

AISI 01

Oil Hardening Cold Work Tool Steel

Typical Analysis

Carbon 0.90; Manganese 1.20; Silicon 0.35; Chromium 0.50; Tungsten 0.50

Advantages

Moderately wear resistant
Relatively safe to harden
Easy to machine

Applications

Use for general purpose tooling where a combination of wear resistance and toughness is needed along with reduced chances of warpage and inexpensive fabrication costs. Common uses include blanking and forming dies, rolls, gages, taps, and trim dies.

Thermal Treatment Summary

Critical Points

Heating (Ac) - 100°F/Hr – begins 1350°F, ends 1400°F

Cooling (Ar) - 50°F/Hr. – begins 1295°F, ends 1240°F

Forging – 2000 to 2050°F, stop at 1600°F, cool slowly

Annealing – 1400 to 1450°F, furnace cool, BHN 207 max

Hardening - 1475°F, oil quench to 150°F

Tempering – 350 to 450°F Rc 50 to 61

FABRICATION

Forging

AISI 01 requires a forging temperature of 1700-1900°F or slightly higher than 1.00 carbon tool steel. Heating for forging should be slow and uniform to insure an even distribution of heat throughout the piece. Do not hot work the steel to as low a temperature as carbon tool steel, that is, not below about 1450°F. Always anneal after forging before proceeding to the hardening operation.

Annealing

Preferably, AISI 01 should be atmosphere or vacuum annealed at 1400°F and not exceeding 1450°F. Length of time of the annealing will, of course, depend on the size of the charge, but for the amount handled in the average small furnace, about 2 or 3 hours at temperature will be required. Allow the charge to cool slowly (less than 50°/hr), in the furnace. Brinell hardness in the fully annealed condition will range from 187-217.

Machinability

AISI 01 is easily machined in the annealed condition and carries a rating of 90% of annealed 1% carbon tool steel.

Grindability

AISI 01 is relatively easy to grind and has a grindability index of 50.0* when hardened and tempered to full-working hardness.

* courtesy of Norton Company

HEAT TREATMENT

Hardening

AISI 01 will harden best at temperatures from 1425-1500°F, depending on the size of the section. The latter temperature should not be exceeded. A temperature of 1450°F will be suitable for tools of ordinary size. Heat slowly at first (preheat if possible) to 1100-1200°F; then heating can be more rapid up to the hardening temperature. When uniformly at the hardening temperature, quench in oil. Do not quench in water. The oil bath should be slightly warm to the touch to insure proper fluidity.

Tempering

AISI 01 should be tempered soon after quenching or when the tools have almost reached the temperature of the oil quenching bath. Cutting tools, taps, and reamers will require a low temperature tempering treatment at about 300-375°F. Ordinary blanking and cold forming tools should be tempered at 375-400°F, particularly when holding close to size is important. Large tools for heavy cold forming or blanking work will require a higher temperature range, 425-475°F.

Hardening Series

Test pieces 2 inches long cut from 1 inch round ground bars were heated in an electric furnace in an atmosphere of approximately 8% CO. The samples were held for 20 minutes after reaching the indicated temperature and then oil quenched.

Hardening Temperature °F	Hardness Rockwell C	Shepherd Fracture Rating	Fracture Appearance
1350	27-28	6	Coarse
1400	61-62	8	Slightly coarse
1450	64-65	9 ½	Refined
1475	64 ½	9	Refined
1500	65-65 ½	8 ½	Slightly coarse
1550	64 ½	6 ½	Coarse
1600	63 1/2	5	Coarse

Tempering Temperature °F	Hardness Rockwell C
None	64.5
300	62.5-63
350	61
400	60.5
450	59
500	58
600	56
800	48-49