Replaces:
RN 1564:2008-10-09

Delivery Conditions for case-hardening steel

Bevel gears of 18CrNiMo7-6
for rotors with peripheral speeds < 50 m/s

Contents

Changes

2023-04-26:

The following changed in comparison to RN 1564:2008-10-09:

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

1 Scope

This standard applies to	Material-No.:	1.6587
	Material designation:	18CrNiMo7-6
	Delivery conditions:	Bevel gears hot formed; unmachined / preturned
	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 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 642	Steel - Hardenability test by end quenching (Jominy test)
EN ISO 643	Steels - Micrographic determination of the apparent grain size
EN ISO 683-3	Heat-treatable steels, alloy steels and free-cutting steels - Part 3: Case-hardening steels
EN ISO 6506-1	Metallic materials - Brinell hardness test - Part 1: Test method
EN ISO 9712	Non-destructive testing - Qualification and certification of NDT personnel
ISO 6336-5	Calculation of load capacity of spur and helical gears - Part 5: Strength and quality of materials
RN 72	Packaging and Preservation; Supply parts for production
RN 1550	Material samples
RN 1567	Remanent magnetism in components
RN 1927	Case-hardening
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	0,15		0,50			1,50	0,25	1,40		
max	0,21	0,40	0,90	0,025	*0,010*	1,80	0,35	1,70		*0,30*
	Sn	**Al**	**N**	**Ti**	**Nb**	**Sb**	**O_2**	**Ca**	**H_2**	**Al / N**
min		*0,02*	*0,008*							
max		*0,05*	*0,012*	*0,006*			25 ppm	0,0015	2,0 ppm	4,0

4 Physical characteristics

Table 2 Mechanical properties (Test temperature: 20 °C)

Rm	$Rp_{0,2}$	A5 [%]			Z [%]			Av [J]		
[N/mm²]	[N/mm²]	longit.	tang.	cross	longit.	tang.	cross	longit.	tang.	cross
min	min	min	min	min	min	min	min	min	min	min
1080	785	12	10	8	45	35	25	35	25	25

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 683-3 — scatter band: +HH
- testing: EN ISO 642

end distance [mm]:	5	11	25	40
hardness [HRC]:	42-48	40-47	35-43	33-41

c) Additional properties
- radioactivity: ≤ 0,10 Bq/g

5 Manufacturing

a) Casting method and forging reduction ratio (VG)
- continuous casting: VG ≥ 6,0 (not permitted for Ø > 180 mm)
- ingot casting: hot rolled: VG ≥ 4,0 — forged: 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: Ø Da < 1000: +FP / +QT — Ø Da ≥ 1000: +QT
- treatment method: liquid quenching and tempering
- anneal to: 600 to 850 N/mm² tensile strength

d) Surface condition
- defect depth: ≤ machining allowance
- unmachined: crack and scale free — preturned (on request): Ra 6,3 (max. Rz 63)
- repair by welding: only after approval by REINTJES

e) Manufacturing tolerances: see drawing

6 Testing

a) Ultrasonic testing

- standard: EN 10228-3
- scanning according to: table 3, type 3b and 3c, grid scanning
- type of testing: marginal and core zone testing AVG-Testing
- probe specification: 4 MHz (normal and TR probe)
- sound attenuation: ≤ 6 dB/m
- examiner qualification: EN ISO 9712, stage 2
- testing accuracy

	diameter	quality class
zone 1 (gearing):	d_1 - d_2	4
zone 2 (power transmission):	d_3 - d_4	4
zone 3 (remaining volume):	d_2 - d_3	3

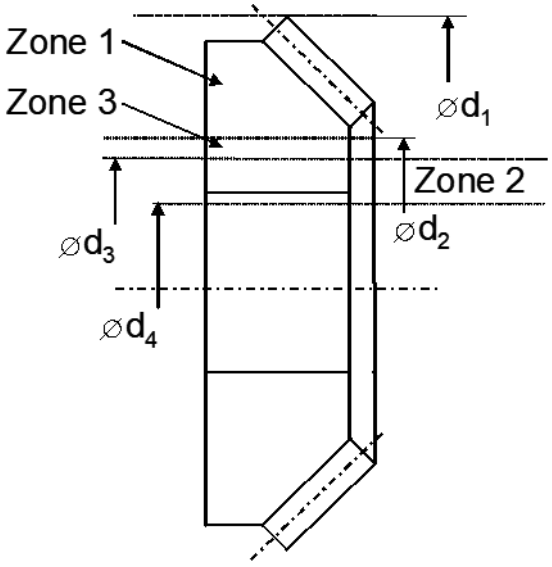

Figure 1 Bevel gear

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)