

Replaces:
RN 830-1-1:2025-01-22

Delivery Conditions for nitriding steel

**Steel bars and forged shafts of 31CrMoV9
for rotors with peripheral speeds < 50 m/s**

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Changes

2025-12-01:
The following changed in comparison to RN 830-1-1:2025-01-22:

- a) Chapter 4: Differentiation of mechanical properties prior and after heat-treatment
- b) editorially revised

Responsible division: EK	Editor M. Förste	Approval: see doc. workflow	Technical reference: C. Eschert	Page: 1 / 4
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1 Scope

This factory standard applies to	Material no.:	1.8519
	Material designation:	31CrMoV9
	Delivery conditions:	Steel bar / shaft; forged / rolled hot formed; unmachined
	Use case:	Rotors with peripheral speeds < 50 m/s

2 References

The following documents, cited in part or in whole, shall apply for the use of this standard. In case of dated references, only the referenced edition applies; in case of undated references, the latest edition of the referenced document (including all amendments) applies. The applicable version of the standards listed below shall apply to all contents not covered by this factory standard.

DIN 50125	Testing of metallic materials - Tensile test pieces
DIN 50602:1985-09	Metallographic examination; microscopic examination of special steels using standard diagrams to assess the content of non-metallic inclusions
DIN EN 10021	General technical delivery conditions for steel products
DIN EN 10060	Hot rolled round steel bars - Dimensions and tolerances on shape and dimensions
DIN EN 10204	Metallic products - Types of inspection documents
DIN EN ISO 148-1	Metallic materials - Charpy pendulum impact test - Part 1: Test method
DIN EN ISO 642	Steel - Hardenability test by end quenching (Jominy test)
DIN EN ISO 643	Steels - Micrographic determination of the apparent grain size
DIN EN ISO 683-5	Heat treatable steels, alloy steels and free-cutting steels - Part 5: Nitriding steels
DIN EN ISO 9443	Surface quality classes for hot-rolled bars and wire rod
RN 1550	Material samples
RN 1567	Remanent magnetism in components
RN 1934	Test instruction; Ultrasonic testing
RN 1936	Labelling; Raw material, parts and gearboxes

3 Chemical composition

Table 1 Chemical composition in %

	C	Si	Mn	P	S	Cr	Mo	Ni	V	Cu
min.	0.27		0.40			2.30	0.15		0.10	
max.	0.34	0.40	0.70	0.02	0.025	2.70	0.25		0.20	0.30
	Sn	Al	N	Ti	Nb	Sb	O ₂	Ca	H ₂	Al / N
min.		0.01								
max.	0.05	0.04	0.012				25 ppm		2.0 ppm	3.7

4 Physical characteristics

Table 2 Mechanical properties in delivery condition

(Test temperature: 20° C)

Diameter		R _m		R _{p0.2}	A ₅ [%]			Z [%]			A _v [J]		
[mm]		[N/mm ²]	[N/mm ²]	[N/mm ²]	longit.	tang.	transv.	longit.	tang.	transv.	longit.	tang.	transv.
over	up to	min.	max.	min.	min.	min.	min.	min.	min.	min.	min.	min.	min.
	40	1100	1300	900	9	7	-	35	25	-	25	15	-
40	100	1000	1200	800	10	8	6	35	25	15	30	20	15
100	160	900	1100	700	11	9	7	35	25	15	35	25	20
160	250	850	1050	650	12	10	8	35	25	15	40	27	22
250 ¹⁾	500	800	1000	600	12	10	8	40	30	20	35	25	20

¹⁾ values for diameter 250 – 500 mm not contained in DIN EN ISO 683-5

Table 3 Mechanical properties in the final heat-treated state

(Test temperature: 20° C)

Diameter		R _m		R _{p0.2}	A ₅ [%]			Z [%]			A _v [J]		
[mm]		[N/mm ²]	[N/mm ²]	[N/mm ²]	längs	tang.	quer	längs	tang.	quer	längs	tang.	quer
		min.	max.	min.	min.	min.	min.	min.	min.	min.	min.	min.	min.
all		800	1100	700	11	9	7	35	25	15	35	25	20

a) Structure, inclusions

- grain size, standard: DIN EN ISO 643
- purity degree, standard: DIN 50602

Standard series: Table C.1; G ≥ 5
method: K; K₄ ≤ 20

b) Hardenability

- Standard: DIN EN ISO 683-5
- testing: DIN EN ISO 642
- end distance [mm]: 5 11 25 40
- hardness [HRC]: 47-56 46-56 39-53 36-50

c) Additional properties

- radioactivity: ≤ 0.10 Bq/g

5 Manufacturing

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- a) Casting method and forging ratio
- bar $\varnothing < 180$ mm: [continuous or ingot casting](#)
 - bar $\varnothing < 250$ mm: [rolled / forged](#)
 - bar $\varnothing \geq 180$ mm: [ingot casting](#)
 - bar $\varnothing \geq 250$ mm: [forged](#)
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- b) Forging reduction ratio (VG)
- forged: [VG \$\geq 5.0\$](#)
 - ingot casting, forged: [VG \$\geq 3.0\$](#)
 - rolled: [VG \$\geq 4.0\$](#)
-
- c) Melting
- making process: [E, LD, ESU \(on special request\)](#)
 - post-treatment: [vacuum degassing \(VD\) for E or LD](#)
-
- d) Heat treatment
- treatment condition: [+QT](#)
 - treatment method: [liquid quenching and tempering](#)
-
- e) Surface condition
- defect depth: [≤ machining allowance](#)
 - unmachined: [crack- and scale-free](#)
 - repair by welding: [only after approval by REINTJES](#)
 - pre-turned (on request): [Ra 6.3 \(max. Rz 63\)](#)
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- f) Manufacturing tolerances: [DIN EN 10060](#)
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6 Other requirements

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- a) Steel and forging plant
- certified acc. to: [DIN EN ISO 9001 ff.](#)
 - approved by at least one member society of IACS
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- b) Delivery condition
- bar length: [≤ 6.3 m](#)
 - bar weight: [≤ 10 t](#)
 - end faces: [mechanically separated](#)
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- c) Testing
- material identification check: [to be carried out](#)
 - ultrasonic testing: [RN 1934 for rotors with peripheral speeds < 50 m/s](#)
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- d) Sample material and collection
- [RN 1550](#)
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- e) Remanent magnetism
- [RN 1567](#)
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- f) Labelling
- [RN 1936](#)
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- g) Documentation (must be digitally available upon delivery)
- acceptance test certificate 3.1 acc. to DIN EN 10204 per melt and furnace trip or per piece or production lot with specification of primary material and forging ratio
 - copy of the acceptance test certificate 3.1 from the steel manufacturer
 - evidence of radioactivity and remanent magnetism
 - forging schedule (on special request)
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