

VdTÜV-Material data sheet

WB 337

VD

Heat resistant steel

TÜV

20 NiCrMo 145 I and 20 NiCrMo 145 II

337

For nuts and bolts

06.2008

Material No. 1.6772

The VdTÜV material data sheets are prepared in collaboration with the material manufacturers and are a summary of the first certification of the experts of a TÜO¹⁾ in terms of the technical rules for annexures, which require monitoring (e.g. TRD, TRB, AD 2000 data sheets, TRG, TRbF, TRFL, KTA). For deviations from the stipulations of the subsequent sections there should be an agreement between the manufacturers, buyers/secondary producers and the authorized TÜO¹⁾ and individual certification or supplementary certifications are required.

This sheet is applicable to steel rods for nuts and bolts.

Other relevant documents: DIN EN 10269: Steels and nickel alloys for securing elements for use at increased and/or low temperatures

1 Manufacturer/factory See data sheet

2 Brand name and stamp see data sheet

3 Product form (testing Object)

Dimension and delivery state

Product form	Standard max. Heat treatment diameter ¹⁾ mm	Delivery state
Steel rods for nuts and bolts	200	Hardened and tempered

¹⁾ for certified dimensions see data sheet

4 Melting see data sheet

5 De-oxidizing killed/steadied

6 Further manufacturing details hot rolled, forged

¹⁾ technical monitoring organization, which is a member of VdTÜV.

**Substitute for
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**Compiled as per the details of TÜV Saarland and
TÜV South Germany**

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7 Areas of application

- 7.1 for components in the primary circuit of nuclear power plants with light water reactors (LWR) as per KTA 3201.1.
- 7.2 for components of the external system as per RSK guidelines for compressed water reactors (DWR) section 4.2.
- 7.3 for reactor safety container as per RSK guidelines for compressed water reactors (DWR) section 5 and KTA 3401 annexure A4.
- 7.4 for other components for atomic plants.
- 7.5 for pressure containers as per AD 2000-data sheet W7 and W10 from -40°C to 400°C. the material cannot be allocated to any group of the table 1 of AD 2000 data sheet HP 0.
- 7.6 pressure devices as guideline 97/23/EG with due consideration of section 4 annexure 1 of the guideline.
- 7.7 For steam boiler as per TRD 105 to 400°C.

8. Chemical analysis

Cast/ladle analysis (Schm)

Product analysis (stck)

Type of analysis		Per cent by weight								
		C	Si	Mn	P	S	Cr	Ni ¹⁾	Mo	Al
Schm	Min.	0.18	0.15	0.30	-	-	1.20	3,40	0.25	0.005
	Max.	0.25	0.40	0.50	0,010	0,010	1.50	4.00	0.50	0.050
Stck	Min.	0.16	0.12	0.26	-	-	1.15	3.33	0.21	0.005
	Max.	0.27	0.43	0.54	0.025	0.015	1.55	4.07	0.54	0.055

¹⁾ for diameter > 70 mm the range of the product analysis is extended to 3.30 to 4.0%

9 Material properties

9.1 Mechanical-technological properties

The analysis is carried as per sections 10 (test details) and 14 (type of test certificate).

The details for 0.2% twist boundary $R_{p0.2}$, the elongation at fracture, the contraction at fracture Z and the impact energy KV are minimum values.

The mechanical properties are applicable for the testing stand as per section 11.

9.1.1 Values of the at room temperature as per DIN EN 10002-1

Material grade	Sample direction	$R_{p0.2}$ MPa	R_m MPa	A %	Z %
I	Longitudinal	940	1040 to 1240	14	55
II ✓		980	1080 to 1280	14	55

9.1.2 Values of the tensile test at higher temperature as per DIN EN 10002-5

Material grade	Sample direction	R _{p0.2} at Temperature °C					
		100	145	200	300	350	400
I	Longitudinal	885	865	830	785	735	685
II		930	910	885	830	785✓	705

9.1.3 Values of the impact test (perpendicular to the surface) as per DIN EN 10045-1

MW = average value of 3 samples

EW = smallest individual value

Material grade	Sample direction	Type of sample	Diameter	Temperature	Value	KV J	Lateral widening ¹⁾ mm
I and II	Longitudinal	V-sample	≤130	20	MW	75	-
					EW	64	0.65
			>130 to ≤200		MW	63	-
					EW	52	0.65
			≤200	-10	MW	47	-
					EW	39	-
				-40	MW	31	-
					EW	24	-

¹⁾ required only for the application area "atomic plants" according to section 7.1 to 7.4

¹⁾ required only for the application area "atomic plants" according to section 7.1 to 7.4

9.2 Long-term elevated temperature properties

The long-term values are examined on the basis of tests for upto 10 000 hours and graphic extrapolation upto 100 000 hours. They are applicable as rating characteristic values.

Temperature °C	1% creep limit for		Creep strength for	
	10 ⁴ h MPa	10 ⁵ h MPa	10 ⁴ h MPa	10 ⁵ h MPa
350	685	585	775	665
400	440	340	550	440

9.3 Other properties

No details

10 Test stipulations

10.1 Atomic plants

Type and scope of the tests are as per the KTA rules and standards and as per the specifications checked by experts.

