



Technical delivery conditions  
**Steel bolts for use in permanent way**

**DBS**  
**918 024**

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## Foreword

This DB standard was drawn up by DB Netz AG – I.NPF 111(G) Technology and Facility Management, Permanent Way Technology – in collaboration with the DB AG Quality Assurance department (FS.EI 21) on the basis of Deutsche Bahn Standard DBS 918 024 published in August 2012. It represents the interests of Deutsche Bahn AG. The following revisions were made:

- Editorial and structural revision
- Reference made in the technical requirements to international standards
- Tests to be carried out

## Introduction

The purpose of this DB standard is to set out rules for qualification and quality assurance with respect to steel bolts for the permanent way. It takes account of UIC Leaflets 864-1V and 864-2V and complements the performance requirements for rail fastening systems described in DIN EN 13481.

## 1 Scope

This DB standard applies to steel bolts for use in the permanent way under the field conditions encountered at DB AG. It is to be applied in connection with the qualification of new permanent way steel bolts for the DB AG network (qualification test) and in the context of quality assurance. In the context of this standard, steel bolts for the permanent way refers to bolts for the permanent way with non-metric threads (e.g. coach screws), bolts for the permanent way with metric threads (e.g. hook bolts, fishbolts or turnout bolts) and the associated nuts. Steel bolts and nuts for the permanent way are designated below as "products". Where necessary, please refer to the corresponding standard drawing for product-specific requirements that go beyond the scope of this standard.

This DB standard does not regulate the testing of DIN bolts. In individual cases, however, these can also be qualified and monitored for quality subject to agreement with the responsible quality assurance department of DB AG.

## 2 Normative references

This DB standard contains stipulations from other publications in the form of dated or undated references. These normative references are quoted in the respective positions in the text and the names of the publications are stated thereafter. In the case of dated references, subsequent amendments or revisions to these publications only belong to this standard if they have been incorporated by means of amendment or revision. In the case of undated references, the latest version of the referenced publication applies (including amendments).

DIN ISO 8992	Fasteners – General requirements for bolts, screws, studs and nuts
DIN EN ISO 898-1	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

DIN EN 20 898-2	Mechanical properties of fasteners – Part 2: Nuts with specified property classes – Regular threads
DIN EN 26 157-1	Fasteners – Surface discontinuities – Part 1: Bolts for general requirements
DIN EN 26 157-3	Fasteners – Surface discontinuities – Part 3: Bolts for special requirements
DIN EN ISO 6157-2	Fasteners – Surface discontinuities – Part 2: Nuts
DIN EN ISO 10 684	Fasteners – Hot dip galvanized coatings
Deutscher Schraubenverband e.V. – Richtlinie für die Herstellung feuerverzinkter Schrauben (Guideline for the manufacture of hot-dip galvanized bolts)	
DIN EN ISO 1461	Dip galvanized coatings on fabricated iron and steel articles
UIC 864-1 V	Technical specification for the supply of coach screws
UIC 864-2 V	Technical specification for the supply of steel bolts for use in permanent way
DIN EN 10 025-2	Hot-rolled products of structural steels; Part 2: Technical delivery condi- tions for non-alloy structural steels
DIN EN 13 232	Railway applications – Permanent way – Points and Crossings – Parts 5–8
DIN EN ISO 148-1	Metallic materials – Charpy impact test – Part 1: Method of test

### **3 Technical requirements**

#### **3.1 General**

Steel bolts for use in the permanent way shall be manufactured from a single piece without welding. The bolts shall be hot headed. Non-metric threads of coach screws shall be hot rolled. Metric bolt threads shall be cold formed. Nut threads shall be tapped. In addition, the general requirements of DIN ISO 8992 shall be observed.

#### **3.2 Material**

The following standards apply to the materials of the products: DIN EN ISO 898-1, Section 6 for bolts and DIN EN 20898-2, Section 4 for nuts. The material S 355 J2 is to be used for the products. All products must comply at least with strength class 5.6 (nuts to comply with strength class 5). Any higher strength classes of the products (e.g. 8.8 or 10.9) that deviate from this are to be obtained from the corresponding standard drawings.

### **3.3 Dimensions, tolerances**

The corresponding DB AG standard drawings apply regarding the form and dimensions of the products. The functional dimensions are highlighted in the standard drawings.

### **3.4 Surface condition**

The surface condition of the products is governed by DIN EN 26 157-1 for bolts (regulations for hexagonal bolts are definitive for all steel bolts for permanent way) and DIN EN ISO 6157-2 for nuts. For the assessment of surface discontinuities on bolt threads, DIN EN 26 157-3 Section 3.6 shall apply.

### **3.5 Metallographic inspection**

In order to record possible cracks (see Section 3.4) a metallographic inspection must be carried out with a longitudinal section (bolts and nuts) during qualification and quality assurance. For high-strength bolts, the head area is also inspected for cracks.

