



## AIRKOOL® (AISI A2)

**CRUCIBLE DATA**

AIRKOOL is an air hardening tool steel with high wear resistance and good toughness. Its combination of properties makes it well suited to a wide variety of tooling applications, particularly molding and processing of abrasive plastics.

### Typical Chemistry

Carbon	1.00%
Manganese	0.85%
Silicon	0.35%
Chromium	5.25%
Molybdenum	1.10%
Vanadium	0.25%

### Typical Applications

Blanking Dies	Thread Roll Dies
Forming Tools	Trim Dies
Punches	Shear Blades
Gauges	Wear Inserts

### Hardening

**Preheat:** 1100/1250F (595/675C), equalize, 1350/1450F (775/790C), equalize.

**High Heat:** 1750/1800F (995/895C), 30/45 minutes at temperature.

**Quench:** Air, positive pressure vacuum to 150F (65C).

**Temper:** 400/1000F (205/540C), 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.

### Hardness and Impact Toughness Data

Air cooled from 1775F(970C)

**Chemistries  
& Properties  
Table**

**Heat  
Treatments  
Table**

Tempering Temp.		Hardness HRC	Toughness, Charpy C-notch	
°F	°C		ft-lbs	Joules
As quenched		64	-	-
300	150	62	-	-
400	205	61	31	42
500	260	60	41	56
600	315	59	37	50
700	379	58	33	45
800	425	58	31	42
900	480	58	29	39
1000	540	57	41	56
1100	595	51	-	-

**Size Change During Hardening**

Hardening Temp.		Tempering Temp.		HRC	Longitudinal Size Change %
°F	°C	°F	°C		
1775	970	400	205	62.5	+0.07
1775	970	500	260	59	+0.10
1775	970	600	315	58	+0.09

## Surface Treatments

Airkool can be given standard surface treatments such as nitriding, titanium nitride coating, or hard chrome plating if desired. When gas nitriding, harden from the high side of the temperature range and single temper at 1000F (540C); then use standard nitriding procedures.

## Annealing

**A.** Heat to 1600F (870C), hold 2 hours, slow cool 50F (30C)/hour maximum to 1200F (650C), air cool.

OR

**B.** Heat to 1600F (870C), hold 2 hours, cool to 1400F (760C), hold 6 hours, air cool.

**Typical annealed hardness:** 197/241 BHN.

## Stress Relieving

**Annealed Material:** Heat to 1200/1250F(650/675C), hold two hours, cool in still air.

**Hardened Material:** Heat to 25F(15C) below original tempering temperature, hold two hours, cool in still air.

## Welding

Use air hardening tool steel filler material.

**Annealed Material:** Preheat to 400/600F(205/315C). Maintain above 400F(205C) during welding. Reanneal or temper 1400F(760C) 6 hours.

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

## Physical Properties

**Modulus of Elasticity** .....30 psi x 10<sup>6</sup> .....(207 GPa)

**Density** .....0.284 lb/in<sup>3</sup> .....(7861 kg/M<sup>3</sup>)

**Thermal Conductivity** .....15 BTU/hr./ft./F .....(26 W/m/°K)

## Thermal Expansion

Temperature Range		Coefficient of Thermal Expansion	
°F	°C	x10 <sup>-6</sup> in./in./°F	x10 <sup>-6</sup> mm/mm/°C
100-500	38-260	5.9	10.6
100-800	38-427	7.2	13.0
100-1000	38-540	7.7	13.9

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