs delivered are of the same melt and heat treatment testing of 4 specimen sets irrespective of the number of pieces will suffice.	

**Materials test sheet 3.18:** Ropes according to DIN EN 12385-1 and DIN EN 12385-2 as well as non-standard ropes

MATERIALS TEST SHEET		WPB 3.18
Part group:	Supporting means, load suspension devices and lifting accessories	
Product form:	Ropes	
Materials:	Non alloyed steel wire according to DIN EN 10264-3 or X5CrNi18-10 (1.4301), X5CrNiMo17-12-2 (1.4401) according to DIN EN 10264-4	
Requirements:	DIN EN 12385-1, DIN EN 12385-2, DIN EN 12385-4, DIN EN 10264-1, DIN EN 10264-4	
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. Tests on wire: Test in acc. with DIN EN 10264-1 and DIN 10264-3 or DIN EN 10264-4; all values shall be determined on the delivery itself. In the case of austenitic ropes the number of bends and wraps is not prescribed for the testing of wire.	3.1	3.1
2. Tests on rope:		
2.1 The effective breaking strength shall be verified in acc. with section 6.4.1 of DIN EN 12385-1	3.1	3.1
2.2 Visual inspection and dimensional check: Each part; surface condition in acc. with purchaser's specification	3.1	3.1
Material identification: The rope shall be durably marked (e.g. on sleeves, split-in plates). For austenitic ropes the material used shall be indicated in the inspection certificate and in the identification marking.		

**Materials test sheet 3.19:** Sling ropes according to DIN EN 13414-1, DIN EN 13414-2 and DIN EN 13414-3

MATERIALS TEST SHEET		WPB 3.19
Component group:	Load carrying means, load carrying attachments and lifting accessories	
Product form:	Sling ropes	
Materials:	Non alloyed steel wire according to DIN EN 10264-3	
Requirements:	DIN EN 10264-1, DIN EN 10264-3, DIN EN 12385-1, DIN EN 13414-1, DIN EN 13414-2 and DIN EN 13414-3, DIN 685-3	
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. Tests on wire: Test in acc. with DIN EN 10264-1 and DIN 10264-3	3.1	3.1
2. Tests on rope:		
2.1 The effective breaking strength shall be verified in acc. with section 6.4.1 of DIN EN 12385-1	3.1	3.1
2.2 Suspension members and intermediate links: In acc. with DIN 685-3	3.1	3.1
2.3 Visual inspection and dimensional check: In acc. with DIN EN 13414-1	3.1	3.1
Material identification: In acc. with DIN EN 13414-1		



**Materials test sheet 3.20:** Sling chains according to DIN EN 818-4, components for lifting accessories according to DIN EN 1677-1, DIN EN 1677-2, DIN EN 1677-3 and DIN EN 1677-4 as well as forged steel shackles according to DIN EN 13889

<b>MATERIALS TEST SHEET</b>		<b>WPB 3.20</b>	
Part group:	Supporting means, load suspension devices and lifting accessories		
Product form:	Sling chains, components for lifting accessories and forged shackles		
Materials:	DIN EN 818-1, DIN EN 1677-1, DIN EN 1677-2, DIN EN 1677-3, DIN EN 1677-4, DIN EN 13889		
Requirements:	DIN EN 818-1, DIN EN 818-2, DIN EN 818-4, DIN EN 1677-1, DIN EN 1677-2, DIN EN 1677-3, DIN EN 1677-4, DIN EN 13889		
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. Chains: In acc. with DIN EN 818-1 and DIN EN 818-2	3.1		3.1
2. Individual parts: In acc. with DIN EN 1677-1, DIN EN 1677-2, DIN EN 1677-3 or DIN EN 1677-4	3.1		3.1
3. Testing in acc. with section 6 of DIN EN 818-4	3.1		3.1
4. Forged shackles: In acc. with DIN EN 13889	3.1		3.1
Material identification: In acc. with DIN EN 818-1, DIN EN 818-4, DIN EN 1677-1, DIN EN 1677-2, DIN EN 1677-3, DIN EN 1677-4, DIN EN 13889			

**Materials test sheet 3.21:** Welded tubes made of austenitic steels according to DIN EN 10217-7

<b>MATERIALS TEST SHEET</b>		<b>WPB 3.21</b>
Part group:	Supporting means, load suspension devices and lifting accessories	
Product form:	Welded tubes	
Materials:	Austenitic stainless steels according to DIN EN 10217-7	
Requirements:	DIN EN 10217-7 (test category 2) <sup>1)</sup>	
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 ac- cording to section 4.3 or 4.4
1. Chemical composition: Ladle analysis	3.1	3.1
2. Attestation of heat treatment condition	3.1	3.1
3. Check for intergranular corrosion resistance <sup>2)</sup> : One specimen per melt and heat treatment batch each	3.1	3.1
4. Tensile test at room temperature: Lot size and extent of testing in acc. with DIN EN 10217-7 section 10.1 and Table 13	3.1	3.2
5. Technological tests: Type and extent of testing acc. to DIN EN 10217-7 Tables 13 and 14	3.1	3.2
6. Visual inspection and dimensional check: Each tube; surface condition in acc. with purchaser's specification	3.1	3.2
7. Material identification check: Each tube, e.g. by spectroscopy	3.1	3.1
8. Non-destructive testing: Type and extent of testing acc. to DIN EN 10217-7 section 11.11 and Table 13	3.1	3.2
9. Tightness test: Each tube in acc. with section 11.8 of DIN EN 10217-7	3.1	3.1
Material identification: Manufacturer's mark, steel grade, melt number, specimen number or identification number, inspector's mark		
<sup>1)</sup> Repair welding in the base material is not permitted. <sup>2)</sup> According to DIN EN ISO 3651-2 procedure A sensitisation T1 or T2 and only if the parts are being welded and are in contact with water.		

**Materials test sheet 3.22:** Bars and forgings made of stainless martensitic steels according to DIN EN 10088-3 or  
DIN EN 10250-4

<b>MATERIALS TEST SHEET</b>		<b>WPB 3.22</b>
Part group:	Supporting means, load suspension devices and lifting accessories	
Product form:	Bars and forgings	
Materials:	X17CrNi16-2 - QT800 (1.4057), X39CrMo17-1 - QT750 (1.4122), X3CrNiMo13-4 - QT780 (1.4313), X5CrNiCuNb16-4 - P800 (1.4542), X5CrNiCuNb16-4 - P930 (1.4542)	
Requirements:	DIN EN 10088-3 <sup>1)</sup> or DIN EN 10250-4 <sup>1)</sup>	
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 ac- cording to section 4.3 or 4.4
1. Chemical composition: Ladle analysis	3.1	3.1
2. Attestation of heat treatment condition (for 1.4313 indication of strength grade)	3.1	3.1
3. Tensile test at room temperature: Test lot and extent of testing according to DIN EN 10088-3 Table 26 or section 11 of DIN EN 10250-1	3.1	3.2
4. Notched bar impact test at room temperature: Test lot and extent of testing as for tensile test (only for nominal dimension $\geq 15$ mm)	3.1	3.2
5. Hardness test for verification of uniform heat treat- ment: On one end of each part three measuring points each	3.1	3.1
6. Visual inspection and dimensional check: Each part, surface quality and dimensions in acc. with purchaser's specification	3.1	3.2
7. Material identification check: Each part, e.g. by spectroscopy	3.1	3.1
8. Ultrasonic testing: For bar steel with product thicknesses $\geq 30$ mm and forgings with a weight in final heat treatment condition $\geq 300$ kg, each part subject to 100 % in acc. with <b>An- nex B</b>	3.1	3.2
Material identification: Manufacturer's mark, steel grade, melt number, specimen number or identification number, inspector's mark		
<sup>1)</sup> Repair welding is not permitted.		

**Materials test sheet 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

MATERIALS TEST SHEET		WPB 3.23
Part group:	Supporting means, load suspension devices and lifting accessories	
Product form:	Bolts and nuts $\leq$ M 39	
Materials:	Property classes Bolts 4.6, 5.6, 6.8, 8.8 and 10.9 Nuts 5, 6, 8 and 10	
Requirements:	Bolts: DIN EN ISO 898-1, DIN EN ISO 3269, DIN EN 26157-3 (Testing of mechanical properties in accordance with DIN EN ISO 898-1, test series MP1. Where test series MP1 is not practicable, test series FF1 plus retempering test may be performed on bolts of property classes 8.8 and 10.9.) Nuts: DIN EN ISO 898-2, DIN EN ISO 3269, DIN EN ISO 6157-2 In the case of electroplated corrosion protection coatings additionally: DIN EN ISO 4042 In the case of hot dip galvanizing additionally: DIN EN ISO 10684 and guideline "Manufacture of hot dip galvanized bolts" [1]	
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
Proof (by continuous recording in the manufacturer's works) that the requirements regarding mechanical properties, surface condition, corrosion protection coating and dimensional accuracy have been met	2.2 <sup>1)</sup> or 3.1 <sup>2)</sup>	2.2 <sup>1)</sup> or 3.1 <sup>2)</sup>
Material identification:	Bolts in acc. with DIN EN ISO 898-1 Nuts in acc. with DIN EN ISO 898-2	
<sup>1)</sup> In lieu of the inspection certificate 2.2 stamping will suffice if the manufacturer is approved in acc. with VdTÜV technical leaflet MB WERK 1253/4. <sup>2)</sup> For bolts of property classes 8.8 and 10.9 as well as for nuts of property classes 8 and 10 an inspection certificate 3.1 is required.		

**Materials test sheet 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

MATERIALS TEST SHEET		WPB 3.24
Part group:	Supporting means, load suspension devices and lifting accessories	
Product form:	Bolts and nuts $\geq$ M 10 and $\leq$ M 39	
Materials:	Property classes 50, 70 and 80 Steel group: A2, A3, A4 and A5	
Requirements:	DIN EN ISO 3506-1, DIN EN ISO 3506-2, DIN ISO 3269, DIN EN 26157-3, DIN EN ISO 6157-2	
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
Proof (by continuous recording in the manufacturer's works) that the requirements regarding mechanical properties, surface condition and dimensional accuracy have been met	2.2 <sup>1)</sup>	2.2 <sup>1)</sup>
Material identification:	In acc. with DIN EN ISO 3506-1, DIN EN ISO 3506-2	
<sup>1)</sup> In lieu of the inspection certificate 2.2 stamping will suffice if the manufacturer is approved in acc. with VdTÜV technical leaflet MB WERK 1253/4.		

**Materials test sheet 3.25:** Terminations with ferrules according to DIN EN 13411-3 for steel wire ropes

MATERIALS TEST SHEET		WPB 3.25
Part group:	Supporting means, load suspension devices and lifting accessories	
Product form:	Terminations with ferrules	
Materials:	EN AW-5051 A (EN AW-ALMg2(B)) according to DIN EN 573-3 or C10C (1.0214) according to DIN EN 10263-2 or X5CrNi18-10 (1.4301), X5CrNiMo17-12-2 (1.4401) according to DIN EN 10088-2	
Requirements:	DIN EN 13411-3; DIN EN 10263-2, DIN EN 10088-2	
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	
Type testing according to DIN EN 13411-3	3.1	3.1
The effective breaking strength of the termination ferrule-rope shall be verified (at least 90% of the minimum breaking strength of the rope)	3.1	3.1
Certificate according to DIN EN 13411-3 section 7.2	3.1	3.1
Material identification: The ferrule shall be durably marked in acc. with DIN EN 13411-3 section 7.1.		

**Materials test sheet 3.26:** Terminations with ferrules for steel wire rope slings according to DIN EN 13414-1

MATERIALS TEST SHEET		WPB 3.26
Part group:	Supporting means, load suspension devices and lifting accessories	
Product form:	Terminations with ferrules for steel wire rope slings	
Materials:	EN AW-5051 A (EN AW-ALMg2(B)) according to DIN EN 573-3 or C10C (1.0214) according to DIN EN 10263-2 or X5CrNi18-10 (1.4301), X5CrNiMo17-12-2 (1.4401) according to DIN EN 10088-2	
Requirements:	DIN EN 13411-3; DIN EN 10263-2, DIN EN 10088-2	
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	
Type testing of eye ferrule-secured terminations according to DIN EN 13411-3	3.1	3.1
Type testing of eye thimble-secured terminations according to DIN EN 13411-1	3.1	3.1
The effective breaking strength of the rope termination shall be verified (at least 90% of the minimum breaking strength of the rope).	3.1	3.1
Material identification: In acc. with DIN EN 13411-1.		

**Materials test sheet 3.27:** Plates, sheets and strips made of quenched and tempered steels according to DIN EN 10025-6

<b>MATERIALS TEST SHEET</b>		<b>WPB 3.27</b>
Part group:	Supporting means, load suspension devices and lifting accessories	
Product form:	Plates, sheets and strips	
Materials:	S460QL1 (1.8916), S500QL1 (1.8984), S690QL1 (1.8988)	
Requirements:	DIN EN 10025-1, DIN EN 10025-6 <sup>1)</sup> , DIN EN 10163-2 class B3, 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 ac- cording to section 4.3 or 4.4
1. Chemical composition: Ladle analysis	3.1	3.1
2. Attestation of heat treatment condition	3.1	3.1
3. Tensile test at room temperature:		
3.1 One specimen per melt and test unit	3.1	3.2
3.2 Three tensile specimens in thickness direction for product thicknesses > 15 mm and tensile loading in thickness direction: Test unit according to DIN EN 10164 Quality class Z 25 according to DIN EN 10164	3.1	3.2
4. Notched bar impact test at test temperature according to DIN EN 10025-6: One set of impact test specimen per tensile test speci- men as per no. 3.1 as far as the nominal thickness is ≥ 6 mm	3.1	3.2
5. Visual inspection and dimensional check: Each part	3.1	3.2
<p>See <b>Table 7-1</b> ser. no. 3 c) regarding ultrasonic testing of parts under tensile stress in thickness direction.</p> <p>Products with thicknesses ≥ 6 mm shall at least meet the requirements of quality class S<sub>1</sub> according to DIN EN 10160 for the body and E<sub>1</sub> for the edge zone.</p>		
<p>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)</p>		
<p><sup>1)</sup> Repair welding is not permitted.</p>		

**Materials test sheet 4.1:** Hot rolled parts made of structural carbon steels according to DIN EN 10025-2

<b>MATERIALS TEST SHEET</b>		<b>WPB 4.1</b>	
Part group:	Running wheels and their axles and shafts		
Product form:	Hot rolled parts		
Materials:	Structural carbon steels according to DIN EN 10025-2		
Requirements:	DIN EN 10025-1, DIN EN 10025-2 <sup>1)</sup>		
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	2.2	3.1	
2. Attestation of heat treatment condition or of as-delivered condition	2.2	3.1	
3. Tensile test at room temperature: One specimen per melt, test unit and thickness range each	2.2	3.1	
4. Notched bar impact test <sup>2)</sup> at test temperature according to DIN EN 10025-2:			
4.1 One test per lot delivered	2.2	—	
4.2 One set of impact test specimen per tensile test specimen as per no. 3 as far as the nominal thickness is $\geq 6$ mm	—	3.1	
5. Visual inspection and dimensional check: Each part	—	3.1	
Material identification: Manufacturer's mark, steel grade, melt number, specimen number or identification number, inspector's mark; for lifting equipment according to KTA 3902, section 4.2 only manufacturer's mark and steel grade			
<sup>1)</sup> Repair welding is not permitted. <sup>2)</sup> For qualities J0, J2 and K2 only.			

**Materials test sheet 4.2:** Forged parts made of structural carbon steels according to DIN EN 10250-2

<b>MATERIALS TEST SHEET</b>		<b>WPB 4.2</b>	
Part group:	Running wheels and their axles and shafts		
Product form:	Forged parts		
Materials:	S235JRG2 (1.0038), S235J2G3 (1.0116), S355J2G3 (1.0570)		
Requirements:	DIN EN 10250-1, DIN EN 10250-2 <sup>1)</sup>		
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	3.1		3.1
3. Tensile test at room temperature: One specimen per melt, test unit and thickness range each	3.1		3.1
4. Notched bar impact test at test temperature according to DIN EN 10025-2: One set of impact test specimen per tensile test specimen as far as the nominal thickness is $\geq 15$ mm	3.1		3.1
5. Visual inspection and dimensional check: Each part	3.1		3.1
Material identification: Manufacturer's mark, steel grade, melt number, specimen number or identification number, inspector's mark; for lifting equipment according to KTA 3902 section 4.2 only manufacturer's mark and steel grade			
1) Repair welding is not permitted.			



