



Tool Steel Processing Characteristics Chart

Comparative ratings for decarburization resistance, hardening response, distortion, cracking resistance, hardness, machinability, toughness, wear resistance and softening resistance across all major tool steel grades. Rated columns use the eight step scale, Lowest, Low, Low to medium, Medium, Medium to high, High, Very high and Highest. Higher is better for decarburization resistance, cracking resistance, machinability, toughness, wear resistance and softening resistance. For amount of distortion a lower rating is better. Hardening response is listed as shallow, medium or deep, and hardness as an HRC range.

Reference only. The ratings reproduce Table 10 of the ASM Handbook as published. They are not an Aobo Steel specification. Verify the property requirements against the applicable standard and the mill certificate before ordering.

Molybdenum High-Speed Steels

Type	Resistance to decarburization	Hardening response	Amount of distortion (a)	Resistance to cracking	Approx. hardness, HRC (b)	Machinability	Toughness	Resistance to wear	Resistance to softening
M1	Low	Deep	A or S, low; O, medium	Medium	60-65	Medium	Low	Very high	Very high
M2	Medium	Deep	A or S, low; O, medium	Medium	60-65	Medium	Low	Very high	Very high
M3 (class 1 and 2)	Medium	Deep	A or S, low; O, medium	Medium	61-66	Medium	Low	Very high	Very high
M4	Medium	Deep	A or S, low; O, medium	Medium	61-66	Low to medium	Low	Very high	Highest
M7	Low	Deep	A or S, low; O, medium	Medium	61-66	Medium	Low	Very high	Very high
M10	Low	Deep	A or S, low; O, medium	Medium	60-65	Medium	Low	Very high	Very high
M30	Low	Deep	A or S, low; O, medium	Medium	60-65	Medium	Low	Highest	Very high
M33	Low	Deep	A or S, low; O, medium	Medium	60-65	Medium	Low	Highest	Very high
M34	Low	Deep	A or S, low; O, medium	Medium	60-65	Medium	Low	Highest	Very high
M35	Low	Deep	A or S, low; O, medium	Medium	60-65	Medium	Low	Highest	Very high
M36	Low	Deep	A or S, low; O, medium	Medium	60-65	Medium	Low	Highest	Very high
M41	Low	Deep	A or S, low; O, medium	Medium	65-70	Medium	Low	Highest	Very high
M42	Low	Deep	A or S, low; O, medium	Medium	65-70	Medium	Low	Highest	Very high
M43	Low	Deep	A or S, low; O, medium	Medium	65-70	Medium	Low	Highest	Very high
M44	Low	Deep	A or S, low; O, medium	Medium	62-70	Medium	Low	Highest	Very high
M46	Low	Deep	A or S, low; O, medium	Medium	67-69	Medium	Low	Highest	Very high
M47	Low	Deep	A or S, low; O, medium	Medium	65-70	Medium	Low	Highest	Very high
M48	Low	Deep	A or S, low; O, medium	Medium	65-70	Low	Low	Highest	Highest
M62	Low	Deep	A or S, low; O, medium	Medium	62-68	Medium	Low	Highest	Very high

Tungsten High-Speed Steels

Type	Resistance to decarburization	Hardening response	Amount of distortion (a)	Resistance to cracking	Approx. hardness, HRC (b)	Machinability	Toughness	Resistance to wear	Resistance to softening
T1	High	Deep	A or S, low; O, medium	High	60-65	Medium	Low	Very high	Very high
T2	High	Deep	A or S, low; O, medium	High	61-66	Medium	Low	Very high	Very high
T4	Medium	Deep	A or S, low; O, medium	Medium	62-66	Medium	Low	Highest	Very high
T5	Low	Deep	A or S, low; O, medium	Medium	60-65	Medium	Low	Highest	Very high
T6	Low	Deep	A or S, low; O, medium	Medium	60-65	Low to medium	Low	Highest	Very high
T8	Medium	Deep	A or S, low; O, medium	Medium	60-65	Medium	Low	Highest	Very high
T15	Medium	Deep	A or S, low; O, medium	Medium	63-68	Low to medium	Low	Highest	Highest

