

Replaces:
RN 1555-1:2010-07-13

Delivery Conditions for quenched and tempered steel

Steel bars and forged shafts of 42CrMo4 for rotors with peripheral speeds > 50 m/s

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Changes

2023-04-06:
The following changed in comparison to RN 1555-1:2010-07-13:

- a) transfer to new numbering system
- b) updated references
- c) editorially revised

Responsible division: PK	Editor M. Förste	Approval: see doc. workflow	Technical reference: C. Eschert	Page: 1 / 5
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1 Scope

This Factory Standard applies to	Material no.:	1.7225
	Material designation:	42CrMo4
	Delivery conditions:	steel bar / forged shaft hot formed; 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 7527-6:1975-02	Steel Forgings; Machining Allowances and Permissible Variations for Open-die Forged Bars
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 ISO 642	Steel - Hardenability test by end quenching (Jominy test)
EN ISO 643	Steels - Micrographic determination of the apparent grain size
EN ISO 683-2	Heat-treatable steels, alloy steels and free-cutting steels - Part 2: Alloy steels for quenching and tempering
EN ISO 9712	Non-destructive testing - Qualification and certification of NDT personnel
SEP 1923	Ultrasonic testing of steel forgings to stringent standards, in particular for components in turbine and generator systems
RN 72	Packaging and Preservation; Supply parts for production
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.	0,38		0,60			0,90	0,15			
max.	0,45	0,40	0,90	0,015	0,005	1,20	0,30	0,60		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	0,05			20 ppm	0,0030	1,7 ppm	3,7

4 Physical characteristics

Table 2 Mechanical properties

 (Test temperature: 20° C / degree of transformation: $\phi \geq 6,0$)

Diameter		Rm		Rp _{0,2}	A5 [%]		Z [%]		Av [J]	
[mm]		[N/mm ²]		[N/mm ²]	longit.	transv.	logit.	transv.	longit.	transv.
over	up to	min.	min.	min.	min.	min.	min.	min.	min.	min.
	40	1000	800	12	-	35	-	25	-	-
40	100	900	650	14	-	40	-	27	-	-
100	160	850	600	15	12	45	40	32	26	26
160	250	800	550	17	12	40	34	32	26	26
250	500	750	500	15	12	50	45	32	24	24
500	750	700	450	14	12	45	30	28	18	18
750	1000	650	400	14	12	45	30	28	18	18

a) Structure, inclusions

- grain size, standard: [EN ISO 643](#) Standard series: [Table C.1; G ≥ 6](#)
- purity degree, standard: [DIN 50602](#) method: [K; K4 ≤ 20](#)

b) Hardenability

- Standard: [EN ISO 683-2](#) scatter band: **+HH**
- testing: [EN ISO 642](#)
- end distance [mm]: 5 11 25 40
- hardness [HRC]: [55-61](#) [48-59](#) [39-53](#) [36-47](#)

c) Additional properties

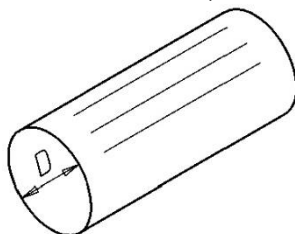
- radioactivity: [≤ 0,10 Bq/g](#)

5 Manufacturing

a) Casting method:	ingot casting	
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, quenched and tempered, stress-relieved annealed after pre-machining	
• treatment method:	liquid quenching and tempering	
d) Surface condition		
• defect depth:	≤ machining allowance	
• unmachined:	rust-, crack- and scale-free	preturned: max. Rz 40
• repair by welding:	not permitted	
e) Manufacturing tolerances	DIN 7527-6	

6 Testing

a) Ultrasonic testing		
• standard:	SEP 1923	
• scanning acc. to:	D3, D7	
• type of testing:	marginal and core zone testing	
• probe specification:	4 MHz (normal, TR and 45° angle probe)	
• sound attenuation:	≤ 6 dB/m	
• examiner qualification:	EN ISO 9712, stage 2	
• testing accuracy:		
○ steel bar, pre-turned / dipping bath	<u>diameter</u>	<u>quality class</u>
zone 1 (power transmission):	$D \geq 0,2 \times dw$	1a
zone 2 (core cross section):	$D < 0,2 \times dw$	2a, 2b for EE+VE with extension



dw = bar diameter

Figure 1 Steel bar

b) Material identification check:	to be carried out
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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
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- b) Delivery condition
- bar length: [5 - 6 m](#) rod end: [smooth sawn](#)
 - bar weight: [≤ 10 t](#)
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- c) Packaging and preservation
- [RN 72](#)
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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 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)