Replaces:
RN 830-3-1:2025-12-01

# Delivery Conditions for nitriding steel

## Punched discs and rings of 31CrMoV9 for rotors with peripheral speeds < 50 m/s

## Content

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**Changes**

2026-03-04:
The following changed in comparison to RN 830-3-1:2025-12-01:

a) Chapter 4, Table 3: Combination of the values for rings and punched discs
b) inserted public document classification

## 1 Scope

| | | |
|---|---|---|
| This factory standard applies to | Material no.: | 1.8519 |
| | Material designation: | 31CrMoV9 |
| | Delivery conditions: | Punched disc /ring<br>hot formed; unmachined / pre-turned |
| | 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 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 |
| RN 1089 | Rings; Machining allowances and tolerances |
| RN 1092 | Punched discs; Machining allowances and tolerances |
| 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)

| | Rm | | $Rp_{0.2}$ | A5 [%] | | | Z [%] | | | Av [J] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | [N/mm²] | [N/mm²] | [N/mm²] | longit. | tang. | | longit. | tang. | | longit. | tang. | |
| | min.[1)] | max.[1)] | min. | min. | min. | | min. | min. | | min. | min. | |
| rings | 750 | *900* | 650 | 12 | 10 | | 35 | 25 | | 40 | 27 | |
| punched discs | *850* | 1100 | 700 | 11 | 9 | | 35 | 25 | | 45 | 25 | |

[1)] italic values deviating from DIN EN ISO 683-5

**Table 3 Mechanical properties in the final heat-treated state** (Test temperature: 20° C)

| | Rm | | $Rp_{0,2}$ | A5 [%] | | | Z [%] | | | Av [J] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | [N/mm²] | [N/mm²] | [N/mm²] | longit. | tang. | | longit. | tang. | | longit. | tang. | |
| | min[1)] | max[1)] | min | min | min | | min | min | | min[1)] | min | |
| all | 800 | 1100 | 700 | 11 | 9 | | 35 | 25 | | 45 | 25 | |

a) Structure, inclusions
- grain size, standard: DIN EN ISO 643 — standard series: Table C.1; G ≥ 5
- purity degree, standard: DIN 50602 — 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

a) Forging reduction ratio (VG)
- continuous casting: VG ≥ 5.0 — ingot casting: VG ≥ 3.0

b) Melting
- making process: E, LD, ESU (on special request)
- post-treatment: vacuum degassing (VD) for E or LD

c) Heat treatment
- treatment condition: +QT

- treatment method: liquid quenching and tempering
- annealed to: tempering values (see Table 2)

d) Surface condition
- defect depth: ≤ machining allowance
- unmachined: crack- and scale-free pre-turned (on request): Ra 6.3 (max. Rz 63)
- repair by welding: only after approval by REINTJES

e) Manufacturing tolerances: RN 1089 and RN 1092

## 6 Other requirements

a) Steel and forging plant
- certified acc. to DIN EN ISO 9001 ff.
- approved by at least one member society of IACS

b) Testing
- material identification check: to be carried out
- ultrasonic testing: RN 1934 for rotors with peripheral speeds < 50 m/s

c) Sample material and collection
- RN 1550

d) Remanent magnetism
- RN 1567

e) Labelling
- RN 1936

f) 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)