

# MICROFOND BRESCIANA SRL – Commonly used steels for Investment Casting



## Chemical composition (%)

## Mechanical properties after treatment

## Features and applications

Title	Wr.n.	Standard	Italian designation	C	Si <sup>1</sup>	Mn	Cr	Ni	Mo	P	S	Altri	Suggested treatment	R MPa	R (0,2%) MPa	Hardness	Features and applications
Case Hardening	1.0301 1.1121	EN 10277-2 EN10084:2006	C10 C10E	0,07 0,13	0,45 max	0,30 0,60	-	-	-	0,035 max	0,035 max	-	Annealing	400	250		Mild and easy machinable steel. High weldability. Low stressed components.
Case Hardening	1.0402 1.1151	EN10083:1998 EN10083:2006	C20 C22E	0,17 0,24	0,45 max	0,40 0,80	-	-	-	0,035 max	0,035 max	-	Annealing or normalization	450	300		Reasonable mech. properties and good weldability. Low stressed components
Case Hardening	1.7131	EN10084:2006	16MnCr5	0,14 0,19	0,45 max	1,00 1,30	0,80 1,10	-	-	0,035 max	0,04 max	-	Case Hardening	1250	980	58-65 HRC	High strength and wear resistance, high surface hardness, good machinability (cemented) and heart toughness. Mechanical components subject to rolling and / or friction and excellent toughness: cams, pins, rollers, bearings
Case Hardening	1.5714	EN10084:2006	16CrNi4	0,13 0,19	0,45 max	0,70 1,00	0,60 1,10	0,80 -	-	0,035 max	0,04 max	-	Quenching and distension	1030	690	58-64 HRC	
Case Hardening		UNI7846:1978	18NiCrMo5 K2D	0,15 0,21	0,45 max	0,60 0,90	0,70 1,00	1,20 1,50	0,15 0,25	0,035 max	0,035 max	-	Case Hardening	1250	980	58-65 HRC	
Case Hardening		ASTM A958 -17	8620	0,18 0,23	0,45 max	0,70 1,20	0,40 0,60	0,70 0,70	0,15 0,25	0,035 max	0,035 max	-	Case Hardening	1050	765	55-60 HRC	
Heat treatable steel	1.1181	EN 10083: 2006	C35 C35E	0,32 0,39	0,45 max	0,50 0,80	0,40 0,40	0,40 max	0,10 0,10	0,035 max	0,04 max	-	Quenching and tempering	560-730	325-430	180-220 HRB	Good toughness and great machinability. Good weldability
Heat treatable steel	1.7218	EN10083:2006	25CrMo4	0,22 0,29	0,45 max	0,60 0,90	0,90 1,20	-	0,15 0,30	0,035 max	0,04 max	-	Quenching and tempering	890-1000	650-800	20-44 HRC	Excellent toughness. Mechanical components under fatigue. Motor industry and gun making. Good weldability of 25CrMo4
Heat treatable steel	1.7220	EN10083:2006	34CrMo4	0,30 0,37	0,45 max	0,60 0,90	0,90 1,20	-	0,15 0,30	0,035 max	0,04 max	-	Quenching and tempering	890-1100	690-890	23-49 HRC	
Heat treatable steel	1.0511 1.1186	EN10083:2006 UNI7874 :1979	C40E C40	0,37 0,44	0,45 max	0,50 0,80	-	-	-	0,035 max	0,035 max	-	Quenching and tempering	590-750	350-450	185-225 HRB	Higher mech. properties and hardness than C35 but lower toughness.
Heat treatable steel	1.2311	DIN 17350	40CrMnMo7	0,35 0,45	0,20 0,40	1,30 1,60	1,80 2,10	-	0,15 0,25	0,035 max	0,04 max	-	Quenching and tempering	950-1100		280-325HB	Stampi plastica con esigenze di ottima finitura superficiale. Stampi per leghe leggere a basso punto di fusione, piastre, porta stampi, ecc
Heat treatable steel	1.7225	EN10083:2006 EN10083:1998	42CrMo4 40CrMo4	0,38 0,45	0,45 max	0,60 0,90	0,90 1,20	-	0,15 0,30	0,035 max	0,04 max	-	Quenching and tempering	880-1300	690-1060	27-57 HRC	Good performance. High stress components, both static and dynamic shafts, connecting rods, gears, pistons, gaskets. The 39NiCrMo3 requires less precautions in quenching
Heat treatable steel	1.6510	EN10083:2006	39NiCrMo3 38NiCrMo4	0,35 0,43	0,45 max	0,50 0,80	0,60 1,00	0,70 1,00	0,15 0,25	0,035 max	0,04 max	-	Quenching and tempering	1020	880	31 HRC	
Heat treatable steel		ASTMA322	AISI 8650	0,48 0,53	0,45 max	0,75 1,00	0,40 0,60	0,40 0,70	0,15 0,25	0,040 max	0,04 max	-	Quenching and tempering	715-1255	104-1165	212-363 HB	