**Materials test sheet 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

<b>MATERIALS TEST SHEET</b>		<b>WPB 4.3</b>
Part group:	Running wheels and their axles and shafts	
Product form:	Forged or rolled parts	
Materials:	Quenched and tempered steels according to DIN EN ISO 683-1, DIN EN ISO 683-2 or SEW 550	
Requirements:	DIN EN ISO 683-1 <sup>1)</sup> , DIN EN ISO 683-2 <sup>1)</sup> or SEW 550 <sup>1)</sup>	
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	2.2	3.1
2. Attestation of heat treatment condition	2.2	3.1
3. Tensile test at room temperature: One specimen per melt, dimensional range and heat treatment batch each	2.2	3.1
4. Notched bar impact test at room temperature: One set of impact test specimens per tensile test specimen, as far as the nominal dimension is $\geq 15$ mm	2.2	3.1
5. Visual inspection and dimensional check: Each part	—	3.1
6. Materials identification check for alloyed steels: Each part, e.g. by spectroscopy	—	3.1
Material identification: Manufacturer's mark, steel grade, melt number, specimen number or identification number, inspector's mark		
<sup>1)</sup> Repair welding is not permitted.		

**Materials test sheet 4.4:** Bright steel made of carbon steels according to DIN EN 10277

<b>MATERIALS TEST SHEET</b>		<b>WPB 4.4</b>	
Part group:	Running wheels and their axles and shafts		
Product form:	Bright steel		
Materials:	Carbon steels according to DIN EN 10277		
Requirements:	DIN EN 10277 <sup>1)</sup>		
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	2.2	3.1	
2. Attestation of heat treatment condition	2.2	3.1	
3. Tensile test at room temperature: One specimen per melt, dimensional range and heat treatment batch each	2.2	3.1	
4. Visual inspection and dimensional check: Each part	—	3.1	
Material identification: Manufacturer's mark, steel grade, melt number, specimen number or identification number, inspector's mark; for lifting equipment according to KTA 3902 section 4.2 only manufacturer's mark and steel grade			
1) Repair welding is not permitted.			

**Materials test sheet 4.5:** Running wheels made of cast steel according to DIN EN 10293 or of cast steel for pressure vessels to DIN EN 10213

<b>MATERIALS TEST SHEET</b>		<b>WPB 4.5</b>	
Part group:	Running wheels and their axles and shafts		
Product form:	Running wheels		
Materials:	Cast steel according to DIN EN 10293 or cast steel for pressure vessels to DIN EN 10213		
Requirements:	DIN EN 10293 or DIN EN 10213		
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	3.1	3.1	
3. Hardness testing on each wheel with conversion to tensile strength according to DIN EN ISO 18265	3.1	3.1	
4. Visual inspection and dimensional check: Each part	3.1	3.1	
Material identification: Manufacturer's mark, steel grade			

**Materials test sheet 5.1:** Brake disks made of spheroidal graphite cast iron according to DIN EN 1563

<b>MATERIALS TEST SHEET</b>		<b>WPB 5.1</b>	
Part group:	Other parts for hoists		
Product form:	Brake disks		
Materials:	Spheroidal graphite cast iron		
Requirements:	DIN EN 1563		
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 (if heat treatment was performed)	3.1	3.1	
3. Tensile test at room temperature: One specimen per melt treated in same way <sup>1)</sup> , heat treatment batch (if heat treatment was performed) and 2500 kg of similar dimensions each from separately or parallel cast test pieces	3.1	3.1	
4. Notched bar impact test at room temperature: For grades with guaranteed notch toughness one set of specimens per tensile specimen	3.1	3.1	
5. Visual inspection and dimensional check: Each parts	3.1	3.1	
Material identification: Manufacturer's mark, steel grade, melt number, specimen number			
1) Melts treated in same way are melts from the same magnesium treatment batch.			

**Materials test sheet 5.2:** Brake drums and brake disks made of structural carbon steel according to DIN EN 10025-2

<b>MATERIALS TEST SHEET</b>		<b>WPB 5.2</b>
Part group:	Other parts for hoists	
Product form:	Hot rolled plates and sheets for brake drums Hot rolled plates and sheets <sup>1)</sup> for brake disks	
Materials:	S235J0 (1.0114), S235J2 (1.0117), S235JR (1.0038), S355J2 (1.0577), S355K2 (1.0596)	
Requirements:	DIN EN 10025-1, DIN EN 10025-2 <sup>2)</sup> , 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: One specimen per melt, test unit and thickness range each	3.1	3.1
4. Notched bar impact test at test temperature to DIN EN 10025-2: One set of impact test specimen per tensile test specimen as per no. 3 as far as the nominal dimension is $\geq 6$ mm	3.1	3.1
5. Visual inspection and dimensional check: Each part	3.1	3.1
<p>Material identification:</p> <p>Manufacturer's mark, steel grade, melt number, specimen number or identification number (the plate or sheet number may also be used as specimen number), inspector's mark</p>		
<p>1) Brake disks may also be manufactured from rolled round bars, in which case the requirements of materials test sheet WPB 2.2 shall be met.</p> <p>2) Repair welding is not permitted.</p>		

## Annex B

### Non-destructive testing (NDT)

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#### B 1 Scope

(1) This Annex applies to the performance of non-destructive tests and contains procedural requirements and evaluation criteria for non-destructive testing.

(2) Deviations from this Annex may be possible in justified individual cases.

##### Note:

The procedure, extent and point in time of NDT are laid down in material test sheets as well as in test and inspection sequence plans for final inspection.

#### B 2 General specifications

##### B 2.1 Personnel

(1) Test supervisors shall have the technical knowledge required to perform their tasks and know the possibilities of application as well as limits of test procedures. The test supervisory personnel

a) in case of production tests, shall have basic knowledge of the fabrication processes used and of the characteristic appearance of fabrication imperfections; they shall normally be independent from the fabrication department and the authorized inspector shall be notified of their names;

b) in case of in-service inspections, shall be familiar with the characteristic features of operationally caused defects.

The test supervisory personnel is responsible for the application of the test procedure and for the details of the implementation of the test in accordance with the relevant specifications. They are responsible for the employment of qualified and certified NDT operators. This applies also to the employment of personnel not belonging to the works. The test supervisory personnel shall sign the test report.

(2) The test supervisory personnel shall have been qualified and certified for the examination procedures in the relevant product or industrial sectors at least with level 2 according to DIN EN ISO 9712. For radiographic and ultrasonic testing level 3 qualification and certification is required.

(3) The NDT operators shall have been qualified and certified according to DIN EN ISO 9712 for the applicable examination procedure in the relevant product or industrial sectors. For radiographic and ultrasonic testing at least level 2 qualification and certification is required.

**B 2.2 Equipment and test fluids**

The measuring and testing equipment to be used shall be monitored. The type and intervals of monitoring shall be fixed by the equipment manufacturer with a view to the accuracy of the equipment. The testing of such measuring and testing equipment shall be certified.

**B 2.3 Requirements for surfaces**

(1) The surfaces shall be free from scale, weld spatters or any other contaminants. Any grooves or notches affecting the test result shall be eliminated.

(2) The arithmetical mean deviation of the assessed profile (average roughness) Ra according to DIN EN ISO 4287 shall not exceed

- a) 10 µm for surface inspection by magnetic particle and penetrant testing,
- b) 20 µm for ultrasonic testing on the scanning and opposite surface if it is used as reflection surface.

(3) In the case of waviness of the scanning surfaces for ultrasonic testing the waviness shall be so little as to provide sufficient probe shoe contact. This is generally the case if the distance between probe shoe surface and scanning surface does not exceed 0.5 mm at any point.

(4) Coatings with a thickness up to and including 50 µm are permitted when performing non-destructive examinations, except for surface inspection by penetrant testing.

(5) Upon completion of the examination the parts shall be properly cleaned to remove test liquid residuals.

**B 2.4 Point in time of NDT during production testing**

The product forms shall be tested in the as-delivered condition and weld seams in the final-heat treatment condition, where possible, and prior to any coating.

**B 3 NDT procedural requirements**

**B 3.1 Visual inspection**

Visual inspection shall be performed according to DIN EN ISO 17637.

**B 3.2 Surface inspection by magnetic particle and penetrant testing**

**B 3.2.1 Viewing conditions**

(1) The viewing conditions of DIN EN ISO 3059 shall be met. In addition, the requirements of para. (2) to (5) shall be observed.

(2) The eyes of the operator shall have at least 5 minutes to adapt to the light conditions.

(3) For the purpose of better detectability of defects sufficient contrast shall be provided in magnetic particle testing by the use of suitable media (e.g. fluorescent detection media or application of a thin colour coat only slightly covering the underground). UV-A radiation may additionally be used to improve the contrast in penetrant testing using fluorescent penetrants.

(4) During the examination the angle of viewing shall not deviate by more than 30 degrees from the surface normal. During viewing the distance to the test surface shall normally be approximately 300 mm.

(5) For the inspection auxiliary means (e.g. magnifying glasses, contrast-improving spectacles, mirrors) are permitted.

**B 3.2.2 Magnetic particle testing**

**B 3.2.2.1 Methods and performance of examination**

Magnetic particle testing shall be performed according to DIN EN ISO 9934-1 using the wet technique and in accordance with the following requirements.

**B 3.2.2.1.1 Methods**

(1) Where magnetisation is achieved in partial areas by the current flow technique or yoke magnetisation, AC magnetisation shall normally be used.

(2) The residual magnetic field strength shall not exceed 800 A/m unless a lower value is required. Where the specified value is exceeded, the part shall be demagnetised and the value of the residual magnetic field strength be recorded.

(3) For the magnetic particle testing techniques the following identifying characters shall be used:

Magnetic particle testing technique		Characters
Yoke magnetization	with permanent magnet	JD
	with electromagnet	JE
Magnetization by current carrying-conductors	with coil	LS
	with other conductors (cable)	LK
Magnetization by current flow	self-induced current	SS
	induced current flow	SI

**B 3.2.2.1.2 Contact areas in case of current flow technique**

(1) Where the test is performed by current flow technique, consumable electrodes (e.g. lead fin alloys) shall be used, if possible. It shall be ensured that in the contact areas overheating of the material to be tested is avoided.

(2) Where overheating has occurred the overheated areas shall be marked, ground over after the examination and be subject to surface inspection, preferably by magnetic particle testing using yoke magnetisation.

**B 3.2.2.1.3 Direction of magnetisation**

Each location on the surface shall be tested from two directions of magnetisation offset by approximately 90 degrees.

**B 3.2.2.1.4 Magnetic field strength**

(1) In the case of AC magnetisation the tangential field strength on the surface shall normally be at least 2 kA/m and shall not exceed 6.5 kA/m.

Note:

- a) The required magnetic flux density in the test object surface of at least 1 Tesla will be obtained in low-alloy or low-carbon steels with high relative permeability as early as at a tangential field strength of 2 kA/m.
- b) For other steels with lower permeability a higher field strength may be required.
- c) Where magnetisation is too high, structural indications (spurious indications) may cover relevant indications.

(2) It shall be checked by measurements that these values are adhered to or test conditions shall be determined under which these values may be obtained.

#### **B 3.2.2.1.5 Magnetisation times**

The following guide values apply with respect to the application of the magnetic particles and magnetisation:

- a) Magnetisation and wetting: at least 3 seconds
- b) Post-magnetisation time: at least 5 seconds.

#### **B 3.2.2.2 Detection media**

(1) Detection media shall be used that have been type-tested in accordance with DIN EN ISO 9943-2. Verification of such type testing shall be submitted to the authorized inspector.

(2) Magnetic particles with an average grain size smaller than or equal to 8 µm shall be used. Depending on application, black, fluorescent or coloured powders may be used.

(3) Immediately prior to wetting the surface care shall be taken to ensure that the magnetic powder is distributed uniformly in the carrier liquid and is kept in suspension. Prior to and during testing the powder suspension shall be spot-checked by suitable pre-magnetised calibration blocks.

#### **B 3.2.2.3 Test instruments**

The test instruments shall meet the requirements of DIN EN ISO 9934-3.

#### **B 3.2.3 Penetrant testing**

##### **B 3.2.3.1 Test system**

(1) Colour contrast penetrants shall preferably be used. Fluorescent penetrants or fluorescent colour contrast penetrants may be used.

(2) Solvents or water or both in combination may be used as penetrant remover.

(3) Only solvent based wet developers shall be used. Dry developers may only be applied on the test surface by electrostatic spraying.

(4) For the test system at least sensitivity class "highly sensitive" according to DIN EN ISO 3452-2 shall be adhered to.

(5) The suitability of the test system (penetrant, solvent remover and developer) shall be demonstrated by type testing according to DIN EN ISO 3452-2. Verification shall be submitted to the authorized inspector.

(6) Penetrants in test equipment and partly used open tanks (except for aerosol cans) shall be monitored by the user using the reference block 2 according to DIN EN ISO 3452-3. In this test the penetration and development times shall not exceed the times specified for the evaluation. The examination sensitivity obtained shall be recorded.

##### **B 3.2.3.2 Performance**

(1) Penetrant testing shall be performed in accordance with DIN EN ISO 3452-1 and the following requirements.

(2) The penetration time shall be at least half an hour.

(3) Immediately after drying of the developer a first inspection shall normally be made. A further inspection shall normal-

ly be made not earlier than half an hour after the first inspection has passed.

(4) Further points in time of inspection are required if indications are detected during one of the inspections or if essential changes of indications or additional indications are detected compared with the previous inspection.

(5) The evaluation shall be made in due consideration of all inspection results.

#### **B 3.3 Radiographic testing**

(1) Radiographic testing of weld seams shall be performed according to DIN EN ISO 17636-1 class B.

(2) The image quality indicators according to DIN EN ISO 19232-1 shall be used.

#### **B 3.4 Ultrasonic testing**

##### **B 3.4.1 Requirements for test frequencies, transducer dimension and scanning positions**

The test frequency, transducer dimension and scanning positions are laid down in sections B 4 to B 6. These specifications are considered guide values from which deviations are possible in justified cases.

##### **B 3.4.2 Performance**

###### **B 3.4.2.1 Basic specifications for ultrasonic testing**

(1) Depending on design and material, the tests on product forms shall be performed based on the standards DIN EN 10228-3, DIN EN 10228-4 or DIN EN 10308.

(2) The test shall be performed in a state of simple geometry (with plane-parallel or cylindrical surfaces, pre-machined where required) in which case the full volume shall be tested.

(3) Section B 6 shall apply to ultrasonic testing of weldings.

###### **B 3.4.2.2 Test instructions**

The details for ultrasonic testing shall be laid down in test instructions if

- a) it is required by the standards applied,
- b) parts are tested for which test instructions are required in section B4, and
- c) the geometries to be tested are not covered by sections B 4 and B 5.

###### **B 3.4.2.3 Setting the testing level**

(1) The testing level shall be set on the test object, on calibration block no. 1 according to DIN EN ISO 2400 or on calibration block No. 2 according to DIN EN ISO 7963 or on reference blocks by using suitable reference reflectors.

(2) The reference block must correspond to the test object as regards the test-relevant characteristics (material, constructional design, shape, wall thickness, heat treatment). The wall thickness of the reference block shall deviate not more than 10 % from that of the test object.

(3) Reference reflectors may be back walls, notches and boreholes.

(4) Setting the testing level shall be carried out according to DIN EN ISO 16811.

**B 4 Performance and evaluation of testing on ferritic product forms**

**B 4.1 Bars**

**B 4.1.1 Surface inspection**

(1) The entire surface shall be tested in its finished condition. Magnetic particle testing shall preferably be used.

