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Wear resisting alloyed cast iron
Information on heat treatment, mechanical and
physical properties and microstructure

Supplement 1
to
DIN 1695

Verschleißbeständiges legiertes Gußeisen; Inhaltsangaben über Wärmebehandlungen, Eigenschaften, Gefüge

In keeping with current practice in standards published by the International Organization for Standardization (ISO), a comma has been used throughout as the decimal marker.

This Supplement provides information relating to DIN 1695,
but no additional standard specifications

This supplement contains guideline values for heat treatment temperatures (cf. table 1), mechanical and physical properties (cf. table 2) and information on the microstructure (cf. table 3) of wear resisting alloyed cast iron.

Literature

- [1] K. Röhrig; H. G. Gerlach; O. Nickel. *Legiertes Gußeisen, Gußeisen mit Kugelgraphit* (Alloyed cast iron and ductile cast iron), 1974:2, 67-74, issued by *Gießerei-Verlag*, Düsseldorf. H. G. Gerlach. *Herstellung und Anwendung von bainitischen und martensitischen Gußeisen mit Kugelgraphit* (Manufacture and use of bainitic and martensitic ductile cast iron). *Nickel-Berichte*, 1964:10 (22), 355-360, issued by *International Nickel Deutschland GmbH*.
- [2] *Die verschleißfesten Ni-Hard-Werkstoffe* (Wear resisting Ni-hard iron), 1967:48, 96 pages, issued by *International Nickel Deutschland GmbH*.
- [3] K. Röhrig. *Die verschleißfesten martensitischen Chrom-Molybdän-Gußeisen* (Wear resisting martensitic chromium-molybdenum cast iron). *Gießerei-Praxis*, 1971:2, 20-33, special edition.
- [4] F. Maratray and R. Usseglio-Nanot. *Atlas: Umwandlungsschaubilder von chrom- und molybdän-legiertem weißem Gußeisen* (Transformation characteristics of chromium and chromium-molybdenum white iron), 1970, 198 pages, issued by *Climax-Molybdän-Gesellschaft*.
- [5] F. Maratray and R. Usseglio-Nanot. *Einflußfaktoren auf die Gefügestruktur des chrom- und chrom-molybdän-legierten weißen Gußeisens* (Factors affecting the microstructure of chromium white cast iron and chromium molybdenum white cast iron), 1970, 32 pages, issued by *Climax-Molybdän-Gesellschaft*.

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Table 1. Guideline temperatures for heat treatment *)

Material		Hardening	Annealing	Softening	Special heat treatment
designation	number				
G-X 300 NiMo 3 Mg	0.9610	850 °C, 1 h/air, oil or water	250 to 400 °C, 6 to 24 h/air or oven	850 to 920 °C/oven, as a function of initial micro- structure and wall thickness	
G-X 260 NiCr 4 2	0.9620	Naturally hard when cooled on being cast	250 to 300 °C, 6 to 24 h/air or oven	-	To obtain improved fracture toughness, 450 °C/air or oven + 250 to 300 °C, 12 to 16 h
G-X 330 NiCr 4 2	0.9625		250 to 300 °C, 6 to 24 h/air or oven		
G-X 300 CrNiSi 9 5 2	0.9630	750 to 820 °C, 4 to 10 h/air or oven			To obtain best fracture toughness, 800 °C, 4 to 10 h/air or oven + 250 to 300 °C, 12 to 14 h/air. In the case of forgings with very thick walls, 450 °C, 4 h/air + 450 °C, 16 h
G-X 300 CrMo 15 3	0.9635	930 to 980 °C, 1 to 8 h/air	200 to 300 °C, 2 to 6 h/air or oven	930 to 960 °C, 1 to 8 h/oven at 800 °C, then at under 40 °C/h to 550 °C/air or oven	-
G-X 300 CrMoNi 15 2 1	0.9640	930 to 980 °C, 1 to 8 h/air	200 to 300 °C, 2 to 6 h/air or oven	930 to 960 °C, 1 to 8 h/oven to 800 °C, then at under 20 °C/h to 650 °C/air or oven	-
G-X 260 CrMoNi 20 2 1	0.9645	970 to 1050 °C, 4 to 10 h/air	200 to 300 °C, 2 to 6 h/air or oven	970 to 1000 °C, 4 to 10 h/oven at 800 °C, then at under 15 °C/h to 700 °C/held 5 to 20 h/air or oven	-
G-X 260 Cr 27	0.9650	970 to 1050 °C, 4 to 10 h/air	200 to 300 °C, 2 to 6 h/air or oven	980 to 1050 °C, 4 to 10 h/oven	-
G-X 300 CrMo 27 1	0.9655	970 to 1050 °C, 4 to 10 h/air	300 to 500 °C, 2 to 6 h/air or oven	980 to 1050 °C, 4 to 10 h/oven	-