Nitriding steel	1.8515	EN10085:2003	31CrMo12	0,27 0,34	0,40 0,70	0,75 max	2,70 3,30	-	0,30 0,40	0,035 max	0,04 max	-	Quenching and tempering	1100	950	34 HRC	Components subjected to high specific loads and under fatigue; better resistance to abrasive wear, adhesive and binding compared to quenched and tempered steels (treatment advisable)
Nitriding steel	1.8509	EN10085:2003	41CrAlMo7	0,38 0,45	0,50 max	0,40 0,80	1,50 1,80	-	0,20 0,35	-	-	Al 0,80-1,20	Quenching and tempering	1100	950	34 HRC	
Springs steel	1.8159	EN10083:2006	50CrV4 51CrV4	0,47 0,55	0,50 max	0,70 1,10	0,90 1,20	-	-	0,035 max	0,035 max	V 0,10-0,25	Quenching and tempering	960-1390	830-1241	30-60 HRC	Components requiring a high elastic limit and fatigue strength without deformation
Sofmagnetic	1.0884		FeSi3	0,10 max	2,50 3,00	0,20 0,50	-	-	-	-	-	-	Annealing	≥ 500	≥ 300	120-160 HV1	High magnetic permeability steel
Austenitic Stainless steel	1.4301	EN 10088:2005	AISI 304	0,07 Max	1,00 max	2,00 max	17,5 19,5	8,00 10,5	-	0,045 max	0,03 max	-	Solution annealing	485-585	275-345		Medium-high corrosion resistance. Widely used in food industry and general application, which are not requiring extreme resistance. Good weldability. Not hardenable
Austenitic Stainless steel	1.4307	EN 10088:2005	AISI 304L	0,03 Max	1,00 max	2,00 max	17,5 19,5	8,00 10,5	-	0,045 max	0,03 max	-	Solution annealing	450 - 680	≥ 175		
Austenitic Stainless steel	1.4401	EN 10088:2005	AISI 316	0,08 max	1,00 max	2,00 max	16,5 18,5	10,0 13,0	2,00 2,50	0,045 max	0,03 max	-	Solution annealing	485-585	275-345		Excellent corrosion resistance and good corrosion resistance at elevated temperatures: nautical, chemical, petrochemical, pharmaceutical. Good weldability. Not hardenable.
Austenitic Stainless steel	1.4404	EN 10088:2005	AISI 316L	0,03 max	1,00 max	2,00 max	16,5 18,5	10,0 13,0	2,00 2,50	0,045 max	0,03 max	-	Solution annealing	500-700	200		
Austenitic-refractory	1.4845	EN 10088:2005	AISI 310	0,10 max	1,50 max	2,00 max	24,0 26,0	19,0 22,0	-	0,045 max	0,03 max	-	Solution annealing	415-515	205-275		High corrosion resistance at elevated temperatures
Austenitic-refractory	1.4828	EN10095	AISI 309	0,20 max	1,50 2,50	2,00 max	19,0 21,0	11,0 13,0	-	0,045 max	0,03 max	-		>500	>240		Resistance to hot oxidation up to 1.000°C, low resistance to oxidation by sulfuric gases
Austenitic-refractory	1.4837	ASTM A297HK40	SCH22	0,35 0,45	1,75 max	1,50 max	23,0 27,0	19,0 22,0	-	0,04 max	0,04 max	-		>440	>235		Excellent properties at high temperatures
Precipitation hardening	1.4542	EN 10088:2005	AISI 630 (17-4PH)	0,07 max	0,70 max	1,50 max	15,0 17,0	3,00 5,00	-	0,045 max	0,03 max	3,00≤Cu≤5,00 5xCSNb ≤0,45	Solution annealing and hardening	1030-1310	960-1100	34-44 HRC	Combines excellent mechanical performance with good resistance to corrosion. Military and aerospace
Martensitic Stainless steel	1.4057	EN 10088:2005	AISI 431	0,12 0,22	1,00 max	1,50 max	15,0 17,0	1,50 2,50	-	0,045 max	0,03 max	-	Quenching	750-1100	515-720	20-40 HRC	Low corrosion resistance but excellent mechanical performance. Centrifugal pumps shafts and bodies (AISI 431). Knives and blades (AISI 420).
Martensitic Stainless steel	1.4021	EN 10088:2005	AISI 420 A <sup>2</sup>	0,16 0,25	1,00 max	1,50 max	12,0 14,0	-	-	0,045 max	0,03 max	-	Quenching	1390-1550	890-1440	30-52 HRC	
Martensitic Stainless steel	1.4125	EN 10088:2005	AISI 440 C <sup>3</sup>	0,96 1,20	1,00 max	1,00 max	16,0 18,0	0,40 0,80	-	0,045 max	0,03 max	-	Quenching	750-950	550	40-55 HRC	Low corrosion resistance but excellent mechanical performance. Scissors, scalpels, injectors for engines
Ferritic Stainless steel	1.4016	EN 10088:2005	AISI 430	0,08 max	1,00 max	1,00 max	16,0 18,0	-	-	0,045 max	0,03 max	-	Annealing	430	250	195 HRB	Good atmospheric corrosion resistance and good wear resistance