(2) The magnetic particle test shall be performed and evaluated in compliance with the requirements of DIN EN 10228-1, quality class 4. In addition, the stipulations laid down in B 3.2.2 shall apply. The evaluation shall be made during post-magnetization.

(3) The penetrant test shall be performed and evaluated in compliance with the requirements of DIN EN 10228-2, quality class 4. In addition, the stipulations laid down in B 3.2.3 shall apply.

**B 4.1.2 Ultrasonic testing**

**B 4.1.2.1 Performance**

Section B 3.4 applies to the performance of ultrasonic testing.

**B 4.1.2.2 Scanning positions, scanning conditions and evaluation**

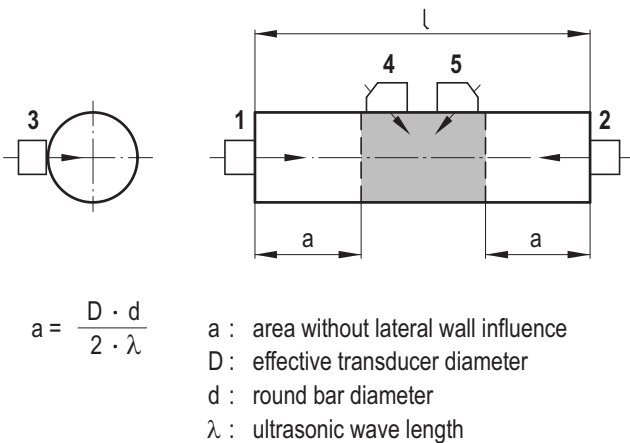
(1) The scanning positions for round bars are shown in **Figure B-1**, those for rectangular or polygonal bars in **Figure B-2**.

(2) On bars with diameters or side lengths exceeding 30 mm ultrasonic testing shall be performed according to DIN EN 10228-3 to an extent of 100 % in due consideration of the stipulations in (3) and (4).

**Note:**

For straight beam scanning the requirements of DIN EN 10228-3 are also met by DIN EN 10308.

(3) In case of diameters or side lengths exceeding 60 mm straight beam scanning in axial direction shall be performed additionally (positions 1 and 2); where in this case no distance between recording level and noise level of at least 6 dB can be adhered to over the entire length of the bar, the test shall be performed in the cut-to-length condition or using 45° angle beam scanning in both axial directions (positions 4 and 5).

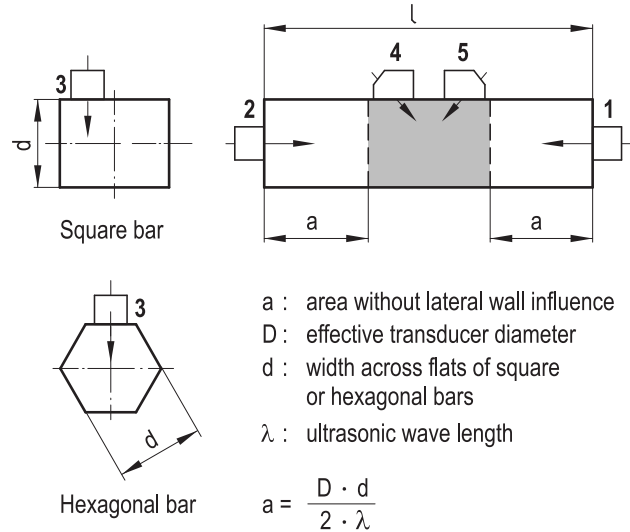


**Figure B-1:** Scanning positions for round bars

(4) The following shall apply to the evaluation:

- a) for straight beam scanning on bars with diameters or side lengths equal to or less than 60 mm: quality class 3
- b) for straight beam scanning on bars with diameters or side lengths exceeding 60 mm: quality class 2
- c) for angle beam scanning: quality class 2

according to DIN EN 10228-3 and the recording levels and acceptance criteria resulting herefrom.



**Figure B-2:** Scanning positions for rectangular or polygonal bars

**B 4.2 Forged load hooks and load hook nuts**

**B 4.2.1 Surface inspection**

**B 4.2.1.1 Performance**

(1) The entire surface shall be examined in its finished condition. Magnetic particle testing shall be used preferably.

(2) Magnetic particle testing shall be performed in accordance with B 3.2.2.

(3) Penetrant testing shall be performed in accordance with B 3.2.3.

**B 4.2.1.2 Evaluation**

(1) Indications which suggest the presence of crack-like defects are not permitted. Indications with a maximum extension equal to or smaller than 1.5 mm detected by magnetic particle testing and indications equal to or smaller than 3 mm detected by penetrant testing shall not be included in the evaluation. Indications proved to be non-metallic inclusions as well as rounded indications up to an extension of 6 mm are permitted.

(2) The frequency of permissible indications shall be limited locally to a number of 5 per square decimetre, however to a number of 10 per square metre referred to the entire surface area.

(3) In case of greater extension or frequency or in case of systematically occurring irregularities these locations shall be repaired or the product's further usability shall be determined jointly with the authorized inspector.

(4) In addition, the following applies: in the shank area and in the saddle region linear indications transverse to the direction of loading are not permitted.

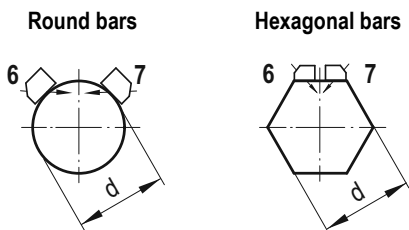


**B 4.2.2 Ultrasonic testing**

**B 4.2.2.1 Basic material for die-forged single load hooks and load hook nuts**

(1) The provisions for testing of bars according to section B 4.1.2 shall apply.

(2) In case of hexagonal and round bars for nuts, the circumferential face shall be completely scanned by angle beam scanning in both circumferential directions using a 35° angle beam probe. The scanning positions are shown in **Figure B-3**.

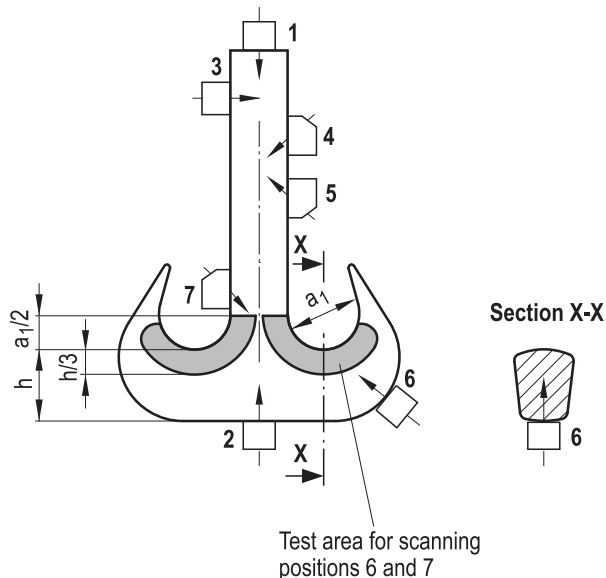


**Figure B-3:** Scanning positions on bars for load hook nuts

**B 4.2.2.2 Ramshorn load hook**

(1) The scanning positions are shown in **Figure B-4**.

(2) The evaluation shall be made in accordance with **Table B-1**.



**Figure B-4:** Scanning positions for ramshorn load hooks

**B 4.2.2.3 Open-die forged single load hooks**

Test instructions shall be established in due consideration of para. B 4.2.2.2.

Scanning positions	1 and 2	3	4 and 5	6	7
Nominal beam angle, degrees	0	0	45	0	45
Frequency, MHz	2 or 4	2 or 4	4	2	2
Recording level (diameter of equivalent flat bottom hole $d_{eq}$ in mm)	4	6	4	4	4
Permissible excess of echo amplitude over the recording level, dB	< 6	< 6	< 6	0	0
Permissible half-amplitude length <sup>1)</sup> , mm	≤ 10	≤ 50	≤ 10	—	—
Allowable frequency of indications per hook	1	3	1	0	0

1) When evaluating the half-amplitude length of reflectors, the probe displacement at a signal amplitude drop of 6 dB to the maximum echo height shall be determined.

**Table B-1:** Evaluation of ultrasonic testing on ramshorn load hooks

**B 4.3 Load hook lifting beams**

**B 4.3.1 Surface inspection**

**B 4.3.1.1 Performance**

(1) The entire surface shall be examined in its finished condition. Magnetic particle testing shall be used preferably.

(2) Magnetic particle testing shall be performed in accordance with clause B 3.2.2.

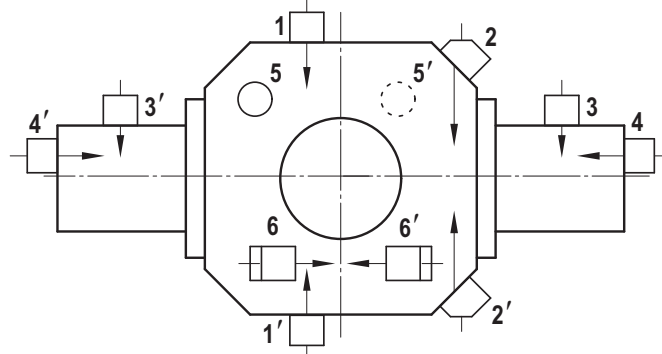
(3) Penetrant testing shall be performed in accordance with clause B 3.2.3.

**B 4.3.1.2 Evaluation**

The evaluation shall be made in accordance with B 4.2.1.2. Linear indications transverse to the direction of loading are not permitted.

**B 4.3.2 Ultrasonic testing**

(1) The scanning positions are shown in **Figure B-5**. The test shall cover the entire volume.



**Figure B-5:** Scanning positions for load hook lifting beams

- (2) The scanning conditions shall be taken from **Table B-2**.
- (3) The evaluation shall be made in accordance with **Table B-3**.

Scanning positions	Nominal beam angle, degrees	Frequency, MHz
1, 3, 4, 5	0	4
2	45	2
6 <sup>1)</sup>	35	2

<sup>1)</sup> Scanning position 6 or 6' shall be used if scanning in position 2 or 2' is not or not entirely possible.

**Table B-2:** Scanning positions for load hook lifting beams

Scanning positions	Straight beam and angle beam scanning
Recording level (diameter of equivalent flat bottom hole $d_{eq}$ in mm)	$s \leq 120$ mm: 4 $s > 120$ mm: 6
Permissible excess of echo amplitude over the recording level, dB	< 6
Permissible half-amplitude length <sup>1)</sup>	1 · wall thickness, 100 mm at maximum
Allowable frequency of indications	2 indications per m <sup>2</sup> of the part's surface

<sup>1)</sup> When evaluating the half-amplitude length of reflectors, the probe displacement at a signal amplitude drop of 6 dB to the maximum echo height shall be determined.

**Table B-3:** Evaluation of ultrasonic testing on load hook lifting beams

**B 4.4 Shafts and axles for gear boxes**

**B 4.4.1 Surface inspection**

The surface inspection shall be performed and evaluated in accordance with B 4.1.1. In addition, the following applies: linear indications transverse to the direction of loading are not permitted.

**B 4.4.2 Ultrasonic testing**

**B 4.4.2.1 Extent and point in time of testing**

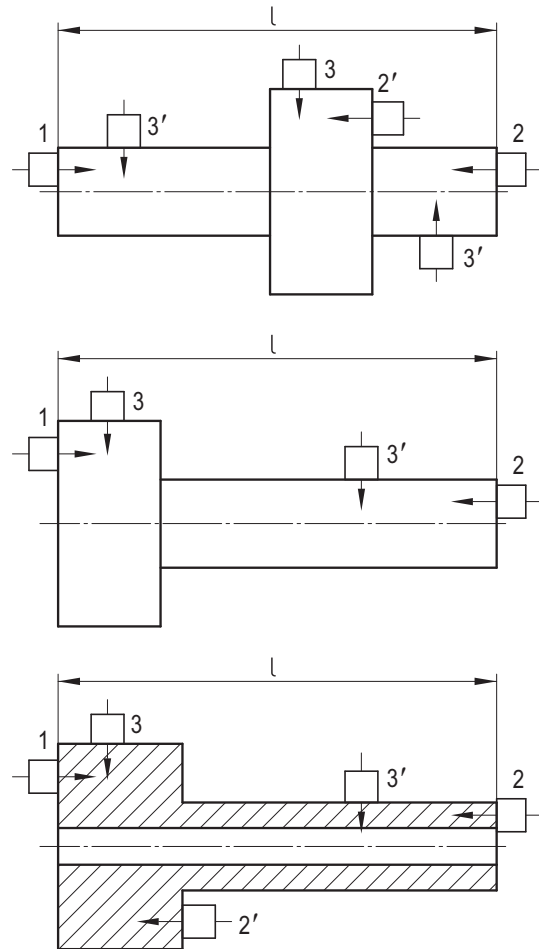
The test shall be performed in a state of simple geometry (with plane-parallel or cylindrical surfaces, pre-machined where required) in which case the full volume shall be tested.

**B 4.4.2.2 Scanning conditions**

- (1) The parts shall be tested such that each volumetric area is tested from at least two scanning positions offset by approximately 90 degrees. If this cannot be done by straight beam scanning, angle beam scanning from two opposite directions shall be performed for each straight beam scanning omitted.
- (2) For rough-turned cylindrical non-stepped shafts and axles the scanning positions of B 4.1.2.2 shall apply.
- (3) **Figure B-6** shows examples of scanning positions for rough-turned stepped axles and shafts.
- (4) Test instructions shall be established for axles and shafts, if the scanning conditions of subparas 2 and 3 cannot be applied (e.g. due to specific geometric conditions).

**B 4.4.2.3 Evaluation**

The evaluation shall be made in accordance with **Table B-4**.



**Figure B-6:** Scanning positions for stepped axles and shafts (examples)

Scanning positions	1 and 2	3
Recording level (diameter of equivalent flat bottom hole $d_{eq}$ in mm)	$60 < d \leq 120$ : 4 $d > 120$ : 6	$d \leq 60$ : 3 $60 < d \leq 120$ : 4 $d > 120$ : 6
Permissible excess of echo amplitude over the recording level, dB	< 6	< 6
Permissible half-amplitude length <sup>1)</sup> , mm	$\leq 10$	$\leq d$ , maximum 50
Allowable frequency of indication per metre	5	$d \leq 60$ : 3 $d > 60$ : 5

<sup>1)</sup> When evaluating the half-amplitude length of reflectors, the probe displacement at a signal amplitude drop of 6 dB to the maximum echo height shall be determined.

**Table B-4:** Evaluation of ultrasonic testing on shafts and axles for gear boxes

**B 4.5 Gear box housings of series-production electric hoists with rope and of series-production hoist gear boxes**

- (1) A surface inspection by penetrant testing shall be performed and be evaluated according to DIN EN 1371-1 at machined bearings of gear box housings.
- (2) The severity levels SP 3, LP 3, CP 3, AP 3 shall be satisfied.

(3) Indications which suggest the presence of crack-like defects are not permitted.

## **B 5 Performance and evaluation of testing on product forms made of austenitic steels (rolled or forged components)**

### **B 5.1 Surface inspection**

- (1) The entire surface shall be tested in its finished condition.
- (2) The requirements according to DIN EN 10228-2, quality class 4, shall apply to the performance and evaluation. In addition, the stipulations laid down in B 3.2.1 and B 3.2.3 apply.

### **B 5.2 Ultrasonic testing**

#### **B 5.2.1 Extent and point in time of testing**

The test shall be performed in a state of simple geometry (with plane-parallel or cylindrical surfaces, pre-machined where required) in which case the full volume shall be tested.

#### **B 5.2.2 Determination of testability**

- (1) For the purpose of determining the test object testability the back wall echoes shall be determined in a grid by straight beam scanning in wall thickness direction. In areas of non-parallel or non-concentric walls reference echoes shall be used for this test (e.g. bores available, edges or through transmission).
- (2) For the area with the largest determinable sound attenuation it shall be proved that the required recording levels can be observed.

