

O-1 Oil Hardening Tool Steel

AISI O-1 is an oil-hardening tool steel, which may be hardened from fairly low temperatures with little size change. O-1 combines deep-hardening qualities with a fine-grained structure, affording good initial production runs, and good continued production after grinding.

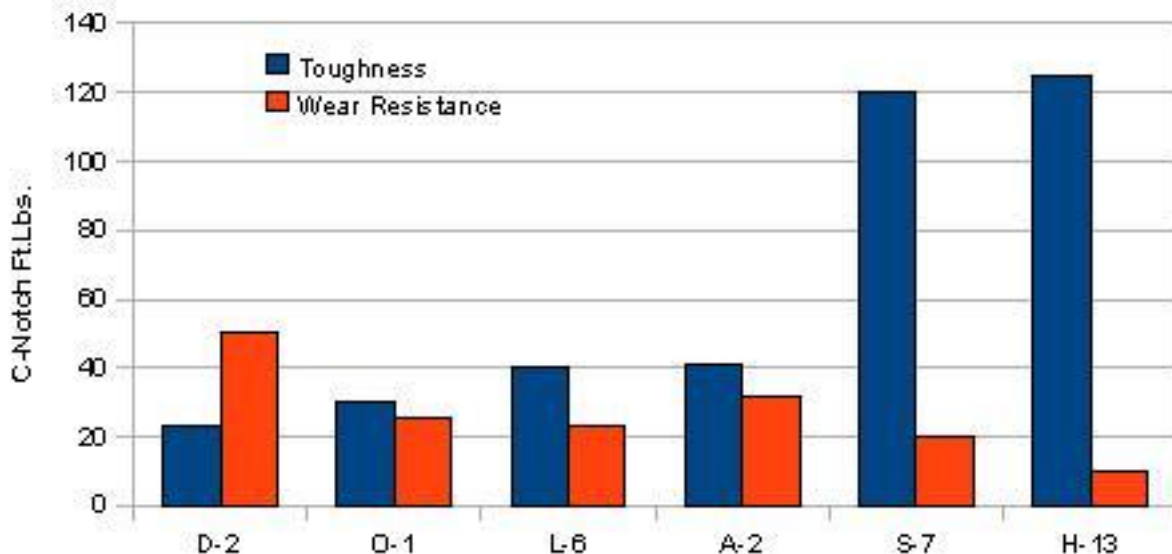
Chemical Composition

Carbon 0.90%
 Manganese 1.25%
 Chromium 0.50%
 Silicon 0.50%
 Tungsten 0.50%

Typical Applications

Blanking Dies Engraving Tools
 Forming Dies Gauges
 Knives Shear Blades

Cold Work Tool Steel Comparison



Thermal Treatments

Note: Full hardness will only be attained in sections less than 3" thick

Preheat: 1250/1350F (675/730C), equalize

Austenize: 1450/1500F (790/815C), 30/45 minutes at temperature.

Quench: Oil to 150F (65C).

Temper: 350/600F (175/315C), hold 2 hours at temperature, air cool. Temper twice.

Cryogenic Treating: Refrigeration treatments may improve long term dimensional stability by transforming retained austenite. Refrigeration treatments should generally be performed after the first temper, and must be followed by a temper.

Surface Treatments

O-1 can be given standard surface treatments such as hard chrome plating if desired. Nitriding is not generally practical due to a substantial loss of core hardness.

Annealing

A. Heat to 1425/1450F(775/790C), hold two hours, cool slowly, 50F(30C) per hour maximum, to below 1000F(540C), then air cool.

OR

B. Heat to 1425/1450F(775/790C), hold 2 hours, cool to 1275F(690C) 6 hours, then air cool.

Typical annealed hardness: 187/221 BHN.



Hardness and Impact Toughness Data

Oil Quenched from 1475F(800C)

Tempering		Toughness		
Temperature		Hardness	Charpy C-Notch	
Deg. F	Deg. C	HRC	Ft. Lbs.	Joules
As quenched		65	-	-
300	150	64	14	19
350	175	63	28	38
400	205	62	30	41
450	230	61	30	41
500	260	59	30	41
600	315	56	32	43
700	370	52	-	-
800	425	49	-	-
900	480	44	-	-
1000	540	40	-	-



Stress Relieving

Annealed Material: Heat to 1100/1300F(595/705C), hold two hours, cool in still air.

Hardened Material: Heat to 50F(15C) below original tempering temperature, hold two hours, cool in still air.

Welding

Use oil hardening (O-1) tool steel filler material.

Annealed Material: Preheat to 400/600F(205/315C). Maintain above 400F(205C) during welding. Reanneal or temper 1250/1300F(675/700C) 6 hours.

Hardened Material: Preheat to 50F(15C) below original tempering temperature (300F(150C) minimum). Maintain above 300F(150C) during welding. Cool to 150F(65C) after welding. Retemper twice 25F(15C) below original tempering temperature.

Physical Properties

Modulus of Elasticity

30psix10(6) (207 GPa)

Density 0.283 lb/in³ (7850 kg/M³)

Thermal Conductivity 20 BTU/hr./ft./F 34 W/m/ °K)