Intermediate High-Speed Steels

Type	Resistance to decarburization	Hardening response	Amount of distortion (a)	Resistance to cracking	Approx. hardness, HRC (b)	Machinability	Toughness	Resistance to wear	Resistance to softening
M50	Low	Deep	A or S, low; O, medium	Medium	58-63	Medium	Low	High	High
M52	Low	Deep	A or S, low; O, medium	Medium	58-64	Medium	Low	High	High

Chromium Hot-Work Steels

Type	Resistance to decarburization	Hardening response	Amount of distortion (a)	Resistance to cracking	Approx. hardness, HRC (b)	Machinability	Toughness	Resistance to wear	Resistance to softening
H10	Medium	Deep	Very low	Highest	39-56	Medium to high	High	High	Medium
H11	Medium	Deep	Very low	Highest	38-54	Medium to high	Very high	High	Medium
H12	Medium	Deep	Very low	Highest	38-55	Medium to high	Very high	High	Medium
H13	Medium	Deep	Very low	Highest	38-53	Medium to high	Very high	High	Medium
H14	Medium	Deep	Low	Highest	40-47	Medium	High	High	Medium
H19	Medium	Deep	A, low; O, medium	High	40-57	Medium	High	High	Medium to high

Tungsten Hot-Work Steels

Type	Resistance to decarburization	Hardening response	Amount of distortion (a)	Resistance to cracking	Approx. hardness, HRC (b)	Machinability	Toughness	Resistance to wear	Resistance to softening
H21	Medium	Deep	A, low; O, medium	High	36-54	Medium	High	High	Medium to high
H22	Medium	Deep	A, low; O, medium	High	39-52	Medium	High	High	Medium to high
H23	Medium	Deep	Medium	High	34-47	Medium	Medium	Very high	Medium to high
H24	Medium	Deep	A, low; O, medium	High	45-55	Medium	Medium	Very high	High
H25	Medium	Deep	A, low; O, medium	High	35-44	Medium	High	Very high	Medium
H26	Medium	Deep	A or S, low; O, medium	High	43-58	Medium	Medium	Very high	High

Molybdenum Hot-Work Steels

Type	Resistance to decarburization	Hardening response	Amount of distortion (a)	Resistance to cracking	Approx. hardness, HRC (b)	Machinability	Toughness	Resistance to wear	Resistance to softening
H42	Medium	Deep	A or S, low; O, medium	Medium	50-60	Medium	Medium	Very high	High

Air-Hardening, Medium-Alloy Cold-Work Steels

Type	Resistance to decarburization	Hardening response	Amount of distortion (a)	Resistance to cracking	Approx. hardness, HRC (b)	Machinability	Toughness	Resistance to wear	Resistance to softening
A2	Medium	Deep	Lowest	Highest	57-62	Medium	Medium	High	High
A3	Medium	Deep	Lowest	Highest	57-65	Medium	Medium	High	Very high
A4	Medium to high	Deep	Lowest	Highest	54-62	Low to medium	Medium	Medium	Medium to high
A6	Medium to high	Deep	Lowest	Highest	54-60	Low to medium	Medium	Medium	Medium to high
A7	Medium	Deep	Lowest	Highest	57-67	Low	Low	High	Highest
A8	Medium	Deep	Lowest	Highest	50-60	Medium	High	High	Medium to high
A9	Medium	Deep	Lowest	Highest	35-56	Medium	High	High	Medium to high
A10	Medium to high	Deep	Lowest	Highest	55-62	Medium to high	Medium	Medium	High

High-Carbon, High-Chromium Cold-Work Steels

Type	Resistance to decarburization	Hardening response	Amount of distortion (a)	Resistance to cracking	Approx. hardness, HRC (b)	Machinability	Toughness	Resistance to wear	Resistance to softening
D2	Medium	Deep	Lowest	Highest	54-61	Low	Low	High	High to very high
D3	Medium	Deep	Very low	High	54-61	Low	Low	High	Very high
D4	Medium	Deep	Lowest	Highest	54-61	Low	Low	High	Very high
D5	Medium	Deep	Lowest	Highest	54-61	Low	Low	High	High to very high
D7	Medium	Deep	Lowest	Highest	58-65	Low	Low	High	Highest

