AISI A2 DATA SHEET

AISI A2 is an air-or oil chromium molybdenum vanadium tool steel.

Typical analysis %	C 1.0	Si 0.3	Mn 0.6	Cr 5.3	Mo 1.1	V 0.2
Delivery condition	Soft annealed approx. 215 HB					
Color code	Red/Green					

APPLICATIONS

AISI A2 offers an excellent combination of good wear resistance and toughness. It may be regarded as a “universal” cold work steel for cutting and forming applications.

HEAT TREATMENT

SOFT ANNEALING–

Protect the steel and heat through to 1560°F (850°C). Then cool in the furnace at 20°F (10°C) per hour to 1200°F (650°C), then freely in air.

STRESS RELIEVING–

Between rough and semi-finish machining, the tool should be heated through to 1200°F (650°C), holding time of 2 hours. Cool slowly to 930°F (500°C) then freely in air.

HARDENING–

Preheating temperature:1200-1300°F (650-750°C) Austenitizing temperature:1690-1780°F (925-970°C) but usually 1720°-1760°F (940-960°C). Hold for 30 minutes once the entire tool reaches temperature. Protect the part against decarburization and oxidation during hardening.

QUENCHING MEDIA–

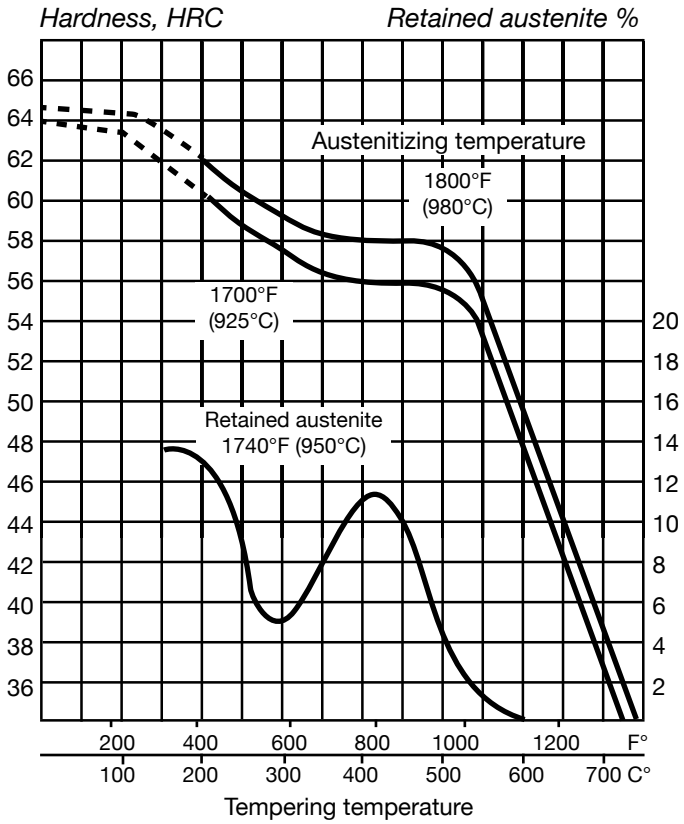
Quench as quickly as possible. Cooling must be uniform and rate must be adequate to avoid transformation products; however, risk of excessive distortion and/or quench cracking must be considered.

- Oil (only for small and uncomplicated tools)
- Martempering bath or fluidized bed at 360-430°F (180-220°C) or 840-1020°F (450-550°C) then cool in air
- Vacuum furnace with overpressure of gas at cooling
- Circulating air or atmosphere

TEMPERING–

Choose the tempering temperature according to the hardness required by referencing the tempering graph. Temper twice with intermediate cooling to room temperature. Lowest tempering temperature at 360°F (180°C). Holding time at temperature for minimum 2 hours.

TEMPERING GRAPH



Note: The tempering graphs are valid for small samples. The hardness achieved is also dependent on the tool size.

DIMENSIONAL CHANGES–

Dimensional change during hardening and tempering should not exceed 0.20% of the largest tool dimension per side, as long as the prescribed stress relief is performed.