#### **B 5.2.3 Scanning conditions**

The specifications of section B 4 shall apply to the scanning conditions. The test frequencies shall normally range from 2 MHz to 4 MHz.

#### **B 5.2.4 Performance and Evaluation**

- (1) The performance shall be made in accordance with the respective specifications of section B 4, however, the standard DIN EN 10228-4 shall be used instead of DIN EN 10228-3.
- (2) The following shall apply to the evaluation:
  - a) quality class 2 for straight beam scanning on bars with diameters or side lengths equal to or less than 250 mm,
  - b) quality class 3 for straight beam scanning on bars with diameters or side lengths exceeding 250 mm
 according to DIN EN 10228-4 and the recording levels and acceptance criteria resulting herefrom.

## **B 6 Performance and evaluation of testing on welded connections between ferritic steels**

### **B 6.1 General**

The area to be tested shall include the weld metal and the adjacent base metal on both sides over a width of

- a) 10 mm on each side for wall thicknesses equal to or smaller than 30 mm,
- b) 20 mm on each side for wall thicknesses exceeding 30 mm.

### **B 6.2 Ultrasonic testing of weld junction areas for plates under tensile stress in thickness direction**

Ultrasonic testing of the weld junction areas on plates shall be effected in accordance with DIN EN 10160. The tested weld junction areas shall meet the requirements of quality class E<sub>4</sub>

of DIN EN 10160, Table 5. The test shall be performed with the recording level of 3 mm disc shaped reflector.

### **B 6.3 Visual inspection of weld seams**

#### **B 6.3.1 Performance**

The visual inspection shall be performed according to DIN EN ISO 17637.

#### **B 6.3.2 Evaluation**

The evaluation of imperfections in fusion-welded joints of steel, nickel, titanium and their alloys (beam welding excluded) is carried out according to DIN EN ISO 5817 and the evaluation of electron and laser-beam welded joints in steel, nickel, titanium and their alloys according to DIN EN ISO 13919-1. Weld seams subject to dynamic loadings shall in each case satisfy the requirements of quality level B and weld seams primarily subject to static loadings shall in each case satisfy the requirements of quality level C.

### **B 6.4 Surface inspection of weld seams**

#### **B 6.4.1 Performance**

- (1) Surface inspection shall be performed in accordance with clause B 3.2.2 or B 3.2.3.
- (2) As far as practicable, magnetic particle testing shall be performed. The evaluation shall be made during post-magnetization.

#### **B 6.4.2 Evaluation**

- (1) Indications which suggest the presence of crack-like defects are not permitted. Indications with a maximum extension equal to or smaller than 1.5 mm detected by magnetic particle testing and indications equal to or smaller than 3 mm detected by penetrant testing shall not be included in the evaluation. Indications proved to be non-metallic inclusions as well as rounded indications up to an extension of 6 mm are permitted.
- (2) The frequency of permissible indications may locally be up to 3 per 100 mm weld length.
- (3) In the case of larger dimensions or frequency or systematically occurring irregularities these locations shall be repaired or decision shall be made jointly with the authorized inspector on the acceptability of the component.

### **B 6.5 Radiographic testing of weld seams**

- (1) Radiographic testing shall be performed and evaluated in accordance with section B 3.3.
- (2) For the evaluation acceptance level 1 according to DIN EN ISO 10675-1 applies.

### **B 6.6 Ultrasonic testing of weld seams**

- (1) All butt welds shall be scanned from both sides for presence of longitudinal and of transverse defects. The scanning positions are shown in **Table B-5**. Setting the testing level shall preferably be performed in accordance with the DGS method. When the reference block method or the DAC method is used, the reference reflectors to **Figure B-7** shall be used for setting the testing level.
- (2) The scanning conditions shall be taken from **Table B-6**. The beam angle in the test for transverse defects shall normally be selected such that the angle of incident on defects which are perpendicular to the surface is as small as possible.
- (3) In the case of differing nominal wall thicknesses the greater nominal wall thickness shall govern the determination of the

number of beam angles and the smaller nominal wall thickness shall govern the determination of the recording level.

Wall thickness or nominal wall thickness of the test object, mm	Side view of the reference block
$s \leq 10$	
$10 < s \leq 15$	
$15 < s \leq 20$	
$20 < s \leq 40$	
$40 < s \leq 80$	
$s > 80$	

The length of the reference reflectors shall be at least the beam width referred to a 20 dB echo amplitude decrease regarding the maximum sound path to the reference reflector.

**Figure B-7:** Reference blocks for setting the testing level when using the DAC method- or the reference block method

(4) The evaluation of longitudinal defects shall be made in accordance with **Tables B-7** and **B-8**.

(5) The recording level for the examination for transverse defects shall be taken from **Table B-7**. Indications reaching or exceeding the recording level are permitted only if they occur individually and as spots and if they are not accompanied by frequent indications up to 12 dB below the recording level.

(6) In the case of unacceptable indications it may be demonstrated by further examinations (e.g. by radiography, by

telltale holes) that the use of the part or component is permitted.

(7) Where recordable echoes are to be classified as indications due to external contour, control measurements to detect the cause of indication shall be performed.

(8) Where, by measurement of the projection distances on the test piece, it shall be proved that the echoes recorded on both sides of the weld seam are caused by the two faces of an unmachined weld seam root and not by weld defects, the exact projection distance shall be determined on reference blocks. If the locations of the reflections are found to be distinctly separate from each other, the indications are considered due to external contour. Where a distance of less than 3 mm is found, the reflections shall not be treated as separate reflections.

(9) Indications due to external contour shall be entered in the test reports with indication of location, position and size.

**B 7 Performance and evaluation of testing on welded connections between austenitic steels**

**B 7.1 General**

The area to be tested shall include the weld metal and the adjacent base metal on both sides over a width of

- a) 10 mm on each side for wall thicknesses equal to or smaller than 30 mm,
- c) 20 mm on each side for wall thicknesses exceeding 30 mm.

**B 7.2 Ultrasonic testing of weld junction areas for plates under tensile loading in thickness direction**

Ultrasonic testing of the weld junction areas on plates shall be effected in accordance with DIN EN 10307. The examined weld junction areas shall meet the requirements of quality class E<sub>4</sub> of DIN EN 10307, Table 5. The test shall be performed with the recording level of 3 mm disc shaped reflector.

**B 7.3 Visual inspection of weld seams**

**B 7.3.1 Performance**

The visual inspection shall be performed according to DIN EN ISO 17637.

**B 7.3.2 Evaluation**

The evaluation of imperfections in fusion-welded joints of steel, nickel, titanium and their alloys (beam welding excluded) is carried out according to DIN EN ISO 5817 and the evaluation of electron and laser-beam welded joints in steel, nickel, titanium and their alloys according to DIN EN ISO 13919-1. Weld seams subject to dynamic loadings shall in each case satisfy the requirements of quality level B and weld seams primarily subject to static loadings shall in each case satisfy the requirements of quality level C.

**B 7.4 Surface inspection of weld seams**

Surface inspection shall be performed and evaluated in accordance with section B 6.4 using penetrant testing according to section B 3.2.3.

**B 7.5 Radiographic testing of weld seams**

(1) Radiographic testing shall be performed in accordance with section B 3.3.

(2) For the evaluation the requirements of acceptance level 1 according to DIN EN ISO 10675-1 apply.

Ser. No.	Accessibility for scanning	Required surface condition of the weld seam	Scanning positions	
1	From both sides of the weld seam and from one surface at one skip distance	—		<b>Test for longitudinal defects:</b> Positions 1 and 2 at p <sup>1)</sup> <b>Test for transverse defects:</b> Position QF at p in the two opposite directions on the weld seam <sup>2)</sup> .
2	From both sides of the weld seam and from both surfaces at ½ skip distance	—		<b>Test for longitudinal defects:</b> Positions 1 up to 4 at p/2 <b>Test for transverse defects:</b> Position QF at p or QF' and QF' at p/2, each in the two opposite directions on the weld seam <sup>2)</sup>
3	From one side of the weld seam and from both surfaces at one skip distance	Outside and inside machined flat		<b>Test for longitudinal defects:</b> Positions 1 and 2 at p <b>Test for transverse defects:</b> Position QF at p or QF' and QF' at p/2, each in the two opposite directions on the weld seam
4	From one side of the weld seam and from one surface at 1 ½ skip distances. If s > 40 mm, second beam angle at one skip distance.	Outside and inside machined flat		<b>Test for longitudinal defects:</b> Position 1 at 3/2 p If s ≤ 20 mm position 1 using 60 degrees permitted. If s > 40 mm position 1 with second angle at p <b>Test for transverse defects:</b> Position QF at p in the two opposite directions on the weld seam

p : skip distance

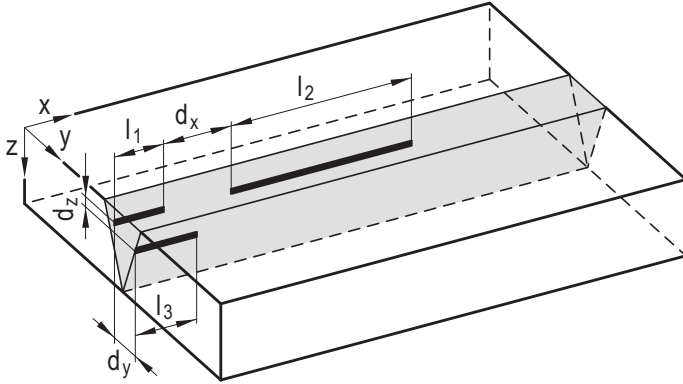
1) In the case of wall thicknesses > 40 mm, this shall only apply to the smaller beam angle, the evaluation up to p/2 shall be sufficient for the large beam angle.

2) Where the test for transverse defects is not possible on the weld seam, the test may be performed at the base material surface adjacent to the weld seam (in an acute angle as possible to the weld seam).

**Table B-5:** Scanning positions for butt welds

Nominal wall thickness s, mm	$s \leq 20$	$20 < s \leq 40$	$s > 40$
Beam angle, general	70 degrees	60 degrees	45 degrees and 60 degrees
Beam angle in direction of curvature or in the case of wall thickness transitions	45 degrees up to 60 degrees	45 degrees up to 60 degrees	35 degrees up to 45 degrees and 60 degrees up to 70 degrees
Frequency, MHz	4	2 to 4	2 to 4

**Table B-6:** Scanning conditions for butt welds

Reference reflector	Circular arc of calibration block no. 1 or no. 2 or side-drilled hole with a diameter of 3 mm or notch with a depth of 1 mm
Evaluation method	DGS or reference block method or DAC method
Recording level	$8 \leq s \leq 15$ 1.5 mm disc shaped reflector or 50 % echo amplitude of side-drilled hole or notch $15 \leq s \leq 40$ : 2 mm disc shaped reflector or 50 % echo amplitude of side-drilled hole $s > 40$ : 3 mm disc shaped reflector or 50 % echo amplitude of side-drilled hole
Permissible excess over the recording level	< 6 dB <sup>1)</sup>
Permissible length of recordable indications	in accordance with <b>Table B-8</b>
Permissible distances between recordable indications	<p>For every two indications the distance of which is smaller than twice the length of the larger indication, the indication distance shall be covered by the evaluation. In this connection, particularly the orientation of the indications in relation to each other and in the weld seam, their reflection behaviour from different scanning directions and the wall thickness shall be taken into consideration.</p> <p>The following generally applies:</p> <p>a) Indications of the same position in depth direction (<math>d_z &lt; 2.5</math> mm) and the same position in width direction (<math>d_y &lt; 5</math> mm) shall have a distance from each other in the direction of welding of at least the length of the longer indication (<math>d_x \geq L_2</math>). Otherwise, the indications are considered to be continuous. Where more than two indications follow each other closely, they shall be compared to each other in pairs and shall fulfil the above criteria.</p> <p>b) Indications of the same position in width direction (<math>d_y &lt; 5</math> mm) shall have a distance from each other in thickness direction <math>d_z</math> exceeding half the length of the longer indication, but not less than 10 mm.</p> <p>c) Indication of the same position in depth direction (<math>d_z &lt; 2.5</math> mm) located side by side shall have a distance <math>d_y</math> of at least 10 mm in width direction.</p> 
<p><sup>1)</sup> Per metre of weld seam an indication with a length <math>\leq 10</math> mm may exceed the recording level by up to 12 dB. When calculating the cumulative length this indication shall be considered with 10 mm.</p>	

**Table B-7:** Evaluation of ultrasonic testing on butt welds

Nominal wall thickness $s$ <sup>1)</sup> , mm	Maximum allowable length <sup>1)</sup> of individual reflectors	Allowable cumulated length (sum of individual reflector's lengths) per reference length <sup>2)</sup>
$15 < s \leq 40$	$\leq 25$ mm, but $\leq s$	$\leq 1.5 \cdot s$
$40 < s \leq 60$	$\leq 30$ mm	$\leq 1.5 \cdot s$
$60 < s \leq 120$	$\leq 40$ mm	$\leq 2 \cdot s$
$s > 120$	$\leq 50$ mm	$\leq 2 \cdot s$

<sup>1)</sup> When evaluating the length of reflectors, the probe displacement at an echo amplitude drop of 6 dB to the maximum echo height shall be determined (half-amplitude length).  
<sup>2)</sup> The reference length is  $6 \cdot s$ .

**Table B-8:** Acceptable length of recordable indications detected by ultrasonic testing for longitudinal defects

## Annex C

### Forms for test records and qualification tests

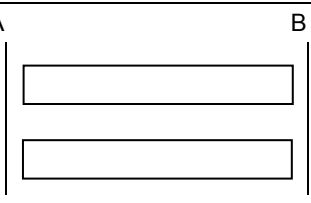
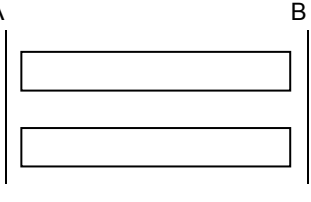
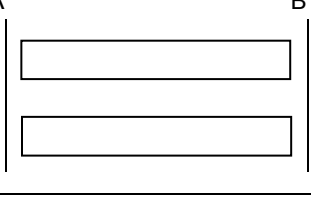
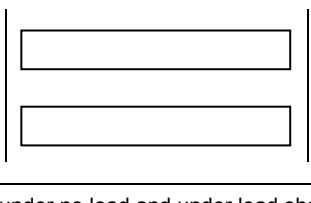
#### List of Forms

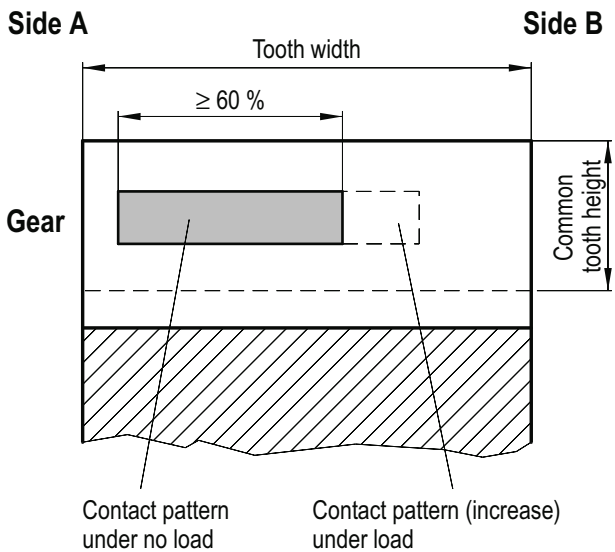
Form C-1:	Test record for gear box - characteristics and measured data
Form C-2/A:	Test record for test run of gear box
Form C-2/B:	Test record for test run of gear box
Form C-3:	Qualification test for motor shaft
Form C-4:	Qualification test for brake with or without brake disks - service brake or auxiliary brake (series-production part)
Form C-5:	Qualification test for brake with or without brake disks - safety brake (series-production part)
Form C-6:	Qualification test for motor coupling with or without brake disks (series-production part)
Form C-7:	Qualification test for drum coupling (series-production part)
Form C-8:	Qualification test for rope sheaves (series-production part)
Form C-9:	Qualification test for rope termination/wedge socket (series-production part)
Form C-10:	Test record for series-production electric hoist with rope

