Kraftfahrt-
Bundesamt

Directive

on the supply and testing of load-bearing components made of malleable cast iron for road vehicle trailer couplings (GTW)

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1 Purpose and applications

This guideline contains conditions of supply and instructions for the testing of load-bearing components made of malleable cast iron for road vehicle trailer couplings.

The specified tests are related to the mechanical characteristics of the materials as laid down in section 3 and to the non-destructive testing of castings made of these types of material.

The testing parameters and permissible failure limits depend on the component concerned and are to be laid down before manufacturing on the evidence of type approval tests by the Technical Service or by the authorized representative of the Kraftfahrt-Bundesamt, Flensburg.

In addition, the regulations laid down in DIN EN 1559-1:2011-05 "technical conditions of supply for castings made of metallic materials - general requirements" must be observed.

2 Conditions of supply

2.1 Marking of castings

All castings for load-bearing components made of malleable cast iron for trailer couplings are to be unambiguously and legibly marked (by an integrally cast indented or raised marking) as follows:

- Company symbol of the casting production facility
- Casting date or batch marking

Castings are to be marked in such a way that neither subsequent processing nor the transmission of effort is adversely affected. In cases of doubt, a suitable area of the casting for the marking is to be agreed between the manufacturer and buyer.

2.2 Batch sizes and test bars or specimens

2.2.1 Batch size

For testing purposes, the material produced in a single shift represents the batch size. At least one specimen, or in the case of mass production a corresponding number of specimens, has to be separately or parallel casted or integrally casted for the testing of the mechanical characteristics. The specimens can also be taken from the casting.

Production records (smelting logbook, batch logbook, etc.) must confirm, without any gaps, the uniformity of production and its compliance with the specimens withdrawn during a shift in respect of the raw materials and smelting method used, the chemical composition of the molten metal, heat treatment, etc.

2.2.2 Documentation

Documentation must be kept in such a way that, with its aid, the manufacturer is able to prove that the conditions of supply have been fulfilled continuously throughout the entire period of production. And the manufacturer has to verify the same with test results.

The Kraftfahrt-Bundesamt and the assigned Technical Services are authorized to see and inspect all the relevant documents.

2.2.3 Number of test bars or specimens

At least three test bars and four substitute bars must be withdrawn for tensile testing at every sampling. In case of all-black malleable iron the test bars may be taken out of the casting, in which the equivalence of the test results has to be proved once. The location the test bars are to be taken from the casting is to be agreed between the buyer and the manufacturer.

3 Mechanical characteristics

The permitted types of material for the production of load-bearing components made of malleable cast iron for trailer couplings must comply with DIN EN 1562:2019-06 "malleable cast iron". In combination, the following minimum values for tensile properties must be assured:

white malleable cast iron (decarbonized tempered)

test bar Ø		**9**	**mm**	**preferred**	**12**	**mm**
tensile strength	R_m	360	N/mm²		400	N/mm²
0.2 limit	$R_{p0,2}$	200	N/mm²		220	N/mm²
breaking elongation	A_3	8	%		5	%

weldable malleable cast iron (decarbonized tempered; EN GJMW 360)

test bar Ø		**9**	**mm**	**preferred**	**12**	**mm**
tensile strength	R_m	320	N/mm²		360	N/mm²
0.2 limit	$R_{p0,2}$	170	N/mm²		190	N/mm²
breaking elongation	A_3	15	%		12	%

all-black malleable iron (not decarbonized tempered)

test bar Ø		**12**	**mm**	**preferred**	**15**	**mm**
tensile strength	R_m	350	N/mm²		350	N/mm²
0.2 limit	$R_{p0,2}$	200	N/mm²		200	N/mm²
breaking elongation	A_3	10	%		10	%

4 Non-destructive tests

Evidence must be provided by suitable non-destructive tests, as per section 9, to the effect that the castings do not exhibit any impermissible defects.

5 Verification of tests

5.1 Acceptance test certificate

All test results are to be confirmed in the form of acceptance test certificates according to DIN EN 10204- 3.1 B:2005-01 signed by the person who is explicitly authorized by the foundry.

5.2 Documentation

Acceptance test certificates must be kept by the foundry and presented on request to the authorized representative of the Kraftfahrt-Bundesamt.

5.3 Evidence of material characteristics of every delivery

A copy of the acceptance test certificate is to be supplied to the buyer, unsolicited, with every delivery and is to be kept by the buyer for at least 10 years.

