AISI D2 DATA SHEET

AISI D2 is a high-carbon, high-chromium tool steel alloyed with molybdenum and vanadium.

Typical analysis %	C 1.55	Si 0.3	Mn 0.4	Cr 11.8	Mo 0.8	V 0.8
Delivery condition	Soft annealed approx. 210 HB					
Color code	Yellow/white					

APPLICATIONS

AISI D2 is recommended for tools requiring very high wear resistance, combined with moderate toughness (shock-resistance). AISI D2 can be suppied in various finishes, including the hot-rolled, pre-machined and fine machined condition. It is also available in the form of hollow bar and rings.

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–

After rough 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:1110-1290°F (600-700°C) Austenitizing temperature:1810-1920°F (990-1050°C) but usually 1830°-1905°F (1000-1040°C). Protect the part against decarburization and oxidation during hardening.

QUENCHING MEDIA–

- Oil (only very simple geometries)
- Vacuum (high speed gas)
- Forced air/gas
- Martempering bath or fluidized bed at 360-930°F (180-500°C), then cool in air

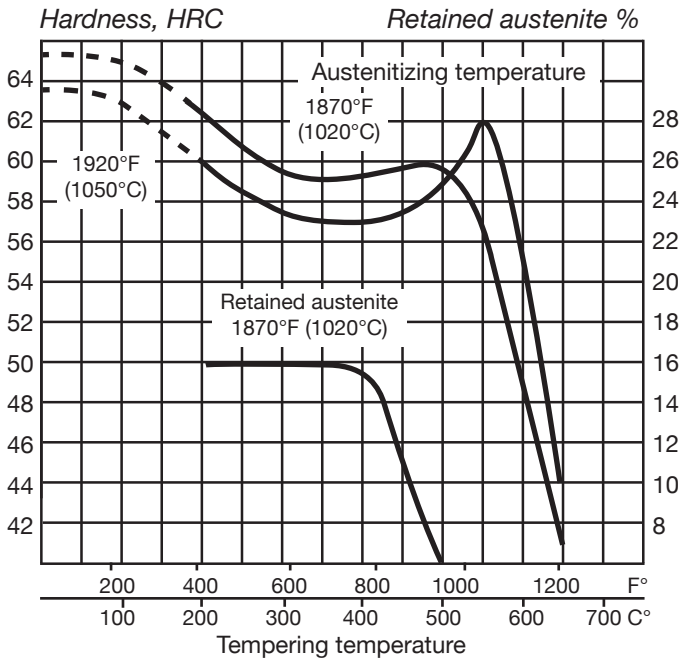
Note: Temper the tool as soon as its temperature reaches 120-160°F (50-70°C).

AISI D2 hardens through in all standard sizes.

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. High temperature tempers are the preferred process when dimensional stability is a concern, if tools are to be coated and/or if significant wire EDM will be performed in the hardened condition.

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, 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.	330-400	400-460	45
m/min	100-120	120-140	14
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	C2	C2	—
ISO	K15*	K15*	—

*Use wear resistant Al_2O_3 coated carbide grade, for example Sandvik Coromant GC 3015 or Seco T15M

• End Milling

Cutting data parameters	Type of milling		
	Solid carbide	Carbide indexable insert	High speed steel
Cutting speed (V_c)			
f.p.m.	80	260-430	40[1]
m/min	25	80-130	12[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	C2	—
ISO	K20	K15[3]	—

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.
3) Use a Al_2O_3 coated carbide grade.

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	30*	10*	0.003-0.008	0.08-0.20
3/16-3/8	5-10	30*	10*	0.008-0.012	0.20-0.30
3/8-5/8	10-15	30*	10*	0.012-0.014	0.30-0.35
5/8-3/4	15-20	30*	10*	0.014-0.016	0.35-0.40

1) For coated HSS drill v_c~45 f.p.m./min. (14 m/min.)

• Carbide Drill

Cutting data parameters	Type of drill		
	Indexable insert	Solid carbide	Brazed carbide[1]
Cutting speed (V_c)			
f.p.m.	400-560	115	145
m/min	120-170	45	35
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 D2 are given below.

• Wheel Selection

Type of grinding	Wheel recommendation	
	Soft Annealed Cond.	Hardened Cond.
Face grinding: straight wheel	A46HV	B151 R75 B3[1] 3SG 46 HVS[2] A46GV
segments	A24GV	3SG 36 HVS[2] A36GV
Cylindrical grind.	A46LV	B126 R75 A60IV 3SG 60 KVS[2]
Internal grinding	A46JV	B126 R75 B3[1] 3SG 60 JVS[2] A60HV
Profile grinding	A100LV	B126 R100 B6[1] 5SG 80 KVS[2] A120JV

1) If possible use CBN wheels for this application.
2) Grinding wheel from Norton Co.

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.

FURTHER INFORMATION

CANADIAN LOCATIONS–

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

U.S. LOCATIONS–

Tuscumbia, Alabama	+1 (256) 386-0606
Auburn, Massachusetts	+1 (508) 757-3500
Blaine, Minnesota	+1 (763) 585-9020
Cleveland, Ohio	+1 (216) 362-8440
Meadville, Pennsylvania	+1 (814) 337-6164