Test record for gear box - characteristics and measured data					Form C-1	
Type of gear box:			Where used:			
Gear box manufacturer:			Lifting equipment unit:			
Serial no.:			Serial no.:			
1	Characteristics :					
1.1	Performance P1	:	kW			
1.2	Total ratio	:				
1.3	Maximum speed, drive, $n_1$	:	$\text{min}^{-1}$			
1.4	Maximum torque, drive, $T_1$	:	Nm			
1.5	Maximum torque, drive, $T_2$	:	Nm			
1.6	Weight (complete with lubricant)	:	kg			
1.7	Lubricant	:	Type of lubrication:			
2	Measured data		1st stage	2nd stage	3rd stage	4th stage
2.1	Gears and toothing					
	Drawing no.	Pinion				
		Gear				
	Number of teeth $Z_{1,2}$	Pinion				
		Gear				
	Module					
	Material	Pinion				
		Gear				
	Hardening process	Pinion				
		Gear				
	Hardness depth on accompanying test specimens	Required *) Pinion				
		Gear				
	Hardness penetration depth, mm	Actual Pinion				
		Gear				
	Hardness values in HRC or HV on accompanying test specimens	Required *) Pinion				
		Gear				
	Actual	Pinion				
		Gear				
	Tooth distance in mm over ... teeth, mean of 3 measurements Measuring accuracy: 0.01 mm	Required *) Pinion				
		Gear				
		Permiss. deviation				
	Actual	Pinion				
		Gear				
2.2	Bearing		1st stage	2nd stage	3rd stage	4th stage
	Distance of axes A Measuring accuracy: 0.01 mm (on the boring mill)	Required *)				
		Actual	right			
			left			
	Permiss. deviation					
	Parallelism of axes Measuring accuracy: 0.01 mm (on the boring mill)	Required *)				
		Actual				
	Horizontal deviation (centre height distance of axes) Measuring accuracy: 0.01 mm (on the boring mill)	Required *)	right			
		left				
	Actual	right				
		left				
*) Required values with tolerances						
Test notes:						
Manufacturer:			Date:			



Test record for test run of gear box						Form C-2 / A
Type of gear box:		Design:		Where used:		
Gear box manufacturer:				Lifting equipment unit:		
Serial no.:				Serial no.:		
Recording of contact pattern (tooth bearing) before test run under no load according to Form C-2/B						
Gear box speed $n_1$ : <span style="float: right;"><math>\text{min}^{-1}</math></span>						
Date:	Test run duration, h	Load		Oil temperature before and after test run:		
	counterclockwise:	counterclockwise:		°C   °C		
	clockwise:	clockwise:		Ambient temperature during test run:		
				°C		
Noise:	1 : noiseless	counterclockwise	loaded:	dB (A)		
	2 : humming	clockwise	unloaded:	dB (A)		
	3 : irregular		loaded:	dB (A)		
	4 : rolling		unloaded:	dB (A)		
Flank clearance:		1st stage	2nd stage	3rd stage	4th stage	Remarks
3 measurements on circumference, Measuring accuracy: 0.01 mm						
Recording of contact pattern (tooth bearing) after test run under load according to Form C-2/B						
Has the gear box been cleared with flushing oil after test run?						yes/no
Are sufficient amounts of oil supplied to the bearings in the case of splash or pressure lubrication?						yes/no
Is there any oil flow at the specified bearings in the case of pressure lubrication?						yes/no
Is ample amount of lubrication oil supplied to the teeth?						yes/no
Leak tightness upon visual inspection?						yes/no
Test notes:						
Manufacturer:				Date:		
Authorized inspector according to § 20 Atomic Energy Act:				Date:		

Test record for test run of gear box		Form C-2 / B
Contact pattern (tooth bearing)		average layer thickness:     μm
Spotting means:		
Stage	Type and location of contact patterns on the tooth flank and marking of deformation tendency	Contact pattern width in % of tooth flank length (tooth width) x contact pattern height in % of common tooth height, average value from 3 teeth groups on the circumference
1	<div style="display: flex; justify-content: space-between;"> <span>Pinion</span> <span>A</span> <span>B</span> </div> 	<p>..... X .....</p> <p>..... X .....</p>
2	<div style="display: flex; justify-content: space-between;"> <span>Pinion</span> <span>A</span> <span>B</span> </div> 	<p>..... X .....</p> <p>..... X .....</p>
3	<div style="display: flex; justify-content: space-between;"> <span>Pinion</span> <span>A</span> <span>B</span> </div> 	<p>..... X .....</p> <p>..... X .....</p>
4	<div style="display: flex; justify-content: space-between;"> <span>Pinion</span> <span>A</span> <span>B</span> </div> 	<p>..... X .....</p> <p>..... X .....</p>
<p>The minimum contact pattern under no load and under load shall not exceed the following values:</p> <ul style="list-style-type: none"> <li>- for non-crowned teeth 60 % of the usable tooth width,</li> <li>- for longitudinally crowned teeth 40 % of the usable tooth width.</li> </ul> <p>The sides "A" and "B" shall be clearly marked on the gear box.</p>		



The deformation tendency under load shall be indicated by the manufacturer

**Figure C-1:** Example for filling-in Form C-2 / B

**Qualification test for motor shaft**

**Form C-3**

Type/construction of motor

Serial no.

Manufacturer

Type/construction of brake

Serial no.

Manufacturer

Qualification test no., if any

Where used:

Lifting equipment unit

Serial no.

Nominal speed

Number of starts per hour

Maximum ambient temperature

Maximum humidity

Design data A-side	Operational load (lifting)	Operational load (braking)	Assembly load	Special load	Test load
Maximum static torque according to KTA 3902	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Maximum dynamic torque according to KTA 3902	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Maximum starting torque of motor	<input type="text"/>				
Radial force	<input type="text"/>				

Design data B-side	Operational load (lifting)	Operational load (braking)	Assembly load	Special load	Test load
Maximum static torque according to KTA 3902	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Maximum dynamic torque according to KTA 3902	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Maximum starting torque of motor	<input type="text"/>				
Radial force	<input type="text"/>				

**Confirmation of design data by the authorized inspector**

Manufacturer's motor shaft data

Material

Diameter of shaft end

Design of shaft hub joint

**Attestation of qualification by the manufacturer**

Qualification test for brake with or without brake disks - service brake or auxiliary brake (series-production part)				Form C-4
Brake type:		Where used (hoist):		
Type of brake release device:				
Brake manufacturer:		Lifting equipment unit:		
Serial no.:		Serial no.:		
1. Design data	Operational load	Special load	Assembly load	Test load
Load torque				
Maximum mass moment of inertia of the lifting mass				
Maximum mass moment of inertia of the rotating masses				
Minimum safety against load torque <sup>1)</sup>				
Required braking torque				
Nominal rotation speed				
Maximum lowering speed at the beginning of braking				
Material of the brake disk or drum				
Inspection certificate for brake disk or drum in accordance with materials test sheet				
Brake disk or brake drum diameter				
Brake disk thickness or brake drum width				
Full disk, ventilated disk				
Coupling type: make				
Dead time until brake response				
Starts per hour				
Maximum ambient temperature				
Maximum humidity				
Coefficient of friction at brake lining; static				
Coefficient of friction at brake lining; dynamic				
Type of brake lining				
Confirmation of design data by the authorized inspector:	Date:			
2. Qualification test by the manufacturer				
Qualification records:				
Nominal braking torque:				
Maximum braking torque:				
Minimum braking torque:				
Attestation of qualification by the manufacturer:	Date:			
<sup>1)</sup> See KTA 3902 clause 6.2.1.3.3 (2).				

Qualification test for brake with or without brake disks - safety brake (series-production part)		Form C-5
Brake type:	Where used (hoist):	
Type of brake release device:		
Brake manufacturer:	Lifting equipment unit:	
Serial no.:	Serial no.:	
1. Design data	Operational load	Test load
Minimum and maximum load torque:		
Minimum and maximum mass moment of inertia of the rotating masses		
Minimum and maximum mass moment of inertia of the lifting mass		
Minimum safety against maximum load torque		
Required braking torque		
Material quality of the brake disk		
Inspection certificate for brake disk or drum in accordance with materials test sheet		
Brake disk diameter		
Nominal rotation speed		
Maximum triggering rotation speed at the beginning of braking		
Minimum triggering rotation speed at the beginning of braking		
Starts per hour		
Maximum ambient temperature		
Maximum humidity		
Coefficient of friction at brake lining; static, dynamic		
Dead time until brake response		
Confirmation of design data by the authorized inspector:	Date:	
2. Qualification test		
Qualification records:		
Nominal braking torque:		
Maximum braking torque:		
Minimum braking torque:		
Attestation of qualification by the manufacturer:	Date:	
Attestation of qualification by the authorized inspector according to § 20 Atomic Energy Act	Date:	

Qualification test for motor coupling with or without brake disks (series-production part)				Form C-6
Type:	Where used:			
Brake manufacturer:	Lifting equipment unit:			
Serial no.:	Serial no.:			
1. Design data	Operational load	Special load	Assembly load	Test load
Nominal torque of the drive end				
Nominal torque of the load end				
Impact torque of the load end				
Mass moment of inertia of the drive end				
Mass moment of inertia of the load end				
Maximum braking torque				
Breakdown torque of the motor				
Number of run-ups; starts per hour				
Temperature factor				
Maximum surface temperature				
Maximum rotation speed				
Starts per hour				
Maximum ambient temperature				
Maximum humidity				
Material quality of the brake disk or drum				
Inspection certificate for brake disk or drum in accordance with materials test sheet				
Confirmation of design data by the authorized inspector	Date:			
2. Qualification test				
Qualification records:				
Attestation of qualification by the manufacturer:	Date:			

Qualification test for drum coupling (series-production part)				Form C-7
Type:	Where used:			
Manufacturer:	Lifting equipment unit:			
Serial no.:	Serial no.:			
1. Design data	Operational load	Special load	Assembly load	Test load
Maximum design torque in acc. with KTA 3902				
Maximum design radial forces				
Maximum lowering rotation speed				
Maximum nominal rotation speed				
Maximum ambient temperature				
Material quality				
Confirmation of design data by the authorized inspector	Date:			
2. Qualification test				
Qualification records:				
Test notes:				
Attestation of qualification by the manufacturer:	Date:			

Qualification test for rope sheaves (series-production part)				Form C-8
Type:	Where used:			
Manufacturer:	Lifting equipment unit:			
Serial no.:	Serial no.:			
1. Design data	Operational load	Special load	Assembly load	Test load
Maximum rope traction force relevant for design				
Maximum nominal rotation speed				
Materials of rope sheave				
Rope diameter				
Maximum ambient temperature				
Confirmation of design data by the authorized inspector:	Date:			
2. Qualification test				
Qualification records:				
Test notes:				
Attestation of qualification by the manufacturer:	Date:			

Qualification test for rope termination / wedge socket (series-production part)				Form C-9
Type:	Where used:			
Manufacturer:	Lifting equipment unit:			
Serial no.:	Serial no.:			
1. Design data	Operational load	Special load	Assembly load	Test load
Maximum rope traction force relevant for design				
Material quality of wedge socket				
Material quality of wedge socket clamp				
Rope diameter				
Maximum ambient temperature				
Safety factors in acc. with DIN 15020-1				
Confirmation of design data by the authorized inspector:	Date:			
2. Qualification test				
Qualification records:				
Test notes:				
Attestation of qualification by the manufacturer:	Date:			

Test record for series-production electric hoist with rope						Form C-10	
Type:			Where used:				
Lifting capacity:							
Assembly load		kg	Operational load		kg		
Manufacturer:			For lifting equipment unit:				
Serial no.:			Serial no.:				
Year built:							
Operating voltage:		V;	Hz	Control voltage:		V;	Hz
Motor data:							
	Type	Serial no.	kW	V	A	min <sup>-1</sup>	% Duty cycle
Main hoist motor							
Creep speed hoist motor							
Lateral transport motor							
Test data of hoist							
Main hoist:		Load	kg	V	A		
Operation at no load	Lifting						
	Lowering						
Operation at nominal load (assembly load or operational load)	Lifting						
	Lowering						
Operation at test load	Lifting						
	Lowering						
Creep speed hoist:		Last	kg	V	A		
Operation at no load	Lifting						
	Lowering						
Operation at nominal load (assembly load or operational load)	Lifting						
	Lowering						
Operation at test load	Lifting						
	Lowering						
Insulation resistance cold:		Main hoist motor	MΩ				
		Creep speed hoist motor	MΩ				
Test notes:							
Manufacturer:				Date:			
Authorized inspector according to § 20 Atomic Energy Act:				Date:			



## Annex D

### Tests and inspections of hoist brakes

#### D 1 General

(1) Regarding the tests and inspections of individual brakes required in accordance with Table 8-1, no. 1.4 and Table 10-1, no. 2.1.5 h, the sequence of precautionary measures described in D 2 shall apply.

(2) Testing and inspection of safety brakes shall be performed in accordance with specific test instructions.

(3) Brakes may alternatively be tested without attached load if a suitable system for determining the braking effect is used and the suitability of the system is verified in accordance with section D 3.1 for each individual case. In the case of subsequent retrofitting of the system, testing according to § 25 of DGUV 53 will become necessary.

(4) Where a method for determining the braking effect without lifting loads is used, the requirements of section D 3 shall be met regarding the testing of individual brakes according to Table 10-1, no. 2.1.5 h) and 2.1.5 i).

#### D 2 Testing of hoist brakes with load attached

##### D 2.1 Static holding force

The static holding force of each individual brake shall be determined:

- with attached test load in which case each brake alone shall hold the test load, or
- with a braking torque measuring system in which case no essential changes shall be ascertained when comparing the measured values with the calculated values and the values determined in foregoing tests.

##### D 2.2 Braking effect of hoist brakes

(1) The test of the braking effect of hoist brakes with additional requirements according to section 4.2 shall be performed at first with both brakes and then with each individual brake with the test load moving downwards.

(2) The test of the braking effect of hoist brakes with increased requirements according to section 4.3 shall be performed at first with all brakes together, then group by group

and finally with each individual brake with the test load moving downwards.

The following gives an example of the individual test stages for a redundant hoist with 4 brakes (see **Figure D-1**):

- Test of all 4 brakes together.
- Brakes 1 and 2 are released. Brakes 3 and 4 are tested together.
- Brakes 3 and 4 are released. Brakes 1 and 2 are tested together.
- Brakes 2 and 3 are released. Brakes 1 and 4 are tested together.
- Brakes 1 and 4 are released. Brakes 2 and 3 are tested together.
- Brakes 2, 3 and 4 are released. Brake 1 is tested.
- Brakes 1, 2 and 3 are released. Brake 4 is tested.
- Brakes 1, 3 and 4 are released. Brake 2 is tested.
- Brakes 1, 2 and 4 are released. Brake 3 is tested.

The braking torque build-up time (from the signal “brake activated” to the summit of the braking curve) and the braking time (from the summit of the braking curve to standstill) shall be measured, in which case no essential changes shall occur when comparing the measured values with the calculated values and the values obtained in foregoing tests. This applies accordingly to service and auxiliary brakes for hoists with safety brake.