*) See DIN 17 014 Part 1 for concepts and Part 3 for further information on heat treatment.

Table 2. Guideline values for mechanical and physical properties

Material designation	Material number	Vickers hardness, in HV 30	Brinell hardness, in HB	Rockwell hardness, in HRC	Tensile strength ^{*)} , R_m , in N/mm ²	0,2 % proof stress, $R_{0,02}$, in N/mm ²	Elongation, A , as a percentage	Modulus of elasticity, in kN/mm ²	Approx. density, in kg/dm ³	Shrinkage, as a percentage	Coeff. of linear thermal expansion (20 to 100 °C), in 10 ⁻⁶ · K ⁻¹	Thermal conductivity (20 to 100 °C), in W/m · K
G-X 300 NiMo 3 Mg	0.9610	300 to 650	300 to 610	30 to 58	700 to 1300	600 to 1100	1 to 8	165 to 180	7,4	Up to 1,2	-	-
G-X 260 NiCr 4 2	0.9620	450 to 750	430 to 690	45 to 62	320 to 390	-	-	169 to 183	7,7	1,5 to 2,2	8 to 9	14
G-X 330 NiCr 4 2	0.9625	450 to 750	430 to 690	45 to 62	280 to 350	-	-	169 to 183	7,7	1,5 to 2,2	8 to 9	14
G-X 300 CrNiSi 9 5 2	0.9630	450 to 750	430 to 690	45 to 62	500 to 600	-	-	196	7,7	1,5 to 2,2	14 to 15	12,6 to 15
G-X 300 CrMo 15 3	0.9635	380 to 750	380 to 690	39 to 62	450 to 1000	-	-	154 to 190	7,7	1,5 to 2,2	11 to 15	12,6 to 15
G-X 300 CrMoNi 15 2 1	0.9640	380 to 750	380 to 690	39 to 62	450 to 1000	-	-	154 to 190	7,7	1,5 to 2,2	11 to 15	12,6 to 15
G-X 260 CrMoNi 20 2 1	0.9645	380 to 750	380 to 690	39 to 62	450 to 1000	-	-	154 to 190	7,7	1,5 to 2,2	11 to 15	12,6 to 15
G-X 260 Cr 27	0.9650	380 to 750	380 to 690	39 to 62	560 to 960	-	-	154 to 190	7,6	1,5 to 2,2	12 to 15	-
G-X 300 CrMo 27 1	0.9655	380 to 750	380 to 690	39 to 62	450 to 1000	-	-	-	7,6	1,5 to 2,2	-	-

*) These values are not to be used for design purposes.

Table 3. Information on microstructure (for guidance purposes)

Material designation	Material number	Microstructure ^{*)}
G-X 300 NiMo 3 Mg	0.9610	Bainitic or martensitic, and spheroidal; generally, low carbide content.
G-X 260 NiCr 4 2	0.9620	Cementite in predominantly martensitic matrix.
G-X 330 NiCr 4 2	0.9625	
G-X 300 CrNiSi 9 5 2	0.9630	Predominantly chromium carbide in martensitic matrix; may contain traces of austenite.
G-X 300 CrMo 15 3	0.9635	Predominantly chromium carbide in matrix which, as a function of composition and heat treatment, is predominantly pearlitic, martensitic or austenitic.
G-X 300 CrMoNi 15 2 1	0.9640	
G-X 260 CrMoNi 20 2 1	0.9645	
G-X 260 Cr 27	0.9650	
G-X 300 CrMo 27 1	0.9655	

*) Cf. VDG-Merkblatt (VDG instruction sheet) P 442.