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Microalloyed Strip Steel Compositions and Yield Strength

Compositions in weight percent, industrial rolling conditions and yield strength after coiling for five commercial microalloyed hot strip steels, from a low niobium C-Mn baseline to NbTiV grades that reach 599 to 638 MPa. This card is a reference summary of a published chapter. It is not a purchase specification and it is not an Aobo Steel standard.

Reference only. Aobo Steel supplies tool steel and engineering steel in bar and plate form. The compositions, rolling conditions and strength values below are the figures printed in the published source. Verify the values against the applicable standard and the material test certificate before ordering.

Compositions of the five steels

All values are weight percent, as printed.

Steel	C	Mn	Si	P	S	Al	Nb	Ti	V	N	Vf max
Nb	0.07	0.68	0.01	0.012	0.009	0.04	0.04	-	-	0.009	0.00045
NbTi-1	0.05	0.55	0.02	n.d.	n.d.	0.02	0.02	0.06	-	0.006	0.00131
NbTi-2	0.12	1.21	0.33	0.023	0.008	0.048	0.057	0.059	-	0.008	0.00166
NbTi-3	0.11	1.54	0.28	0.026	0.007	0.01	0.04	0.11	-	n.d.	0.00261
NbTiV	0.14	1.38	0.25	0.018	0.007	0.07	0.04	0.04	0.03	0.008	0.00174

Source, Alloy Steel, Properties and Use (E. Morales), chapter 3, Table 5, p. 60.

Industrial processing conditions and yield strength after coiling

Steel	Soaking °C	Roughing °C	Finishing °C	Cooling °C*min-1	Coiling °C	Thickness mm	Y.S. MPa
Nb	1150	≥1080	890	10	650	10	310
NbTi-1	1230	≥1100	870	20	630	8	332
NbTi-2	1150	≥1070	870	10	650	7	534
NbTi-3	1225	≥1100	895	10	650	8	638
NbTiV	1225	≥1100	895	10	670	3	599

Source, Alloy Steel, Properties and Use (E. Morales), chapter 3, Table 6, p. 60.

Where the yield strength comes from

Steel	Grain Size (µm)	σ (MPa)	Δσ (MPa)
Nb	10.0	252	58
NbTi-1	9.4	254	78
NbTi-2	5.0	367	167
NbTi-3	4.2	393	245
NbTiV	3.3	421	178

Source, Alloy Steel, Properties and Use (E. Morales), chapter 3, Table 7, p. 61.

Notes

- The steel names Nb, NbTi-1, NbTi-2, NbTi-3 and NbTiV are the identifiers used in the source chapter, not commercial grade designations.
- The numbers above are the figures printed in that chapter, not a purchase specification.
- All five steels were rolled on an industrial hot strip mill.
- The cooling column is printed as °C*min-1 in the source and is reproduced unchanged.
- The source prints the header of the last column as Δσ(MPa, reproduced here as Δσ (MPa).
- Composition and property data is for general reference only. Actual values vary by standard, mill, and heat number. Confirm against the material test certificate (MTC) or contact Aobo Steel.

Grouping by strength level and grain size

Steel group	Grades in this card	Yield strength after coiling	Grain size and what the figures show
C-Mn with niobium only	Nb	310 MPa	10.0 µm ferrite grain size and 58 MPa of additional strengthening.
Nb with titanium	NbTi-1	332 MPa	9.4 µm grain size and 78 MPa of additional strengthening.
Higher carbon NbTi and NbTiV	NbTi-2, NbTi-3 and NbTiV	534 to 638 MPa	Thinner strip at 3 to 8 mm, grain size 3.3 to 5.0 µm and 167 to 245 MPa of additional strengthening.

Aobo Steel, tool steel supplier

Aobo Steel supplies forged tool steel and engineering steel from Huangshi, Hubei, China, where the local supply chain covers ESR melting, vacuum degassing and LF refining, forging, hot rolling, turned and peeled bar, heat treatment and third party inspection. We have worked in steel since 2003 and supply to order in cold work grades such as D2, D3 and O1, hot work grades such as H10 and H13, stainless grades 420, 440C and 4Cr13, and carbon and alloy bar, with EN 10204 3.1 certification.

Reference data compiled from Alloy Steel, Properties and Use (E. Morales), chapter 3, Comments About the Strengthening Mechanisms in Commercial Microalloyed Steels and Reaction Kinetics on Tempering in Low-Alloy Steels.

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