6 Test equipment, procedures and results

The Technical Service or the authorized representative of the Kraftfahrt-Bundesamt may, at any time, inspect the test equipment, the test procedures and the test results.

7 Welding

Welding of castings for load-bearing components for trailer couplings is generally not permitted. With the expressed permission of the buyer, an exception may be made for components of EN GJMW 360 following DIN EN 1562:2019-06, or production welding in the foundry in the form of pre- and post-heating welding for the repair of minor surface defects, provided the subsequent processing or usability of the casting is not significantly affected as a result.

For the welding performance EN 1011:2018-8 is valid.

Production welded castings are to be marked as such and delivered separately.

8 Test procedure

8.1 Testing of mechanical characteristics

8.1.1 Sampling and test bars

As specified in DIN EN 1562:2019-06 not treated specimens are to be used with a diameter do = 12 mm for normal cases. For castings made of white malleable cast iron with a wall thickness less than 8 mm test bars with a diameter do = 9 mm are to be used.

Spare test bars of all-black malleable iron (GTS) may be taken from the casting. The location is to be agreed between the buyer and the manufacturer.

8.1.2 Marking of specimens

Specimens have to be clearly and distinctively marked with the casting date, shift number or batch mark. Test bars taken out of castings have to be marked in the same way.

8.1.3 Heat treatment of specimens

If heat treatment is carried out, test bars related to the respective batch (shift production) and the castings taken from this production have to undergo the same heat treatment.

8.1.4 Assignment of specimens

Castings and test bars or are to be kept together in batches until the results of the tests (mechanical characteristics and no faults of castings proved by non-destructive test procedures) are available and the test house has given clearance accordingly.

8.2 Tensile test

Tensile strength, the 0.2 limit and breaking elongation are to be determined in accordance with DIN EN 1562:2019-06 for malleable cast iron.

8.3 Repeat testing

If the three test bars meet the requirements of the tests specified in sections 2.2.1 and 2.2.3, the related production material qualifies as satisfactory.

If one test bar fails to meet the specified requirements, two further test bars are to be tested, which must pass. If two test bars fail to meet the specified requirements, four further test bars are to be tested from the specimens which were made during the course of the related production shift or taken from castings as per section 2.2.1. These specimens must meet the specified requirements. If they fail, the batch must be rejected.

If the defect can be eliminated by reworking, the batch is to be re-tested in accordance with section 8.1.

If all three test bars fail to meet the specified requirements, the batch must be rejected.

8.4 Test equipment

Testing may be carried out only on testing machines which have been officially inspected in accordance with DIN 51220:2003-08.

In Germany, the official inspection of material testing machines is carried out by a test centre recognized by the “Verband der Materialprüfungsämter e.V.” (VMPA; Association of Material Testing Offices).

Other (foreign) test centres engaged for this purpose must be agreed with the Kraftfahrt-Bundesamt.

9 Non-destructive tests

Each individual casting for load-bearing components on trailer couplings is to be non-destructively tested for cracks and concealed defects in the following ways:

- visual inspection for surface quality, cracks and defects,
- magnetic particle inspection, according to DIN EN 1369:2013-01 and, if especially agreed, by stethoscopic examination
- or radiographic examination.

The test procedure, test parameters and reliability limits to be used are to be laid down by the Technical Service or by the authorized representative of the Kraftfahrt-Bundesamt on the basis of the tests on the related prototype sample.

In case of magnetic particle inspection, stethoscopic- or radiographic examination it is possible to diverge from the requirement of a 100%-testing, if the safety of process is proved by an audit or by presentation of relating documents.

Here shall be explained:

1. The used procedure for release of production parts (for example PPAP including the specific process-FMEA)
2. The prevention of nonconformities during design process by calculating solidification verified by section wise layer cuttings (laminar flow, slag inclusion, consideration of VDG design rules)
3. The prevention of nonconformities in preparation process as statistic process control of parametric of melting and mould sand.

4. The prevention of nonconformities while casting by statistic process control of individual characteristics (such as temperature, specific weight of the melt, percentage of sulphur, treatment by magnesium, fill-in time, cool-down curve etc.)
5. Performed checks on the conformity of material as characteristics, microscopic structure and spectral analysis

The audit shall be performed by a suitable expert who together with the Technical Service or with the authorized representative of the Kraftfahrt-Bundesamt will determine the spotcheck quote, procedures to apply and reliability limits. The above mentioned approval can be substituted by presenting an IATF16949:2016 certificate.

All further obligations of a holder of an approval to assure the conformity of production remain valid.

Legal notice

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