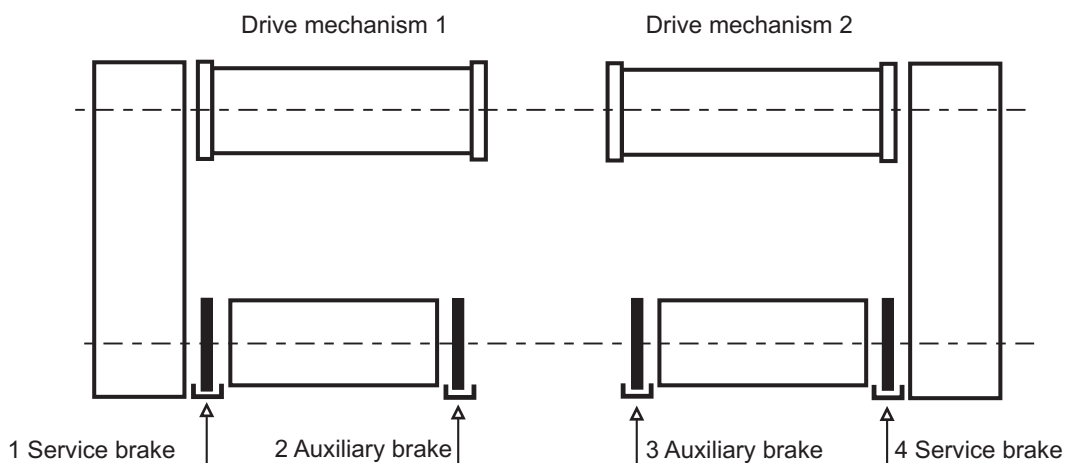
(3) When testing individual brakes care shall be taken to ensure that in the case of failure of the individual brake to be tested all released brakes are activated without delay.

#### D 3 Testing of hoist brakes without load attached

##### D 3.1 General

(1) Within the supervisory procedure under nuclear law the design approval, final inspection and acceptance testing shall be performed to meet the requirements of sections 5, 7 and 8 of this Safety Standard.

(2) The measures required for monitoring and maintaining the braking system and test system shall be specified in a service and maintenance manual.



**Figure D-1:** Example for the arrangement of brakes on a redundant hoist

**D 3.2 Requirements for the test system and the brakes**

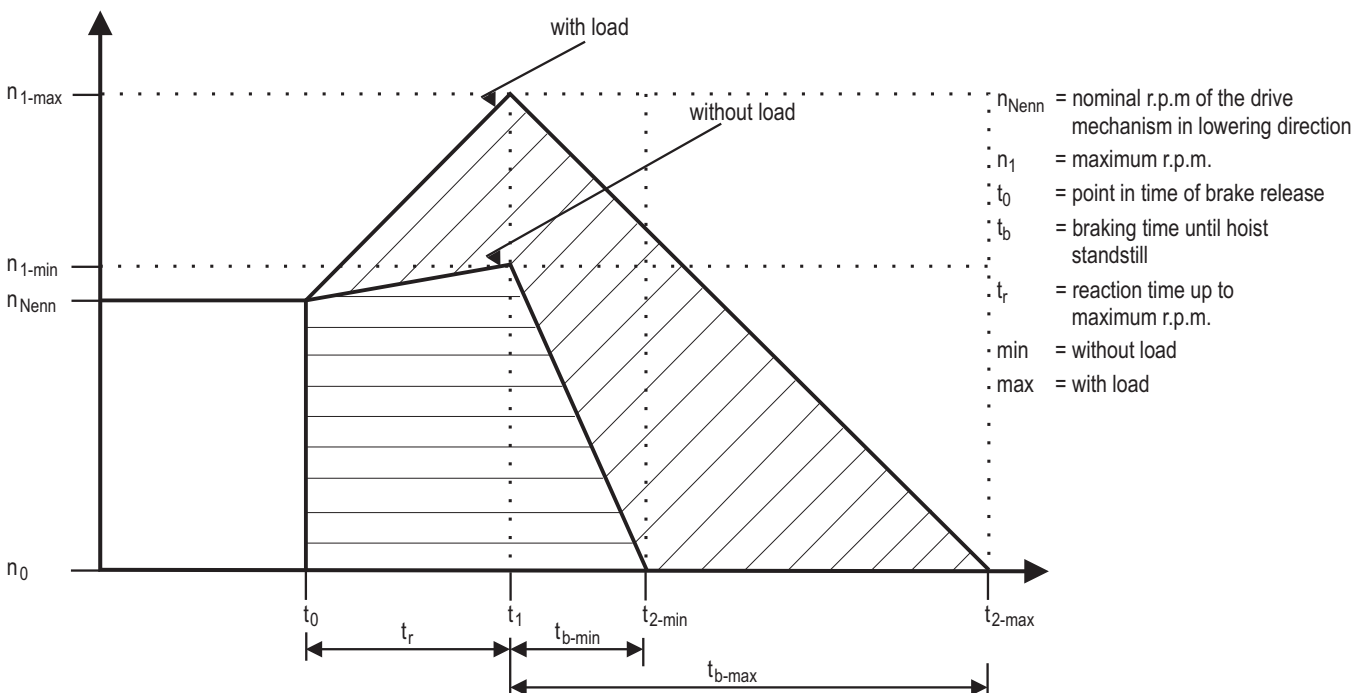
- (1) The test system shall ensure that
- a) during the test without load (lifting mass) the full braking torque can be built up.
  - b) reactions on the drive mechanisms (including electrical equipment) are avoided. Should this not be possible, the reactions shall be considered in the design of the drive mechanisms and specific design approval documents be established.
  - c) it is possible to calibrate and test the equipment and reproduce the measured data, and that the equivalence of the tests with or without load is recognizable.
  - d) the suitability is guaranteed even when considering ambient conditions (e.g. temperature, moisture, dust, condition at intermittent duty).
- (2) Within the design approval procedure respective documents for the suitability and design shall be submitted. The suitability of the test system shall be assessed by the authorized inspector on the basis of these documents for each individual case. The crane manufacturer shall confirm that the intended test system has no safety-relevant negative influences on the drive and the hoist. This procedure shall be agreed upon by the technical committee for cranes and lifts at the office of the federal accident insurance corporations responsible for safety and health.
- (3) The design of the brakes shall be suited for the test method to be applied in the combined operation of hoist and test system.
- (4) The brakes shall meet the requirements of DIN 15434-1 and DIN 15434-2. Their suitability for use in hoists shall be demonstrated by means of **Forms C-4** and **C-5**. In addition, the brake manufacturer or a testing agency shall certify that the requirements of DIN 15436 have been met in which case the suitability of the brake linings shall be proved on large-scale test pieces. The certificate shall state under which conditions the frictional material attains stable frictional behaviour.

**D 3.3 Performance of test**

The test shall be performed in accordance with a test instruction which shall state the total test procedure beginning with a visual inspection of the brakes and the test system (e.g. to determine the general condition, the braking torque setting) up to the checking of the functional capability (by indicating data for the testing of brakes with or without load attached as well as allowable deviations) including a description of the sequence of measuring procedures.

**D 3.4 Documentation of the brake test**

- (1) To fulfil the protective goals of Safety Standard KTA 3902 and to consider the different conditions of energy distribution in the system with or without load attached, comparable data shall be determined during acceptance testing by means of a test with load and a test without load attached, and the following values shall be documented (see **Figure D-2**):
- a) the weight of the load during the test,
  - b) the nominal torque and direction of rotation of the drive,
  - c) the point in time of releasing the brake as definite reference point for the whole braking operation; here, it shall be ensured that the drive motor does not generate a counter torque any more,
  - d) the reaction time of the system consisting of the idle times in the braking system and the time required for braking torque build-up,
  - e) the excess of the rotation speed,
  - f) the magnitude of the braking torque attained,
  - g) the braking time until hoist standstill, where required for the procedure.
- (2) Within the course of acceptance testing and after a change of the type of brake linings the reproducibility of the data shall be demonstrated by a sufficient number of braking tests in the entire load range.
- (3) The data obtained from the conditions with and without load shall be documented for the first acceptance test, after a change of the type of brake lining and during in-service inspections (at the latest after 4 years each).



**Figure D-2:** Example for a brake diagram with or without load attached

## Annex E

### Regulations and literature referred to in this Safety Standard

(The references exclusively refer to the version given in this annex. Quotations of regulations referred to therein refer to the version available when the individual reference below was established or issued.)

Directive 2006/42/EC		Directive 2006/42/EC of the European Parliament and of the Council of May 17, 2006 on machinery, and amending Directive 95/16/EC (revised edition) (Text with EEA relevance) [OJ L 157, 9.6.2006, pp. 24–86, Corrigendum OJ L 76, 16.3.2007, pp. 35–35]
Directive 92/58/EEC		Council Directive 92/58/EEC of 24 June 1992 on the minimum requirements for the provision of safety and/or health signs at work (ninth individual Directive within the meaning of Article 16 (1) of Directive 89/391/EEC) [OJ L 245, 26.8.1992, pp. 23–42]
Directive 2014/33/EU		Directive 2014/33/EU of the European Parliament and of the Council of February 26, 2014 on the harmonisation of the laws of the Member States relating to lifts and safety components for lifts (recast)
Atomic Energy Act (AtG)		Act on the Peaceful Utilization of Atomic Energy and the Protection against its Hazards (Atomic Energy Act) in the Version Promulgated on July 15, 1985 (BGBl. I, p. 1565), most recently changed by article 239 of the Ordinance dated June 19, 2020 (BGBl. I, p. 1328)
ProdSG		Act on making products available on the market (Product Safety Act - ProdSG) dated 8 <sup>th</sup> November 2011 (BGBl. I S. 2178, 2179; 2012 I S. 131), as amended by article 435 of the Ordinance dated August 31, 2015 (BGBl. I p. 1474)
StrlSchG		Act on the Protection against the Harmful Effect of Ionising Radiation (Radiation Protection Act - StrlSchG) of June 27, 2017 (BGBl. I, p. 1966), most recently changed by Article 5, Sec. 1 of the Act dated October 23, 2020 (BGBl. I p. 2232)
StrlSchV		Ordinance on the Protection against the Harmful Effect of Ionising Radiation (Radiation Protection Ordinance - StrlSchV) of November 29, 2018 (BGBl. I, p. 2034, 2036), most recently changed by Article 1 of the Ordinance dated November 20, 2020 (BGBl. I p. 2502)
BetrSichV		Ordinance concerning the protection of safety and health in the use of work equipment at work (Ordinance on Industrial Safety and Health - BetrSichV) dated 3 <sup>rd</sup> February 2015 (BGBl. I p. 49), last Amendment by article 5 para. 7 of the Ordinance dated October 18, 2017 (BGBl. I p. 3584)
SiAnf	(2015-03)	Safety Requirements for Nuclear Power Plants (SiAnf) as Promulgated on March 3 <sup>rd</sup> 2015 (BAnz AT 30.03.2015 B2)
Interpretations	(2015-03)	Interpretations of the Safety Requirements for Nuclear Power Plants of November 22, 2012, as Amended on March 3, 2015 (BAnz. AT 30.03.2015 B3)
ASR A1.3	(2013-02)	Technical regulation ASR A1.3 “Safety and health protection labels” in the version dated February 28, 2013, Announcement of the Federal Ministry of Labour and Social Affairs, Joint Ministerial Gazette 2013 no. 16 p. 334
DGUV 3	(1997-01)	DGUV Accident Prevention Regulation 3 “Electrical equipment and operating equipment” dated April 1, 1979 as reworded 1 <sup>st</sup> January 1997, German Social Accident Insurance
DGUV 53	(2001-07)	DGUV Accident Prevention Regulation 53 “Cranes including implementing regulations” dated June 1974, as reworded July 2001, German Social Accident Insurance
DGUV 55	(2000-10)	DGUV Accident Prevention Regulation 55 “Winches, lifting gear and pulling equipment including implementing regulations” dated October 1979, as reworded October 2000, German Social Accident Insurance
DGUV 100-500	(2008-04)	DGUV Regulation 100-500 “Operation of working equipment“, German Social Accident Insurance, January 2005, revised edition April 2008
DGUV 309-001	(2012-08)	DGUV Guideline 309-001 “Inspection and testing of cranes“, German Social Accident Insurance, edition August 2012
DGUV 309-003	(2013-03)	DGUV Guideline 309-003 “Principles for the selection, training and proof of qualification of crane drivers“, German Social Accident Insurance, edition March 2013
KTA 1202	(2017-11)	Requirements for the Testing Manual
KTA 1401	(2017-11)	General Requirements Regarding Quality Assurance
KTA 1404	(2013-11)	Documentation during the Construction and Operation of Nuclear Power Plants
KTA 3201.3	(2017-11)	Components of the Reactor Coolant Pressure Boundary of Light Water Reactors; Part 3: Manufacture
KTA 3902	(2020-12)	Design of Lifting Equipment in Nuclear Power Plants
KTA 3905	(2020-12)	Load Attachment Points on Loads in Nuclear Power Plants

DIN EN 81-20	(2014-11)	Safety rules for the construction and installation of lifts - Lifts for the transport of persons and goods - Part 20: Passenger and goods passenger lifts; German version EN 81-20:2014
DIN VDE 0100-520; VDE 0100-520	(2013-06)	Low-voltage electrical installations - Part 5-52: Selection and erection of electrical equipment - Wiring systems (IEC 60364-5-52:2009, modified + Corrigendum Feb. 2011); German implementation HD 60364-5-52:2011
DIN VDE 0105-100	(2015-10)	Operation of electrical installations - Part 100: General requirements / including corrigendum A1 (2017-06)
DIN EN 573-3	(2019-10)	Aluminium and aluminium alloys - Chemical composition and form of wrought products - Part 3: Chemical composition and form of products; German version EN 573-3:2019
DIN EN ISO 683-1	(2018-09)	Heat-treatable steels, alloy steels and free-cutting steels - Part 1: Non-alloy steels for quenching and tempering (ISO 683-1:2016); German version EN ISO 683-1:2018
DIN EN ISO 683-2	(2018-09)	Heat-treatable steels, alloy steels and free-cutting steels - Part 2: Alloy steels for quenching and tempering (ISO 683-2:2016); German version EN ISO 683-2:2018
DIN EN ISO 683-3	(2018-09)	Heat-treatable steels, alloy steels and free-cutting steels - Part 3: Case-hardening steels (ISO 683-3:2016); German version EN ISO 683-3:2018
DIN 685-3	(2001-02)	Tested round steel link chains. Part 3: Testing
DIN EN 818-1	(2008-12)	Short link chain for lifting purposes - Safety - Part 1: General conditions of acceptance; German version EN 818-1:1996+A1:2008
DIN EN 818-2	(2008-12)	Short link chain for lifting purposes - Safety - Part 2: Medium tolerance chain for chain slings; Grade 8; German version of EN 818-2:1996
DIN EN 818-4	(2008-12)	Short link chain for lifting purposes - Safety - Part 4: Chain slings - Grade 8; German version EN 818-4:1996+A1:2008
DIN EN 818-6	(2008-12)	Short link chain for lifting purposes - Safety - Part 6: Chain slings - Specification for information for use and maintenance to be provided by the manufacturer; German version EN 818-6:2000+A1:2008
DIN EN ISO 898-1	(2013-05)	Mechanical properties of fasteners made of carbon steel and alloy steel - Part 1: Bolts, screws and studs with specified property classes - Coarse thread and fine pitch thread (ISO 898-1:2013); German version EN ISO 898-1:2013
DIN EN ISO 898-2	(2012-08)	Mechanical properties of fasteners made of carbon steel and alloy steel - Part 2: Nuts with specified property classes - Coarse thread and fine pitch thread (ISO 898-2:2012); German version EN ISO 898-2:2012
DIN ISO 965-2	(1999-11)	ISO general purpose metric screw threads - Tolerances - Part 2: Limits of sizes for general purpose external and internal screw threads; medium quality (ISO 965-2:1998)
DIN EN 1090-2	(2018-09)	Execution of steel structures and aluminium structures - Part 2: Technical requirements for steel structures; German version EN 1090-2:2018
DIN EN 1371-1	(2012-02)	Founding - Liquid penetrant testing - Part 1: Sand, gravity die and low pressure die castings; German version EN 1371-1:2011
DIN EN 1563	(2019-04)	Founding - Spheroidal graphite cast irons; German version EN 1563:2018
DIN EN 1677-1	(2009-03)	Components for slings - Safety - Part 1: Forged steel components, Grade 8; German version EN 1677-1:2000+A1:2008
DIN EN 1677-2	(2008-06)	Components for slings - Safety - Part 2: Forged steel lifting hooks with latch, Grade 8; German version EN 1677-2:2000+A1:2008 (Corrigendum 2009-01)
DIN EN 1677-3	(2008-06)	Components for slings - Safety - Part 3: Forged steel self-locking hooks, Grade 8; German version EN 1677-3:2001+A1:2008 (Corrigendum 2009-01)
DIN EN 1677-4	(2009-03)	Components for slings - Safety - Part 4: Links, Grade 8; German version EN 1677-4:2000+A1:2008
DIN EN ISO 2400	(2013-01)	Non-destructive testing - Ultrasonic testing - Specification for calibration block No. 1 (ISO 2400:2012); German version EN ISO 2400:2012
DIN EN ISO 3059	(2013-03)	Non-destructive testing - Penetrant testing and magnetic particle testing - Viewing conditions (ISO 3059:2012); German version EN ISO 3059:2012
DIN EN ISO 3269	(2020-01)	Fasteners - Acceptance inspection (ISO 3269:2019); German version EN ISO 3269:2019
DIN EN ISO 3452-1	(2014-09)	Non-destructive testing - Penetrant testing - Part 1: General principles (ISO 3452-1:2013, Corrected version 2014-05-01); German version EN ISO 3452-1:2013
DIN EN ISO 3452-2	(2014-03)	Non-destructive testing - Penetrant testing - Part 2: Testing of penetrant materials (ISO 3452-2:2013); German version EN ISO 3452-2:2013
DIN EN ISO 3452-3	(2014-03)	Non-destructive testing - Penetrant testing - Part 3: Reference test blocks (ISO 3452-3:2013); German version EN ISO 3452-3:2013