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MACHINING

MILLING–

• Face and Square Shoulder Milling

Cutting data parameters	Milling with carbide		Milling with HSS
	Rough milling	Fine milling	Fine milling
Cutting speed (V_c)			
f.p.m.	365-465	465-600	60
m/min	110-140	140-180	18
Feed (f_z)			
inch/tooth	0.008-0.016	0.004-0.008	-0.004
mm/tooth	0.2-0.4	0.1-0.2	0.1
Depth of cut (a_p)			
inch	0.08-0.2	-0.08	-0.08
mm	2-5	-2	-2
Carbide designation			
US	C6-C5	C7-C6	—
ISO	P20-P40 Coated carbide	P10-P20 Coated carbide or cermet	—

• End Milling

Cutting data parameters	Type of milling		
	Solid carbide	Carbide indexable insert	High speed steel
Cutting speed (V_c)			
f.p.m.	165	400-565	60[1]
m/min	50	120-170	18[1]
Feed (f_z)			
inch/tooth	0.001-0.008[2]	0.003-0.008[2]	0.002-0.014[2]
mm/tooth	0.03-0.20[2]	0.08-0.20[2]	0.05-0.35[2]
Carbide designation			
US	C2	C6-C5	—
ISO	K20	P20-P40	—

1) For coated HSS end mill v_c~80 f.p.m./min. (24 m/min.)
2) Depending on radial depth of cut and cutter diameter.

DRILLING–

• High Speed Steel Twist Drill

Drill diameter		Cutting speed (V_c)		Feed (f)	
inch	mm	f.p.m.	m/min	i.p.r	mm/r
-3/16	-5	50*	15*	0.003-0.008	0.08-0.20
3/16-3/8	5-10	50*	15*	0.008-0.012	0.20-0.30
3/8-5/8	10-15	50*	15*	0.012-0.014	0.30-0.35
5/8-3/4	15-20	50*	15*	0.014-0.016	0.35-0.40

1) For coated HSS drill v_c~70 f.p.m./min. (22 m/min.)

• Carbide Drill

Cutting data parameters	Type of drill		
	Indexable insert	Solid carbide	Brazed carbide[1]
Cutting speed (V_c)			
f.p.m.	400-565	200	165
m/min	120-170	60	50
Feed (f)			
i.p.r.	0.002-0.01[2]	0.004-0.01[2]	0.006-0.01[2]
mm/r	0.05-0.25[2]	0.10-0.25[2]	0.15-0.25[2]

1) Drill with internal cooling channels and brazed carbide tip.
2) Depending on drill diameter.

ELECTRICAL DISCHARGE MACHINING EDM–

If EDM is performed in the hardened and tempered condition, the recast layer should be removed via stoning and/or polishing. If this is not possible, or for an additional safety factor, the tool should be given a subsequent stress temper at 50°F (28°C) below the lowest tempering temperature used during the heat treatment process. Equalize the temperature of the tool from surface to core and soak at the appropriate stress tempering temperature for 2 hours.

GRINDING–

General grinding wheel recommendations for AISI A2 are given below.

• Wheel Selection

Type of grinding	Wheel recommendation	
	Soft Annealed Cond.	Hardened Cond.
Face grinding: straight wheel segments	A46HV A24GV	A46GV A36GV
Cylindrical grind. Internal grinding Profile grinding	A46LV A46JV A100LV	A60JV A60IV A120JV

WELDING–

Good results when welding tool steel can be achieved if proper precautions are taken during welding (elevated working temperatures, joint preparation, choice of consumables and welding procedure). If the tool is to be polished or photo-etched, it is necessary to work with an electrode type of matching composition and as welded hardness.

FURTHER INFORMATION

CANADIAN LOCATIONS–

Kitchener, Ontario +1 (519) 748-5317
Rexdale, Ontario +1 (905) 799-7474

U.S. LOCATIONS–

Auburn, Massachusetts +1 (508) 757-3500
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