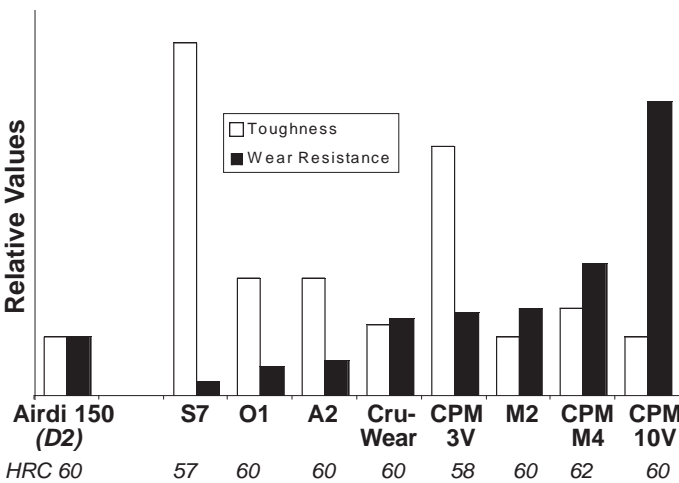


CRUCIBLE

Airdi 150 (AISI D2) is an air-hardening, high carbon, high chromium tool steel, heat treatable to HRC 60-62. It offers excellent abrasion resistance, due to a large volume of carbides in the microstructure. Airdi 150 (D2) has been widely used for many years in cold work applications requiring very high wear resistance. It is machinable in the annealed condition and, like other air-hardening tool steels, exhibits minimal distortion on hardening.

Tool Steel Comparagraph



Typical Applications

- | | |
|--|------------------|
| Stamping or Forming Dies | Punches and Dies |
| Forming Rolls | Blanking Dies |
| Thread Rolling Dies | Coining Dies |
| Lamination Dies | Trim Dies |
| Industrial Knives and Slitters | Shear Blades |
| Fineblanking Tools | Scrap Choppers |
| Wear Parts | Tire Shredders |
| Plastic Injection Feed Screws and Tips | |

Note: These are some typical applications. Your specific application should not be undertaken without independent study and evaluation for suitability.

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DATA SHEET

AIRDI® 150 (AISI D2)

Issue #1

Carbon	1.55%
Chromium	11.5%
Vanadium	0.8%
Molybdenum	0.9%

Physical Properties

Elastic Modulus	30 X 10 ⁶ psi	(207 GPa)
Density	0.278 lbs./in ³	(7.695 g/cm ³)
Thermal Conductivity¹	BTU/hr-ft-°F	W/m-°K cal/cm-s-°C
at 200°F (95°C)	12.1	20.9 0.0500
at 400°F (205°C)	13.0	22.5 0.0538
at 600°F (315°C)	14.0	24.2 0.0579
at 800°F (425°C)	14.6	25.3 0.0604
at 1000°F (540°C)	14.8	25.6 0.0612

¹Heat Treatment 1850°F/1 hr. AC, 400°F/3 hr.

Coefficient of Thermal Expansion

	in/in/°F	mm/mm/°C
70-200°F (20-95°C)	5.8 X 10 ⁻⁶	(10.4 X 10 ⁻⁶)
70-400°F (20-205°C)	6.3 X 10 ⁻⁶	(11.3 X 10 ⁻⁶)
70-600°F (20-315°C)	6.6 X 10 ⁻⁶	(11.8 X 10 ⁻⁶)
70-800°F (20-425°C)	6.8 X 10 ⁻⁶	(12.2 X 10 ⁻⁶)
70-1000°F (20-540°C)	7.0 X 10 ⁻⁶	(12.6 X 10 ⁻⁶)

Mechanical Properties

	Heat Treatment ⁽¹⁾ Austenitizing Temperature	HRC	Impact Toughness ⁽²⁾ ft.-lb. (J)	Wear Resistance ⁽³⁾ Adhesive
Airdi 150	1850°F (1010°C)	60	21 (28)	3-4
S7	1750°F (955°C)	57	125 (165)	1
A2	1750°F (955°C)	60	40 (53)	2-3
Cru-Wear	1950°F (1065°C)	62	30 (40)	5-6
CPM 3V	1950°F (1065°C)	60	70 (95)	7
M2	2050°F (1120°C)	62	20 (27)	8-10
CPM M4	2050°F (1120°C)	62	32 (43)	20-25
CPM 10V	2150°F (1175°C)	63	14 (19)	90

(1) Heat Treatment: Austenitized as indicated and tempered to hardness.