DIN EN ISO 3506-1	(2010-04)	Mechanical properties of corrosion-resistant stainless steel fasteners - Part 1: Bolts, screws and studs (ISO 3506-1:2009); German version EN ISO 3506-1:2009
DIN EN ISO 3506-2	(2010-04)	Mechanical properties of corrosion-resistant stainless steel fasteners - Part 2: Nuts (ISO 3506-2:2009); German version EN ISO 3506-2:2009
DIN EN ISO 3651-2	(1998-08)	Determination of resistance to intergranular corrosion of stainless steels - Part 2: Ferritic, austenitic and ferritic-austenitic (duplex) stainless steels - Corrosion test in media containing sulphuric acid (ISO 3651-2:1998); German version EN ISO 3651-2:1998
DIN 3990-5	(1987-12)	Calculation of load capacity of cylindrical gears; endurance limits and material qualities
DIN EN ISO 4042	(2018-11)	Fasteners - Electroplated coating systems (ISO 4042:2018); German version EN ISO 4042:2018
DIN EN ISO 4287	(2010-07)	Geometrical product specification (GPS). Surface texture: Profile method. Terms, definitions and surface texture parameters. (ISO 4287:1997); German version of EN ISO 4287:1998
DIN ISO 4309	(2013-06)	Cranes - Wire ropes - Care and maintenance, inspection and discard (ISO 4309:2010)
DIN EN ISO 5817	(2014-06)	Welding - Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) - Quality levels for imperfections (ISO 5817:2014); German version EN ISO 5817:2014
DIN EN ISO 6157-2	(2004-10)	Fasteners - Surface discontinuities - Part 2: Nuts (ISO 6157-2:1995); German version EN ISO 6157-2:2004
DIN 6917	(1989-10)	Square taper washers for high-strength structural bolting of steel I sections
DIN 6918	(1990-04)	Square taper washers for high-strength structural bolting of steel channel sections
DIN EN ISO 7963	(2010-12)	Non-destructive testing - Ultrasonic testing - Specification for calibration block No. 2 (ISO 7963:2006); German version EN ISO 7963:2010
DIN EN ISO 9001	(2015-11)	Quality management systems - Requirements (ISO 9001:2015); German and English version EN ISO 9001:2015
DIN EN ISO 9712	(2012-12)	Non-destructive testing - Qualification and certification of NDT personnel (ISO 9712:2012); German version EN ISO 9712:2012
DIN EN ISO 9934-1	(2017-03)	Non-destructive testing - Magnetic particle testing - Part 1: General principles (ISO 9934-1:2016); German version EN ISO 9934-1:2016
DIN EN ISO 9934-2	(2015-12)	Non-destructive testing - Magnetic particle testing - Part 2: Detection media (ISO 9934-2:2015); German version EN ISO 9934-2:2015
DIN EN ISO 9934-3	(2015-12)	Non-destructive testing - Magnetic particle testing - Part 3: Equipment (ISO 9934-3:2015); German version EN ISO 9934-3:2015
DIN EN 10025-1	(2005-02)	Hot rolled products of structural steels - Part 1: General technical delivery conditions; German version EN 10025-1:2004
DIN EN 10025-2	(2019-10)	Hot rolled products of structural steels - Part 2: Technical delivery conditions for non-alloy structural steels; German version EN 10025-2:2019
DIN EN 10025-6	(2020-02)	Hot rolled products of structural steels - Part 6: Technical delivery conditions for flat products of high yield strength structural steels in the quenched and tempered condition; German version EN 10025-6:2019
DIN EN 10028-7	(2016-10)	Flat products made of steels for pressure purposes - Part 7: Stainless steels; German version EN 10028-7:2016
DIN EN 10085	(2001-07)	Nitriding steels - Technical delivery conditions; German version EN 10085:2001
DIN EN 10088-2	(2014-12)	Stainless steels - Part 2: Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for general purposes; German version EN 10088-2:2014
DIN EN 10088-3	(2014-12)	Stainless steels - Part 3: Technical delivery conditions for semi-finished products, bars, rods, wire, sections and bright products of corrosion resisting steels for general purposes; German version EN 10088-3:2014
DIN EN 10160	(1999-09)	Ultrasonic testing of steel flat product of thickness equal to or greater than 6 mm (reflection method); German version EN 10160:1999
DIN EN 10163-2	(2005-03)	Delivery requirements for surface conditions of hot-rolled steel plates, wide flats and sections - Part 2: Plate and wide flats; German version EN 10163-2:2004
DIN EN 10164	(2018-12)	Steel products with improved deformation properties perpendicular to the surface of the product - Technical delivery conditions; German version EN 10164:2018
DIN EN 10204	(2005-01)	Metallic products - Types of inspection documents; German version EN 10204:2004
DIN EN 10210-1	(2006-07)	Hot finished structural hollow sections of non-alloy and fine grain steels - Part 1: Technical delivery conditions; German version EN 10210-1:2006

DIN EN 10213	(2016-10)	Steel castings for pressure purposes; German version EN 10213:2007+A1:2016
DIN EN 10216-1	(2014-03)	Seamless steel tubes for pressure purposes - Technical delivery conditions - Part 1: Non-alloy steel tubes with specified room temperature properties; German version EN 10216-1:2002 + A1:2013
DIN EN 10216-5	(2014-03)	Seamless steel tubes for pressure purposes - Technical delivery conditions - Part 5: Stainless steel tubes; German version EN 10216-5:2013, Corrigendum 2015-01
DIN EN 10217-1	(2005-04)	Welded steel tubes for pressure purposes - Technical delivery conditions - Part 1: Non-alloy steel tubes with specified room temperature properties; German version EN 10217-1:2002 + A1:2005
DIN EN 10217-7	(2015-01)	Welded steel tubes for pressure purposes - Technical delivery conditions - Part 7: Stainless steel tubes; German version EN 10217-7:2014
DIN EN 10222-1	(2017-06)	Steel forgings for pressure purposes - Part 1: General requirements for open die forgings; German version EN 10222-1:2017
DIN EN 10222-5	(2017-06)	Steel forgings for pressure purposes - Part 5: Martensitic, austenitic and austenitic-ferritic stainless steels; German version EN 10222-5:2017
DIN EN 10228-1	(2016-10)	Non-destructive testing of steel forgings - Part 1: Magnetic particle inspection; German version EN 10228-1:2016
DIN EN 10228-2	(2016-10)	Non-destructive testing of steel forgings - Part 2: Penetrant testing; German version EN 10228-2:2016
DIN EN 10228-3	(2016-10)	Non-destructive testing of steel forgings - Part 3: Ultrasonic testing of ferritic or martensitic steel forgings; German version EN 10228-3:2016
DIN EN 10228-4	(2016-10)	Non-destructive testing of steel forgings - Part 4: Ultrasonic testing of austenitic and austenitic-ferritic stainless steel forgings; German version EN 10228-4:2016
DIN EN 10250-1	(1999-12)	Open die steel forgings for general engineering purposes - Part 1: General requirements; German version EN 10250-1:1999
DIN EN 10250-2	(1999-12)	Open die steel forgings for general engineering purposes - Part 2: Non-alloy quality and special steels; German version EN 10250-2:1999
DIN EN 10250-4	(2000-02)	Open die steel forgings for general engineering purposes - Part 4: Stainless steels; German version EN 10250-4:1999
DIN EN 10263-2	(2018-02)	Steel rod, bars and wire for cold heading and cold extrusion - Part 2: Technical delivery conditions for steels not intended for heat treatment after cold working; German version EN 10263-2:2017
DIN EN 10264-1	(2012-03)	Steel wire and wire products - Steel wire for ropes - Part 1: General requirements; German version EN 10264-1:2012
DIN EN 10264-3	(2012-03)	Steel wire and wire products - Steel wire for ropes - Part 3: Round and shaped non alloyed steel wire for high duty applications; German version EN 10264-3:2012
DIN EN 10264-4	(2012-03)	Steel wire and wire products - Steel wire for ropes - Part 4: Stainless steel wire; German version EN 10264-4:2012
DIN EN 10269	(2014-02)	Steels and nickel alloys for fasteners with specified elevated and/or low temperature properties; German version EN 10269:2013
DIN EN 10272	(2016-10)	Stainless steel bars for pressure purposes; German version EN 10272:2016
DIN EN 10277	(2018-09)	Bright steel products - Technical delivery conditions; German version EN 10277:2018
DIN EN 10293	(2015-04)	Steel castings for general engineering uses; German version EN 10293:2015
DIN EN 10307	(2002-03)	Non-destructive testing - Ultrasonic testing of austenitic and austenitic-ferritic stainless steels flat products of thickness equal to or greater than 6 mm (reflection method); German version EN 10307:2001
DIN EN 10308	(2002-03)	Non-destructive testing - Ultrasonic testing of steel bars; German version EN 10308:2001
DIN EN ISO 10675-1	(2017-04)	Non-destructive testing of welds - Acceptance levels for radiographic testing - Part 1: Steel, nickel, titanium and their alloys (ISO 10675-1:2016); German version EN ISO 10675-1:2016
DIN EN ISO 10684	(2011-09)	Fasteners - Hot dip galvanized coatings (ISO 10684:2004 + Cor. 1:2008); German version EN ISO 10684:2004 + AC:2009
DIN EN 12385-1	(2009-01)	Steel wire ropes - Safety - Part 1: General requirements; German version EN 12385-1:2002+A1:2008
DIN EN 12385-2	(2008-06)	Steel wire ropes - Safety - Part 2: Definitions, designation and classification; German version EN 12385-2:2002+A1:2008 (Corrigendum 2009-01)
DIN EN 12385-4	(2008-06)	Steel wire ropes - Safety - Part 2: Definitions, designation and classification; German version EN 12385-2:2002+A1:2008 (Corrigendum 2009-01)

ISO 12488-1	(2012-07)	Cranes - Tolerances for wheels and travel and traversing tracks - Part 1: General
DIN EN 13001-3-1	(2019-03)	Cranes - General Design - Part 3-1: Limit States and proof competence of steel structure; German version EN 13001-3-1:2012+A2:2018
DIN EN 13018	(2016-06)	Non-destructive testing - Visual testing - General principles; German version EN 13018:2016
DIN EN 13411-1	(2009-02)	Terminations for steel wire ropes - Safety - Part 1: Thimbles for steel wire rope slings; German version EN 13411-1:2002+A1:2008
DIN EN 13411-3	(2011-04)	Terminations for steel wire ropes - Safety - Part 3: Ferrules and ferrule-securing; German version EN 13411-3:2004+A1:2008
DIN EN 13414-1	(2020-03)	Steel wire rope slings - Safety - Part 1: Slings for general lifting service; German version EN 13414-1:2003+A2:2008
DIN EN 13414-2	(2009-02)	Steel wire rope slings - Safety - Part 2: Specification for information for use and maintenance to be provided by the manufacturer; German version EN 13414-2:2003+A2:2008
DIN EN 13414-3	(2009-02)	Steel wire rope slings - Safety - Part 3: Grommets and cable-laid slings; German version EN 13414-3:2003+A1:2008
DIN EN 13557	(2009-07)	Cranes - Controls and control stations; German version EN 13557:2003+A2:2008
DIN EN 13586	(2009-05)	Cranes - Access; German version EN 13586:2004+A1:2008
DIN EN ISO 13849-1	(2016-06)	Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design (ISO 13849-1:2015); German version EN ISO 13849-1:2015
DIN EN 13889	(2009-02)	Forged steel shackles for general lifting purposes - Dee shackles and bow shackles - Grade 6 - Safety; German version EN 13889:2003+A1:2008
DIN EN ISO 13919-1	(2020-03)	Electron and laser-beam welded joints - Requirements and recommendations on quality levels for imperfections - Part 1: Steel, nickel, titanium and their alloys (ISO 13919-1:2019); German version EN ISO 13919-1:2019
DIN EN 14399-4	(2015-04)	High-strength structural bolting assemblies for preloading - Part 4: System HV - Hexagon bolt and nut assemblies; German version EN 14399-4:2015
DIN EN 14399-6	(2015-04)	High-strength structural bolting assemblies for preloading - Part 6: Plain chamfered washers; German version EN 14399-6:2015
DIN EN 14399-8	(2019-06)	High-strength structural bolting assemblies for preloading - Part 8: System HV - Hexagon fit bolt and nut assemblies; German version EN 14399-8:2018
DIN 15003	(1970-02)	Lifting Appliances; Load Suspending Devices, Loads and Forces; Definitions
DIN 15018-1	(1984-11)	Cranes; steel structures; verification and analyses
DIN 15018-2	(1984-11)	Cranes; steel structures; principles of design and construction
DIN 15020-1	(1974-02)	Lifting appliances; principles relating to rope drives; calculation and construction
DIN 15030	(1977-11)	Lifting Equipment; Acceptance Testing of Crane Installations; Principles
DIN 15400	(1990-06)	Lifting hooks; materials, mechanical properties, lifting capacity and stresses
DIN 15404-1	(1989-12)	Lifting hooks; technical delivery conditions for forged hooks
DIN 15405-1	(1979-03)	Lifting hooks; inspection of forged hooks in service
DIN 15413	(1983-08)	Bottom blocks for lifting appliances; lifting hook nuts
DIN 15434-1	(1989-01)	Power transmission engineering; principles for drum- and disc brakes, calculation
DIN 15434-2	(1989-01)	Power transmission engineering; principles for drum- and disc brakes; maintenance in service
DIN 15436	(1989-01)	Power transmission engineering; drum- and disc brakes; technical requirements for brake linings
DIN EN ISO 15614-1	(2017-12)	Specification and qualification of welding procedures for metallic materials - Welding procedure test - Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys (ISO 15614-1:2017); German version EN ISO 15614-1:2017
DIN EN ISO 16811	(2014-06)	Non-destructive testing - Ultrasonic testing - Sensitivity and range setting (ISO 16811:2012); German version EN ISO 16811:2014
DIN EN ISO 17636-1	(2013-05)	Non-destructive testing of welds - Radiographic testing - Part 1: X- and gamma-ray techniques with film (ISO 17636-1:2013); German version EN ISO 17636-1:2013
DIN EN ISO 17637	(2017-04)	Non-destructive testing of welds - Visual testing of fusion-welded joints (ISO 17637:2016); German version EN ISO 17637:2016
DIN EN ISO 18265	(2014-02)	Metallic materials - Conversion of hardness values (ISO 18265:2013); German version EN ISO 18265:2013