Duplex Stainless steel	1.4462	EN 10088:2005	F51 X2CrNiMoN22-5-3	0,03 max	1,00 max	2,00 max	21,0 23,0	4,50 6,50	2,50 3,50	0,045 max	0,03 max	N 0,10-0,22	Solution annealing	650-1000	450		Two-phase stainless steel with excellent resistance to stress corrosion cracking. Weldable, suitable for particular constructions under continuous stress. Chemical, petrochemical, marine and off-shore environments
Bearing steel	1.3505	EN 683-17:1999	100Cr6	0,92 1,13	0,12 0,38	0,21 0,49	1,35 1,65	-	-	0,03 max	0,03 max	-	Quenching and tempering	1410-2500		44-62 HRC	Components subject to wear and abrasion, as well as tension and compression. Fifth wheels, bearings, rollers
Tool steel	1.2080	EN 4957: 2002	X210Cr12	1,90 2,20	0,10 0,60	0,15 0,60	11,0 13,0	-	-	0,03 max	0,03 max	-	Quenching and tempering	1820-2420		51-59 HRC	Cold work steel with good wear resistance, good cutting resistance and high hardness. Cylinders for cold rolling mills, circular knives and shear blades, molds for small metal parts, punches and dies for drawing, sintering moulds, profiling rollers, shearing irons
Tool steel	1.2550	DIN 17350	55WCrV8KU	0,55 0,65	0,50 0,70	0,15 0,45	0,90 1,20	-	-	0,035 max	0,035 max	V 0,10-0,20 W 1,80-2,10	Quenching and tempering	1760-2420		50-59 HRC	Suitable for high stresses, it is used for tools subjected to violent impacts such as perforating punches, chisels, deburring and coining tools, shear blades,
Tool steel	1.2379	DIN 17350 EN 4957: 2002	X155CrVMo121 K110	1,50 1,60	0,10 0,40	0,15 0,45	11,0 13,0	-	0,60 0,80	0,03 max	0,03 max	V 0,80-1,20	Quenching and tempering	1760-2375		50-58.5 HRC	Steel with high wear resistance, excellent hardenability and dimensional stability to heat treatment. Main uses: blades for shears, shearing punches, dies, cylinders for cold rolling mills, rollers and threading dies
Tool steel	1.2767	EN 4957: 2002	45NiCrMo16	0,40 0,50	0,55 max	0,20 0,50	1,20 1,50	3,80 4,30	0,15 0,35	0,035 max	0,035 max	-	Quenching and tempering	1640-2160		48-56 HRC	Tool steel for hot and cold applications, it is self-hardening with excellent toughness. Despite its notable hardenability, it is not very sensitive to deformations. Molds for plastic materials, punches, anvils, mallets, molds for coining, shearing, shear knives
Tool steel	-	-	MB33	1,50 2,50	1,50 2,50	0,30 1,00	30,00 35,00	-	2,00 3,00	0,035 max	0,035 max	-	Stabilization				Lega di acciaio con alti tenori di Cr; più simile ad una ghisa che ad un acciaio
Superalloy	2.4856	UNS N06625	Inconel 625	0,10 max	0,50 max	0,50 max	20,00 23,00	58,00 min	8,00 10,00	-	-	Nb 3,15-4,15 Fe 5,00 max	Solution annealing	724-896	290-414	90-100 HRB	Nickel alloy with excellent corrosion resistance in various environments. Typical applications: naval industry, aerospace industry, chemical processes, nuclear reactors, pollution control systems
<p>1) The silicon contents of parts made in foundries may have higher values (up to +0.15 percentage points) 2) Also available in the 420 B versions in which the carbon content varies (0.26&lt;C&lt;0.35) and 420C in which the Carbon (0.36&lt;C&lt;0.42) and Chromium (12.5&lt;Cr&lt;14.5) vary: as the chemical composition varies, the mechanical properties vary too 3) Also available in the 440 B versions (in which 0.85&lt;C&lt;0.95 - 17&lt;Cr&lt;19 - 0.9&lt;Ni&lt;1.3 - 0.07&lt;V&lt;0.12 vary) and 440A (in which 0.65&lt;C&lt;0.85 - 14&lt;Cr&lt;16 vary): as the chemical composition varies, the mechanical properties vary too NB: the list is purely indicative and summary; For information on the mechanical characteristics of other alloys, ask the technical office. <a href="http://www.microfond.it">www.microfond.it</a></p>																	