### **3.6 Mechanical properties**

The mechanical and physical properties of the products at room temperature (and for Charpy impact test at -20°C) must comply with the values of the respective strength class listed in DIN EN ISO 898-1, Section 7 for bolts and DIN EN 898-2, Section 5 for nuts.

To verify the mechanical and physical properties, the test methods listed in Section 5 of the DB Standard must be used. These test methods are to be considered as a minimum requirement. Regardless of this, all values listed in DIN EN ISO 898-1 Section 7 and DIN EN 20898-2 Section 5 are to be observed.

### **3.7 Corrosion protection**

The galvanising of coach screws is to be performed according to DIN EN ISO 1461 and the Guideline for the Manufacture of Hot-Dip Galvanized Bolts of the Deutscher Schraubenverband e.V. The galvanising of all other steel bolts and nuts for use in the permanent way is to be performed according to DIN EN ISO 10684 and the Guideline for the Manufacture of Hot-Dip Galvanized Bolts of the Deutscher Schraubenverband e.V.

In line with DIN EN ISO 10684, in the case of galvanised products, the nuts with oversize threads of tolerance class 6AZ are to be used after applying the coating for pairings with screws which have threads of tolerance position 6g before applying the coating.

In the case of NiroTech coatings, there are no specifications for oversize or undersize dimensions. Both parts are to be manufactured to the nominal dimension.

Differing procedures for corrosion protection are permissible if the technical equivalence has been proven and approval has been obtained from the responsible technical office of DB AG (see cover page). The products may only have a metallic coating (e.g. galvanising) if it is guaranteed that the process temperature does not impair the properties of the products and no hydrogen embrittlement occurs on the surface.

Examples of possible faults on galvanised coach screws are illustrated in Annex A.

### **3.8 Delivery status**

The required delivery status of the products is to be obtained from the standard drawings. Oils must not contain any environmentally harmful substances.

## **4 Qualification and quality assurance**

### **4.1 Qualification of the product**

Each of the requirements described in Section 3 must be verified on three products in this qualification test. The test results for each single tested product must meet the requirements.

The unit responsible for technical aspects at DB AG (see cover sheet) may determine additional requirements and tests. DB AG may waive tests if, for example, product properties do not require certain tests or if material properties are already well known.

Qualification tests may only be carried out by testing organisations nominated by DB AG. The vendor shall bear the cost of qualification testing.

### **4.2 Qualification of the manufacturer**

For certain products (cf. list of permanent-way products subject to quality inspection), the manufacturer's capability to manufacture a product as specified in the contract shall be verified prior to the first delivery to DB AG. This shall take the form of a "manufacturer-related product qualification". One component of the manufacturer-related product qualification is the qualification testing according to Section 4.1. The manufacturer-related product qualification shall be carried out by DB AG's Quality Assurance department (TEI 2). The manufacturer/supplier shall bear the cost of the manufacturer-related product qualification.

It is permissible for manufacturers of bolts for use in the permanent way also to use nuts made by non-qualified manufacturers. These must then be qualified by the bolt manufacturer and DB AG must be notified of this. As part of the product qualification of the bolt manufacturer, the bolts of all sub-contractors are also to be tested. Manufacturers of nuts who have not been inspected or approved shall be excluded from supplies. Instead of identifying the nuts with their manufacturer's mark, they can also be identified with the mark of the bolt manufacturer and the suffix A, B and so on.

### **4.3 Quality assurance at the manufacturer's site**

The manufacturer shall ensure the quality of the products on the basis of appropriate statistical process control. The tests and scope of testing listed in Table 1 are minimum requirements – notwithstanding this provision, every product shall comply with the technical requirements according to Section 3. The unit responsible for technical aspects at DB AG may determine additional tests.

Test	Minimum scope of testing
Dimensions and surface condition (cf. Sections 3.3 and 3.4)	One test specimen per 1,000 products, at least 10 test specimens per production batch <sup>1)</sup>
Metallographic examination (cf. Section 3.5)	At least 3 test specimens per primary material batch
Mechanical properties (cf. Section 3.6)	One test specimen per 10,000 products, at least 3 test specimens per production batch <sup>1)</sup>
Hardness testing on hardened and tempered bolts	4 hardness measurements per furnace batch (3 hardness measurements on the surface; 1 hardness measurement in the core) <sup>2)</sup>

**Table 1: Minimum requirements placed on tests and scope of testing relating to quality assurance**

<sup>1)</sup> The test specimens are to be taken from the beginning, middle and end of a production batch.

<sup>2)</sup> Each hardness measurement consists of 3 hardness indentations. When using multi-purpose batch furnaces, the test specimens are to be taken from the middle and from the edge of the furnace batch. When using continuous or pusher furnaces, the test specimens are to be taken from the beginning, middle and end of the furnace batch.