(2) Charpy C-Notch Impact Test

(3) Crossed cylinder adhesive wear test (higher number = better wear resistance)

Machinability

The machinability of Airdi 150 (D2) as annealed is about 35% of W1 tool steel.

Thermal Treatments

Annealing: Heat to 1600°F (870°C), hold 2 hours, slow cool 25°F (15°C) per hour to 1000°F (540°C) then air cool. OR heat to 1600°F (870°C), hold 2 hrs., cool to 1425°F (775°C) hold 6 hrs. then air cool.

Annealed Hardness: About BHN 221/225

Stress Relieving

Annealed Parts: Heat to 1200-1250°F (650-675°C), hold 2 hours, then cool in still air.

Hardened Parts: Heat to 25-50°F (15-25°C) below the original tempering temperature, hold 2 hours, then cool in still air.

Hardening

Preheat: Heat to 1100-1200°F (595-650°C), equalize, then to 1400-1450°F (760-790°C), equalize.

Austenitize: 1825-1875°F (995-1025°C), Hold time at temperature 30-45 minutes.

Quench: Air or positive pressure quench (2 bar minimum) to below 150°F (65°C)

Temper: 400-1000°F (205-540°C).

Temper 2 hours minimum each time or at least 1 hour per inch (25mm) of thickness. Double Temper. Cool to room temperature in between tempers.

Cryogenic Treating: Refrigeration after the first temper may improve long term dimensional stability by transforming retained austenite. Any refrigeration treatment must be followed by a temper.

Size Change: *(The amount of retained austenite has a significant effect.)*

Hardening Temperature	Tempering Temperature	HRC	Longitudinal Size Change
1850°F (1010°C)	400°F (205°C)	61	+0.025%
1850°F (1010°C)	600°F (315°C)	59	-0.010%
1850°F (1010°C)	800°F (425°C)	58	-0.017%
1850°F (1010°C)	1000°F (425°C)	55	-0.006%

Surface Treatments

Airdi 150 (D2) can be given standard surface treatments such as nitriding, TiN (titanium nitride) coating or hard chrome plating if desired. When using surface treatments, harden from the high side of the austenitizing range and temper at or above the process temperature of the treatment.

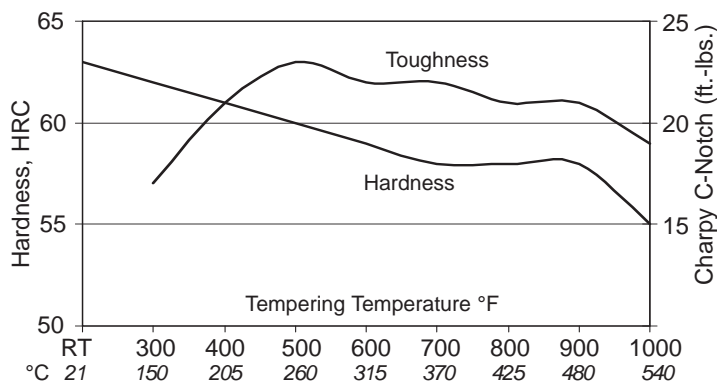
Heat Treat Response

Hardness and Impact Toughness Data

Austenitized 1850°F (1010°C) Air Cool

Tempering Temperature	HRC	Charpy C-Notch	
		Ft. lbs.	Joules
As Quenched	63		
300°F (150°C)	62	17	23
400°F (205°C)	61	21	29
500°F (260°C)	60	23	31
600°F (315°C)	59	22	30
700°F (370°C)	58	22	30
800°F (420°C)	58	21	29
900°F (480°C)	58	21	29
1000°F (540°C)	55	19	26

Results may vary with hardening method and section size. Vacuum or atmosphere cooling may result in up to 1-2 HRC points lower.



Welding

Use air hardening tool steel filler material.

Annealed Material: Preheat 700-900°F (370-485°C), maintain the temperature of the workpiece at 700°F (370°C) minimum during welding. Reanneal after welding or temper at 1425°F (775°C) for 6 hours.

Hardened Material: Preheat 25-50°F (15-30°C) below original tempering temperature or 350°F (175°C) minimum. Maintain the temperature of the workpiece at 350°F (175°C) minimum during welding. Cool to below 150°F (65°C) after welding. Temper 25°F (15°C) below original tempering temperature or 350°F (175°C) minimum.

Note: Properties shown throughout this data sheet are typical values. Normal variations in chemistry, size and heat treat conditions may cause deviations from these values. For additional data or metallurgical engineering assistance, consult your local Crucible Service Center.



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