DIN 18800-7	(2008-11)	Steel structures - Part 7: Execution and constructor's qualification
DIN EN ISO 19232-1	(2013-12)	Non-destructive testing - Image quality of radiographs - Part 1: Determination of the image quality value using wire-type image quality indicators (ISO 19232-1:2013); German version EN ISO 19232-1:2013
DIN EN 26157-1	(1991-12)	Fasteners; surface discontinuities; bolts, screws and studs subject to general requirements (ISO 6157-1:1988); German version EN 26157-1:1991
DIN EN 26157-3	(1991-12)	Fasteners; surface discontinuities; bolts, screws and studs subject to special requirements (ISO 6157-3:1988); German version EN 26157-3:1991
DIN EN 60204-32; VDE 0113-32	(2009-03)	Safety of machinery - Electrical equipment of machines - Part 32: Requirements for hoisting machines (IEC 60204-32:2008); German version EN 60204-32:2008
DIN EN 61000-6-4; VDE 0839-6-4	(2011-09)	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments (IEC 61000-6-4:2006 + A1:2010); German version EN 61000-6-4:2007 + A1:2011
DIN EN 61513; VDE 0491-2	(2013-09)	Nuclear power plants - Instrumentation and control for systems important to safety - General requirements for systems (IEC 61513:2001); German version EN 61513:2013
DIN EN IEC 61800-3; VDE 0160-103	(2019-04)	Adjustable speed electrical power drive systems - Part 3: EMC requirements and specific test methods (IEC 61800-3:2017); German version EN IEC 61800-3:2018
DIN EN IEC 62138; VDE 0491-3-3	(2020-07)	Nuclear power plants - Instrumentation and control systems important to safety - Software aspects for computer-based systems performing category B or C functions (IEC 62138:2018); German version EN IEC 62138:2019
DIN EN 82079 VDE 0039-1	(2013-06)	Preparation of instructions for use - Structuring, content and presentation - Part 1: General principles and detailed requirements (IEC 82079-1:2012); German version EN 82079-1:2012
VDI 2194	(2012-08)	Selection and training of crane-drivers
VDI 3576	(2011-03)	Rails for crane systems - Rail connections, rail beddings, rail fastenings, tolerances for crane tracks
SEW 550	(1976-08)	Steels for larger forgings; quality standards
TRBS 1201-4	(2009-11)	Technical Rules for Operational Safety TRBS 1201, Part 4: Inspection of systems liable to supervision – Inspection of elevator systems; last revised and amended by Joint Ministerial Gazette no. 57 dated 15 <sup>th</sup> November 2013 p. 1154
VdTÜV MB SCHW 1153	(2017-12)	Welding Technology 1153; Guidelines for the suitability testing of welding filler materials
VdTÜV MB WERK 1253/1		Materials 1253-1; List of TÜV approved manufacturers of materials <i>(the latest edition of this VdTÜV technical leaflet shall be used)</i>
VdTÜV MB WERK 1253/4		Materials 1253-4; List of TÜV approved screws and nuts manufacturers (machining operators) renouncing an inspection certificate in accordance with DIN EN 10204 <i>(the latest edition of this VdTÜV technical leaflet shall be used)</i>

## Literature

- [1] Guideline “Manufacture of hot dip galvanized bolts”, jointly issued by: Deutscher Schraubenverband e.V. and Gemeinschaftsausschuss Verzinken e.V., July 2009



## Annex F (informative)

### Changes with respect to the edition 2012-11 and explanations

#### F 1 Main changes

(1) As an alternative to the dimensioning method using a global safety factor according to DIN 15018-1, for supporting structures the method using partial safety factors according to the standard series DIN EN 13001 was allowed in KTA Safety Standard KTA 3902. For the non-destructive tests to be carried out when using the DIN EN 13001 series of standards, appropriate requirements have been included in KTA 3903.

(2) The documents to be submitted for design approval of electrical equipment were clarified in several places after an evaluation of the operating experience (section 5.1.8).

(3) Annex B “Non-destructive testing” has been revised based on current standards.

(4) The whole Safety Standard and Annex E “Regulations and literature referred to in this Safety Standard” have been adapted to the current state of standards. For the purpose of adapting the Safety Standard to actual standards, at all locations of the Safety Standard - as far as applicable - the terms “stress analysis” and “fatigue analysis” as well as “gear box housing” are used.

#### F 2 Explanations to the changes made compared to the 2012-11 edition

(1) The section “Fundamentals“, first subpara. was adapted to take over the uniform text relevant to all KTA Safety Standards and the second subpara. was supplemented by the stipulations set by the Safety Requirements for Nuclear Power Plants as well as the Interpretations on the Safety Requirements for Nuclear Power Plants.

(2) Definitions of “parts in the load path” and “weld seams in the load path” were added in section 2 “Definitions“ to ensure a uniform interpretation of these terms.

(3) In section 5 “Design approval” the following changes were made:

a) In clause 5.1.3 j) the standard DIN EN ISO 13919-1 was taken over in addition to DIN EN ISO 5817 as for the assessment of welded connections, since electron-beam and laser welding is allowed too. In addition, it was added that the execution classes (EXC) of weld seams shall be specified when welding in accordance with DIN EN 1090-2.

b) The rules for applying inspection certificates to DIN EN 10204, edition 1995-08, contained up to now in section 5.1.5, were deleted since for new fabrications only DIN EN 10204, edition 2005-01, is applicable. As a result, the references to DIN EN 10204 (1995-08) contained in several clauses of this Safety Standard and in all material test sheets were deleted. Despite this fact, the following certificates are recognized upon individual checking if stored material is used:

ba) instead of inspection certificate 3.1 to DIN EN 10204 (2005-01) also inspection certificate 3.1.B to DIN EN 10204 (1995-08),

bb) instead of inspection certificate 3.2 to DIN EN 10204 (2005-01) also inspection certificate 3.1.C to DIN EN 10204 (1995-08).

c) In clause 5.1.7 f) the qualification of operating personnel was added, since not only manual or partly mechanized welding is allowed, but also fully mechanized and automated welding.

d) In clause 5.1.8 fb) was added that for functions classified according to KTA 3902 Annex E into Performance Level

c, d or e, proof of the achieved performance level shall also be submitted for design approval. This addition complies with the usual practice of demonstrating the performance level requirements required in KTA 3902.

e) In sub-clause 5.1.8 ib), the reference has been adapted to the current version of the standard.

f) The requirement for proof of independence between operational and safety functions, which was previously under 5.1.8 hd), was shifted to new enumeration j) to clarify that this requirement applies not only to freely programmable systems but to all software-based systems for functions, which are classified according to KTA 3902 Annex E into Performance Level c, d or e. In addition, proof of independence based on an application-independent type test of the device (certification) was allowed, provided that the type test documentation provides proof of the specified requirements.

(4) In section 6 “Materials” the following changes were made:

a) According to section 4.3 of DIN EN 13001-3-1, bolts of property class 12.9 are also permitted. There is no sufficient experience with the use of bolts of property class 12.9 in connection with lifting equipment in nuclear installations to assess their robustness. Therefore, the application of this property class has been excluded in 6.2 (4).

b) The requirements regarding corrosion protection coatings of ferritic bolts and nuts formulated so far with reference to DIN 18800-7 were updated based on the specifications in DIN EN 1993-1-8/NA and in the new standard DIN EN ISO 4042:2018-12, which takes into account, among other things, the up-to-date knowledge about hydrogen embrittlement and prevention measures.

c) For hot dip galvanized fasteners, for which a manufacture in accordance with DSV-GAV guideline was required in DIN 18800-7, according to the state of standardization the application of the now available standard DIN EN ISO 10684 and the current DSV-GAV guideline was specified for the manufacture of hot dip galvanized bolts.

(5) In section 7 “Final inspection” the following changes were made:

a) In section 7.1, the prerequisites for the manufacture were supplemented by requirements that permit certification in accordance with DIN EN 1090-2. It was assumed that welded connections within the scope of application of KTA 3903 are always under dynamic loading with the exception of weld seams on gearbox housings, so that the classification into execution class EXC4 (EXC3 for weld seams on gearbox housings) is appropriate.

The attestation of welding qualification according to DIN 18800-7 has been retained although this standard has been withdrawn, because individual companies still have valid attestations of welding qualification according to DIN 18800-7.

Furthermore, it was made clear that the requirements regarding the attestation of welding qualification only apply to weld seams in the load path.

In addition, the qualification of welding operating personnel was supplemented as both manual and automatic welding is permitted, and it was clarified that the certification of NDT supervisors and NDT personnel shall generally be carried out in accordance with the specifications in section B 2.1.

b) In section 7.3 and in Table 7-1, requirements have been added for non-destructive testing of weld seams in the case of a design according to DIN EN 13001 standard

series. The test requirements were determined based on the requirements in DIN EN 1090-2:2018-09, taking into account the weld inspection classes specified therein, as DIN EN 13001 standard series currently does not contain any requirements for weld seams.

The specified extents of testing ensure the performance of a suitably graduated extent of testing depending on the hazard potential.

Requirements for testing weld seams on gearbox housings were specified only for newly manufactured ones in Table 7-1 because no damage has been reported to existing welded gearbox housings and there is no reason to impose non-destructive testing requirements beyond those specified during design approval and licensing procedures.

- c) The requirements for manufacturing tolerances formulated up to now in Table 7-1 (serial no. 1 i) based on VDI 3571 was updated by reference to ISO 12488-1, as there is currently no standard in German for this.
  - d) The requirement for compliance with the design and the bolting torque for preloaded bolted connections formulated up to now in Table 7-1 (serial no. 3 m) with reference to DIN 18800-7 was specified with reference to the design approval documents, since these in each case must contain the necessary data.
- (6) In section 8 "Acceptance testing" the following changes were made:
- a) All requirements were adapted to the current state of the standards and regulations.
  - b) In Table 8-1 (serial no. 1.4), the specifications regarding the test load were put more clearly in order to maintain the previous test loads according to DIN 15030 and to exclude smaller test loads, which would be permissible according to DIN EN 13001-2.
  - c) The requirement in Table 8-1 (serial no. 2.6) for checking the tightening torque of bolts additionally loaded in tension formulated up to now with reference to DIN 18800-7 was specified with reference to the design approval documents.
- (7) In order to avoid any misunderstandings, the stipulations in 9.3 (5) were put more precisely regarding circumstances of waiving a new design approval.
- (8) In section 10 "In-service inspections" the following changes were made:
- a) All requirements were adapted to the current state of the standards and regulations.
  - b) In clause 10.1 (1), the regulation regarding the time of testing, if lifting equipment is not used for a long time, was put more precisely.
  - c) In clause 10.3 (3), the term "discontinuity" was replaced by the term "conspicuous indication" used in current standards for visual testing. In addition, editorial improvements were made.
  - d) For the purpose of adapting to the current regulations, clause 10.3 (6) was supplemented by the requirement to perform in-service inspections on lifts in reactor containments 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.
  - e) The requirements for the test personnel previously specified under 10.3 (3) c) have been included in the new section 10.4 in a more precise and supplemented form.
  - f) In Table 10-1, in conjunction with the inclusion of standard DIN ISO 4309, a new footnote 1 was added to clarify that the nominal diameter may be used instead of the reference diameter provided the reference diameter has not

been determined before the publication of this standard directly after running in the new rope.

(9) In section 12 "Series-production electric hoists with rope and series-production hoist gear boxes" as well as in Table 12-1 requirements were added for non-destructive testing of weld seams in the case of a design according to DIN EN 13001 standard series similar to those in section 7.3 and in Table 7-1. The requirements for manufacturing tolerances formulated up to now in Table 12-1 (serial no. 1 h) based on VDI 3571 was updated by reference to ISO 12488-1, as there is currently no standard in German for this.

(10) The material test sheets (WPB) in Annex A were completely updated in order to adapt them to the current state of standards. The footnotes for the use of inspection certificates in accordance with DIN EN 10204 (1995-08) were deleted from all material test sheets (see explanation under (3) b). In addition, the following changes were made:

- a) In the material test sheet WPB 1.5, a verification of the notched-bar impact test was added to test number 4 in the case of lifting equipment classification according to KTA 3902 section 4.2, since this test is always required according to DIN EN 10216-1 Table 11.
- b) The material test sheet WPB 1.7 was supplemented by high-strength assemblies of hexagon fit bolts and nuts acc. to DIN EN 14399-8.
- c) In the material test sheets WPB 1.7, WPB 3.17 and WPB 3.23 requirements for the corrosion protection coatings of ferritic bolts and the corresponding inspection certificates were additionally included.
- d) In material test sheets WPB 3.11 and WPB 3.12 the footnote 2 was adapted to VdTÜV Material Sheet 418. This material sheet provides that for the material 1.4462 the methods C and the heat treatment T1 shall be used in the intergranular corrosion test.
- e) In material test sheet WPB 5.2 brake discs made of rolled round bars were added, for which the requirements of the material test sheet WPB 2.2 apply.

(11) Annex B "Non-destructive testing" was revised based on the current standards. In addition to the adaptation to current standards, primarily the following changes were made:

- a) In section B 3.2, some simplifications and clarifications were made, which result from the current versions of standards used. In most cases formulations identical to those in other KTA Safety Standards (e.g. KTA 3211.1, KTA 3211.3, KTA 3905) were used.
- b) The requirements for ultrasonic testing of product forms in section B 3.4.2 were updated in accordance with the stipulation in KTA 3205.1 (2017-11) and are specified based on the standards DIN EN 10228-3, DIN EN 10228-4 and DIN EN 10308. Here it was possible to dispense with specifications for adaptation of the probe to curved surfaces (including the previous Figure B-1), as DIN EN ISO 16811 contains sufficient requirements for this.
- c) The specifications for surface inspection on bars in section B 4.1.1 were adapted to the current state of the standards with reference to DIN EN 10228-1 and DIN EN 10228-2. The now required quality class 4 sets the same requirements as those specified in KTA 3205.1 for bars and in KTA 3211.1 for bars and forgings.
- d) The requirements for performing and evaluating ultrasonic testing of ferritic bars (section B 4.1.2) were updated by taking over the relevant provisions contained in section B 4.1.2 of KTA 3205.1 (2017-11) and in section 11.4.3.3.1 of KTA 3211.1 (2017-11) and are specified based on DIN EN 10228-3 and DIN EN 10308. As a result, the previous Tables B-1, B-3 and B-4 were omitted.

- e) In section B 4.2.1.2, instead of the reference to the not existing any more section B 4.1.1.2, the wording of the requirement contained in this section was taken over.
  - f) The stipulations in section B 4.2.2.1 "Basic material for die-forged single load hooks and load hook nuts" were reworded due to the omission of Tables B-1, B-3 and B-4. Here, the product form "rectangular bars", which does not apply to load hook nuts, was deleted in Figure B-3.
  - g) In Table B-1 (previous Table B-5), footnote 1 has been deleted because probes for angle beam scanning in axial scanning direction (positions 4, 5 and 7) are usually not contoured, but those with a smaller transducer dimension shall preferably be used. If the probes are contoured anyway, a sensitivity setting using DAC makes no sense.
  - h) In Table B-4 (former Table B-2), the title was changed to "shafts and axles for gear boxes" to adapt it to the wording in the Safety Standard. The scanning positions 4 to 7 are not applicable to shafts and axles for gear boxes and were deleted.
  - i) The requirements for performing and evaluating surface inspection and ultrasonic testing on product forms made of austenitic steel were updated by taking over the relevant provisions contained in section B 5 of KTA 3205.1 (2017-11). In accordance with the specifications in DIN EN 10228-4 for classification, the specified quality classes ensure a test sensitivity which corresponds to a recording level of a 3 mm disc shaped reflector for forgings with a thickness up to 75 mm and to a recording level of a 5 mm disc shaped reflector for forgings with a thickness exceeding 75 mm.
  - j) In clauses B 6.3.2 and B 7.3.2 the standard DIN EN ISO 13919-1 was taken over in addition to DIN EN ISO 5817 for the assessment of weld seams, since electron-beam and laser welding is allowed too.
- (12) Annex E "Regulations and literature referred to in this Safety Standard" was totally adapted to the current state of standardization and to the regulations used in the Safety Standard.