Oil-Hardening Cold-Work Steels

Type	Resistance to decarburization	Hardening response	Amount of distortion (a)	Resistance to cracking	Approx. hardness, HRC (b)	Machinability	Toughness	Resistance to wear	Resistance to softening
O1	High	Medium	Very low	Very high	57-62	High	Medium	Low	Medium
O2	High	Medium	Very low	Very high	57-62	High	Medium	Low	Medium
O6	High	Medium	Very low	Very high	58-63	Highest	Medium	Low	Medium
O7	High	Medium	O, very low; W, high	W, low; O, very high	58-64	High	Medium	Low	Medium

Shock-Resisting Steels

Type	Resistance to decarburization	Hardening response	Amount of distortion (a)	Resistance to cracking	Approx. hardness, HRC (b)	Machinability	Toughness	Resistance to wear	Resistance to softening
S1	Medium	Medium	Medium	High	40-58	Medium	Very high	Medium	Low to medium
S2	Low	Medium	High	Low	50-60	Medium to high	Highest	Low	Low to medium
S5	Low	Medium	Medium	High	50-60	Medium to high	Highest	Low	Low to medium
S6	Low	Medium	Medium	High	54-56	Medium	Very high	Low	Low to medium
S7	Medium	Deep	A, lowest; O, low	O, high; A, highest	45-57	Medium	Very high	High	Low to medium

Low-Alloy Special-Purpose Steels

Type	Resistance to decarburization	Hardening response	Amount of distortion (a)	Resistance to cracking	Approx. hardness, HRC (b)	Machinability	Toughness	Resistance to wear	Resistance to softening
L2	High	Medium	O, medium; W, low	O, medium; W, high	45-63	High	Very high	Low	Low to medium
L6	High	Medium	Low	High	45-62	Medium	Very high	Low	Medium

Low-Carbon Mold Steels

Type	Resistance to decarburization	Hardening response	Amount of distortion (a)	Resistance to cracking	Approx. hardness, HRC (b)	Machinability	Toughness	Resistance to wear	Resistance to softening
P2	High	Medium	Low	High	58-64 (c)	Medium to high	High	Low	Medium
P3	High	Medium	Low	High	58-64 (c)	Medium	High	Low	Medium
P4	High	High	Very low	High	58-64 (c)	Low to medium	High	Medium	High
P5	High	—	O, low; W, high	High	58-64 (c)	Medium	High	Low	Medium
P6	High	—	A, very low; O, low	High	58-61 (c)	Medium	High	Low	Medium
P20	High	Medium	Low	High	28-37	Medium to high	High	Low	Low to medium
P21	High	Deep	Lowest	Highest	30-40 (d)	Medium	Medium	Medium	Medium

Water-Hardening Steels

Type	Resistance to decarburization	Hardening response	Amount of distortion (a)	Resistance to cracking	Approx. hardness, HRC (b)	Machinability	Toughness	Resistance to wear	Resistance to softening
W1	Highest	Shallow	High	Medium	50-64	Highest	High (e)	Low	Low to medium
W2	Highest	Shallow	High	Medium	50-64	Highest	High (e)	Low	Low to medium
W5	Highest	Shallow	High	Medium	50-64	Highest	High (e)	Low	Low to medium

Aobo Steel, tool steel supplier

Aobo Steel supplies tool 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 tool steel since 2003 and supply to order in cold work grades such as D2, D3, O1 and DC53, hot work grades such as H10 and H13, and stainless grades 420, 440C and 4Cr13.

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Scan to open the tool steel processing characteristics chart

Source, ASM Handbook, Wrought Tool Steels (revised by Alan M. Bayer, Teledyne Vasco, and Lee R. Walton, Latrobe Steel Company), Table 10. Aobo Steel reference chart, verify the applicable standard before ordering.