Compliance with the requirements demanded by this DB standard shall be assured by means of test schedules and/or test plans and presented to DB AG upon request.

## 5 Test methods

### 5.1 Bolts

The mechanical properties of bolts are to be verified by means of the following tests (minimum requirement):

#### 5.1.1 Qualification tests

Non-metric thread; (e.g. coach screws)	Metric thread; (e.g. hook bolts and fishbolts)
Tensile test on whole bolt according to DIN EN ISO 898-1 with reference to the thread core area	Tensile test on whole bolts according to DIN EN ISO 898-1
Tensile test on proportional rod according to DIN EN ISO 898-1	Tensile test on proportional rod according to DIN EN ISO 898-1
Hardness test on the finished product on the basis of DIN EN ISO 898-1	Hardness test on the finished product on the basis of DIN EN ISO 898-1
	Testing force test on whole bolts according to DIN EN ISO 898-1 (if the bolt geometry allows this)
Bending test according to UIC Leaflet 864-1V, Section 2.3.3.2.2. The diameter of the bending roller is to be related to the core diameter (for short bolts it is permitted to fall below the bending angle).	Bending test according to UIC Leaflet 864-2V, Section 2.3.2.2.2. (if the bolt geometry allows this)
Notched bar impact test on finished product according to DIN EN ISO 898-1 or DIN EN ISO 148-1	Notched bar impact test on finished product according to DIN EN ISO 898-1 or DIN EN ISO 148-1

**Table 2: Qualification tests for bolts**

### 5.1.2 Quality assurance tests

<b>Non-metric thread;</b> (e.g. coach screws)	<b>Metric thread;</b> (e.g. hook bolts and fishbolts)
Tensile test on whole bolts <u>according to</u> DIN EN ISO 898-1 with reference to the thread core area	Tensile test on whole bolts according to DIN EN ISO 898-1
Tensile test on proportional rod according to DIN EN ISO 898-1	Tensile test on proportional rod according to DIN EN ISO 898-1
Hardness test on the finished product on the basis of DIN EN ISO 898-1	Hardness test on the finished product on the basis of DIN EN ISO 898-1
	Testing force test on whole bolts according to DIN EN ISO 898-1 (if the bolt geometry allows this)
Bending test according to UIC Leaflet 864-1V, Section 2.3.3.2.2. The diameter of the bending roller is to be related to the core diameter (for short bolts it is permitted to fall below the bending angle).	Bending test according to UIC Leaflet 864-2V, Section 2.3.2.2.2. (if the bolt geometry allows this)
Notched bar impact test on finished product according to DIN EN ISO 898-1 or DIN EN ISO 148-1	Notched bar impact test on finished product according to DIN EN ISO 898-1 or DIN EN ISO 148-1
Alternatively: notched bar impact test on production material according to DIN EN ISO 898-1 or DIN EN ISO 148-1 In the event of dispute, the notch impact test on the finished product shall be decisive.	Alternatively: notched bar impact test on production material (only in case of strength class 5.6) according to DIN EN ISO 898-1 or DIN EN ISO 148-1 In the event of dispute, the notch impact test on the finished product shall be decisive.

**Table 3: Quality assurance tests for bolts**

### 5.2 Nuts

The mechanical and physical properties of nuts shall be verified by means of the testing force test according to DIN EN 20898-2, Section 8.1 and by the hardness test according to DIN EN 20898-2, Section 8.2. In addition, a metallographic examination for cracks according to DIN EN ISO 6157-2 shall be performed (see also Section 3.5).

## 6 Identification

Bolts are to be marked in the head area with a brief description, strength class, manufacturer's mark, the last two digits of the year of manufacture and, if necessary, the length. Nuts are to be marked on the contact surface with the strength class, the manufacturer's mark and the last two figures of the year of manufacture. See the standard drawings for the position of the marking and the font to be used.

Hot-dip galvanised products with metric threads are to be marked in accordance with DIN EN ISO 10684.



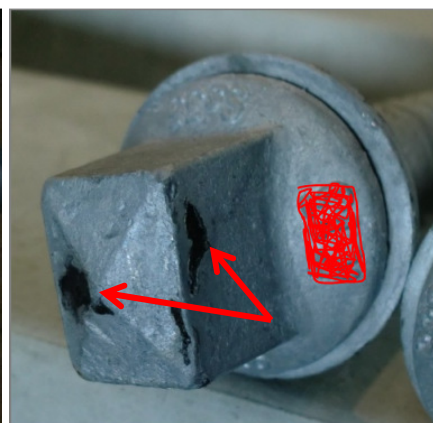
## Annex A: Examples of possible faults on galvanised coach screws

### Part 1: Tolerable

- Zinc residues not higher than 0.5 mm



- Flecks of colour on closed layer of zinc





Part 2: Not tolerable

- Flaking



- Uncoated spots





- Zinc residues higher than 0.5 mm