10.2 Conventional plants requiring monitoring

10.2.1 Melting analysis is to be carried out. The product analysis is to be carried out only when the order is placed. Sampling and sample preparation is carried out as per EN ISO 14284.

10.2.2 The dimensions and the surface quality are to be tested.

10.2.3 All rods are to be tested with a suitable test for material mix-up

10.2.4 10% of the rods of a test unit are to be subjected to an ultrasonic test for internal defects.

10.2.5 Brinell hardness test

In case of rods with a diameter of ≤ 120 mm the test is to be carried out on 10% of the rods of the testing unit as per section 10.2.6, however on at least 10 rods or if the testing unit is less than 10 rods then the test is to be carried out on each rod.

If the values of the hardness thus derived are on the upper or lower limit of those prescribed for the tensile strength then the scope of test is increased to 20%. If the values in case 10 or 20% hardness test lie on the upper or lower limit of the tensile strength then 100% of the rods are to be tested.

In case of rods with a diameter of < 120 mm each rod of the test unit is to be subjected to a hardness test.

The hardness is to be measured at one end of the rods to be tested, in half of the rods at one end and in the other half at the other end.

10.2.6 Mechanical-technological test

10.2.6.1 Test units and sampling

Diameter mm	Test unit for tensile test and impact test	Sampling location	Sample direction	Sample length
≤ 40	Melting, heat treatment batch and dimension range ¹⁾	Start or end of the manufacturing length	Longitudinal	$\frac{1}{2}$ D
< 40				$\frac{1}{6}$ D

¹⁾ In a test unit the diameter of the thickest piece should be maximum 1.5 times that of the corresponding dimension of the thinnest piece.

10.2.6.2 Scope of test

The following test is to be carried out for each testing unit and at the sampling location:

1 tensile test at room temperature on the hardest and softest rod

1 impact test on 3 V-samples on the hardest and softest rod at room temperature for the temperature range above -10°C and at -40°C for the temperature range below -10°C .

10.2.7 10% of the nuts and bolts of a test unit are to be subjected to a surface crack test.

11 Heat treatment

Material grade	Tempering		Annealing	Stress relief annealing
	Hardening	Annealing		
I	830 to 900°C	Water or oil or polymer ²⁾	520 to 600°C	430 to 470°C
II			500 to 580°C	

¹⁾ Stress relief annealing as per the directions of the manufacturer
²⁾ For Böhler Edelstahl GmbH

12 Processing

12.1 Welding and thermal separation
Not permissible.

12.2 Forming
Hot forming can be carried out after discussing with the manufacturer. A new grading as per section 11 is required after hot forming.

Cold forming is not provided for (thread rolling is permissible).

13 Identification marking

13.1 Atomic plants
The products are to be marked according to the KTA rules as per the specifications checked by experts.

13.2 Conventional plants, which require monitoring
Rods with a diameter or a width across flats of more than 25 mm is to be marked on one end with a steel stamp containing

- stamp of the material
- symbol of the manufacturer
- melting (as per AD 2000 data sheet W7)
- sign of the expert

In case of rods with up to 25 mm the marking of each bundle with a tag with the same details is sufficient.

14 Type of test certificate

14.1 Atomic plants
Corresponds to the details given in KTA rules and the specifications checked by experts.

14.2 Conventional plants, which require monitoring
Acceptance test certificate 3.2 (to be issued by the expert of a TÜV) as per DIN EN 10204 according to the technical rules mentioned in section 7.
The following is to be certified by the manufacturer:

- melting process
- result of the melting analysis
- execution of the hardness test and test for material mix-up
- heat treatment condition with details regarding temperature, holding duration and cooling
- execution and result of the non-destructive test
- conformation of the delivery/consignment with the requirements of the VdTÜV material data sheet.

This certificate is a part of the acceptance test certificate 3.2.

15 Calculation

15.1 Atomic plants

The conditions decided in the specifications tested by experts are applicable.

15.2 Conventional plants, which require monitoring

The values mentioned in the corresponding tables in section 9 are to be used for calculation.

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WB 337-Supplementary sheet

**VD
TÜV**

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337

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Sup. Sheet

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09.2008

Material No. 1.6772

This sheet reproduces the contents of sections 1,2,3 (only certified dimensions) and 4 of the VdTÜV-material data sheet 337, edition 06.2008 and is applicable only in combination with this material data sheet.

1 Manufacturer/Factory

Germany

SV/ Saarstahl Völklingen GmbH
66333 Völklingen

Austria

Böhler / Böhler Edelstahl GmbH
8605 Kapfenberg

2 Brand name and stamp

Manufacturer	Material grade	Brand	Stamp
SV	I	20 CrMo 14 5-I	20 CrMo 14 5-I or K 3 I
	II	20 CrMo 14 5-II	20 CrMo 14 5-II or K 3 II
Böhler	I	Böhler V 12D-I	20 CrMo 14 5-I or V120-I
	II	Böhler V 12D-II	20 CrMo 14 5-II V120-II

3 Product form and dimension

Product form	Manufacturer	max. Diameter mm
Steel bar	SV	200
	Böhler	130

4 Melting

Manufacturer	Process
SV	Electro-arc process(E)
Böhler	Electro-arc process(E) with vacuum finishing treatment(VAD)

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