

## Delivery Conditions for nitriding steel

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

Content	Page
1 Scope .....	2
2 References .....	2
3 Chemical composition .....	3
4 Physical characteristics .....	3
5 Manufacturing .....	3
6 Testing .....	4
7 Other requirements.....	4

### Changes

2023-04-26:  
The following changed in comparison to RN 1563-3:2018-06-12:

- a) transfer to new numbering system
- b) Para. 4, table 2 adjusted
- c) updated references
- d) editorially revised

Responsible division: PK	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:	punched disk /ring 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 the case of dated references, only the referenced edition applies; in the 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
EN 10021	General technical delivery conditions for steel products
EN 10204	Metallic products - Types of inspection documents
EN 10228-3	Non-destructive testing of steel forgings - Part 3: Ultrasonic testing of ferritic or martensitic steel forgings
EN ISO 148-1	Metallic materials - Charpy pendulum impact test - Part 1: Test method
EN ISO 642	Steel - Hardenability test by end quenching (Jominy test)
EN ISO 643	Steels - Micrographic determination of the apparent grain size
EN ISO 683-5	Heat treatable steels, alloy steels and free-cutting steels - Part 5: Nitriding steels
EN ISO 9712	Non-destructive testing - Qualification and certification of NDT personnel
RN 72	Packaging and Preservation; Supply parts for production
RN 1089	Rings; Machining allowances and tolerances
RN 1092	Punched disks; Machining allowances and tolerances
RN 1550	Material samples
RN 1567	Remanent magnetism in components
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 <sub>2</sub>	Ca	H <sub>2</sub>	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

(Test temperature: 20° C)

	Rm		Rp <sub>0,2</sub>	A5 [%]			Z [%]			Av [J]	
	[N/mm <sup>2</sup> ]	[N/mm <sup>2</sup> ]	[N/mm <sup>2</sup> ]	longit.	tang.		longit.	tang.		longit.	tang.
	min. <sup>1)</sup>	max. <sup>1)</sup>	min.	min.	min.		min.	min.		min.	min.
rings	750	900	650	12	10		35	25		40	27
punched disks	850	1100	700	11	9		35	25		45	25

<sup>1)</sup> italic values deviating from EN ISO 683-5

**a) Structure, inclusions**

- grain size, standard: EN ISO 643 Standard series: Table C.1; G ≥ 5
- purity degree, standard: DIN 50602 method: K; K4 ≤ 20

**b) Hardenability**

- Standard: EN ISO 683-5
- testing: 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

**d) Surface condition**

- defect depth: ≤ machining allowance
- unmachined: crack- and scale-free returned (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 Testing

a) Ultrasonic testing

- standard: [EN 10228-3](#)
- scanning acc. to: [Table 3, 3b and 3c, grid scanning marginal and core zone testing](#)
- type of testing: [4 MHz \(normal and TR probe\)](#)
- probe specification: [≤ 6 dB/m](#)
- sound attenuation: [EN ISO 9712, stage 2](#)
- examiner qualification: [EN ISO 9712, stage 2](#)
- testing accuracy:

	<u>diameter</u>	<u>quality class</u>
○ punched disks, preturned / dipping bath zone 1 (gearing):	0,8 × da to da	4
zone 2 (power transmission):	di to 2 × di	4
zone 3 (remaining volume):	2 × di to 0,8 × da	3
○ rolled rings, preturned / dipping bath entire diameter range:	di to da	4
○ punched disks and rings, unmachined entire diameter range:	di to da	3

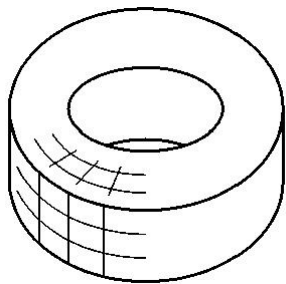


Figure 1 punched disks / rings

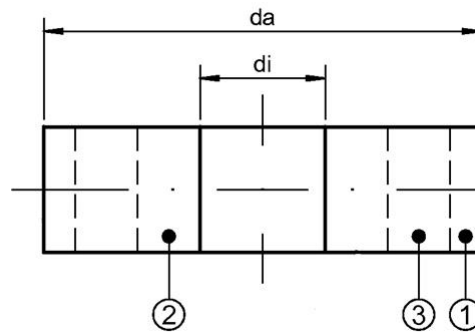


Figure 2 zones for punched disks / rings

- b) Material identification check: [to be carried out](#)

## 7 Other requirements

a) Steel and forging plant

- certified acc. to: [DIN EN ISO 9001 ff.](#)
- approved by at least two member societies of IACS

b) Packaging and preservation

- [RN 72](#)

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 EN 10204 - 3.1 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)