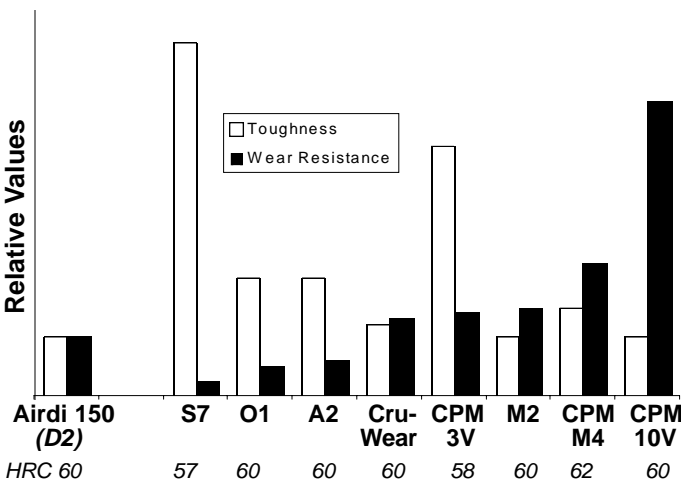


# CRUCIBLE

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.

**Crucible...**  
**The Tool Steel Pros®**

## DATA SHEET

### AIRDI® 150 (AISI D2)

Issue #12

<b>Carbon</b>	<b>1.55%</b>
<b>Chromium</b>	<b>11.5%</b>
<b>Vanadium</b>	<b>0.8%</b>
<b>Molybdenum</b>	<b>0.9%</b>

## Physical Properties

<b>Elastic Modulus</b>	30 X 10 <sup>6</sup> psi	(207 GPa)
<b>Density</b>	0.278 lbs./in <sup>3</sup>	(7.695 g/cm <sup>3</sup> )
<b>Thermal Conductivity<sup>1</sup></b>	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

<sup>1</sup>Heat 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 <sup>-6</sup>	(10.4 X 10 <sup>-6</sup> )
70-400°F (20-205°C)	6.3 X 10 <sup>-6</sup>	(11.3 X 10 <sup>-6</sup> )
70-600°F (20-315°C)	6.6 X 10 <sup>-6</sup>	(11.8 X 10 <sup>-6</sup> )
70-800°F (20-425°C)	6.8 X 10 <sup>-6</sup>	(12.2 X 10 <sup>-6</sup> )
70-1000°F (20-540°C)	7.0 X 10 <sup>-6</sup>	(12.6 X 10 <sup>-6</sup> )

## Mechanical Properties

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

(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.

The Crucible logo, Crucible, Airdi, CRU-WEAR, CPM, 3V, 10V and The Tool Steel Pros are trademarks of the Crucible Materials Corporation.

## 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

Aircl 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.

## Service Center Locations

Location	Phone	Toll Free	FAX
Auburn, MA	508-832-5353	800-365-1101	508-832-2217
Charlotte, NC	704-372-3073	800-365-1160	704-342-0985
Chicago, IL	630-378-0093	800-365-1151	630-378-1965
Cincinnati, OH	513-771-1310	800-365-1163	513-771-0119
Cleveland, OH	330-562-3131	800-365-1132	330-562-7818
Columbus, OH	614-262-4959	800-365-1131	614-262-7850
Dallas, TX	817-649-2800	800-365-1168	817-633-8142
Detroit, MI	248-528-0332	800-365-1133	248-528-1977
Grand Rapids, MI	616-554-9699	800-365-1137	616-554-9328
Huntsville, AL	256-772-0201	800-365-1161	256-772-3361
Indianapolis, IN	317-638-4501	800-365-1146	317-634-7375



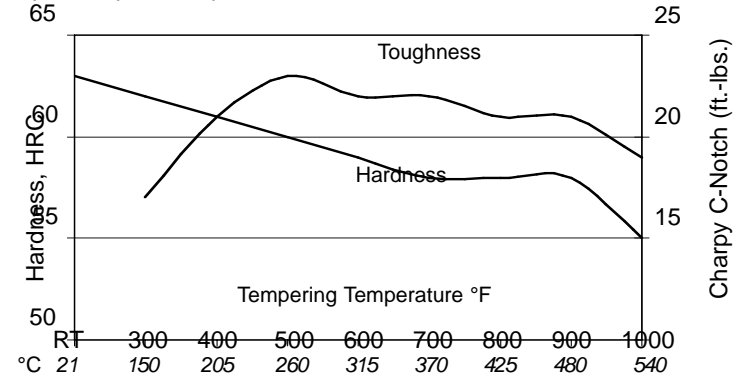
## Heat Treat Response

### 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.

Location	Phone	Toll Free	FAX
Meadville, PA	814-337-8804	800-365-0530	814-337-8808
Milwaukee, WI	262-781-6710	800-242-0948	262-781-6743
Minneapolis, MN	612-331-6320	800-365-1153	612-331-4137
St. Louis, MO	636-272-7220	877-201-4049	636-978-9559
<b>Canada</b>			
Wallaceburg, ONT	519-627-2245	800-265-5293	519-627-2247 Toll Free 888-701-4287
<b>Mexico (SISA)</b>			
Monterrey, N.L.	52-81-8351-7220		52-81-8351-2981
Naucalpan, E de M	52-55-5576-4011		52-55-5360-1865

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