

# AISI H13 DATA

AISI H13 is a chromium-molybdenum-vanadium alloyed steel which is characterized by:

- Good resistance to abrasion at both low and high temperatures
- High level of toughness and ductility
- Uniform and high level of machinability and polishability
- Good high-temperature strength and resistance to thermal fatigue
- Excellent through-hardening properties
- Very limited distortion during hardening

Typical analysis %	C	Si	Mn	Cr	Mo	V
	0.39	1.0	0.4	5.3	1.3	0.9
Delivery condition	Soft annealed approx. 185 HB					
Color code	Orange/Violet					

## APPLICATIONS

Dies, backers, dieholders, liners, dummy blocks, stems. Severe cold punching, scrap shears, hot shearing, shrink rings (e.g. for hard metal dies), wear resisting parts.

## 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: 1100-1560°F (600-850°C)  
Austenitizing temperature: 1800-1900°F (980-1030°C) normally 1870°F (1020°C). 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.

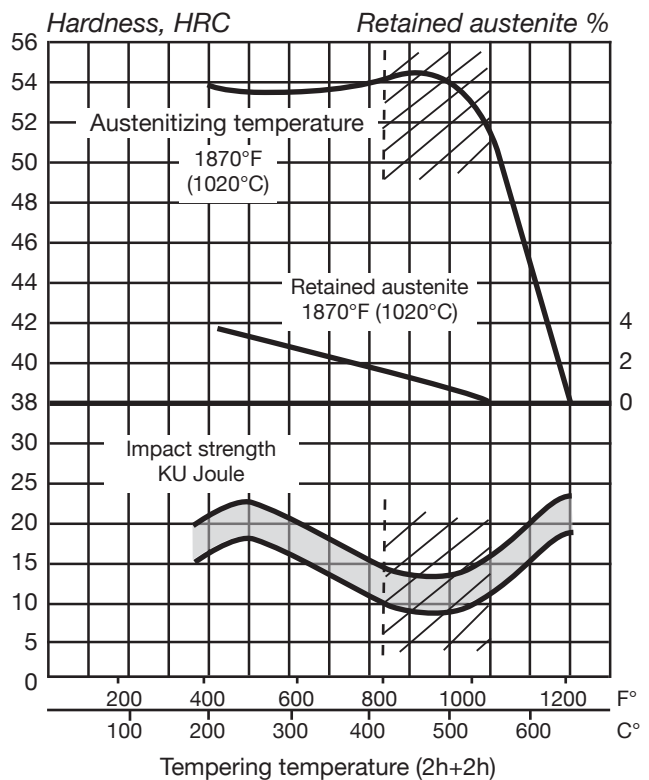
- Circulating air/atmosphere
- Positive gas pressure in vacuum furnace
- Martempering bath or fluidized bed at ~390°F (200°C) or 840-1020°F (450-550°C) for 1-100 minutes, then cool in air
- Warm oil

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

## 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 360°F (180°C). Holding time at temperature minimum 2 hours. Do not temper in the range 800-1020°F (425-550°C).

TEMPERING GRAPH



Tempering within the range 800-1020°F (425-550°C) is not normally recommended due to the reduction in toughness properties.

# 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. m/min	535-700 160-210	700-930 210-280	115 35
Feed ( $f_z$ ) inch/tooth mm/tooth	0.008-0.016 0.2-0.4	0.004-0.008 0.1-0.2	-0.004 -0.1
Depth of cut ( $a_p$ ) inch mm	0.08-0.20 2-5	-0.08 -2	-0.08 -2
Carbide designation US ISO	C5-C6 P20-P40 Coated carbide	C7-C6 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. m/min	235 70	435-600 130-180	115 <sup>1)</sup> 35 <sup>1)</sup>
Feed ( $f_z$ ) inch/tooth mm/tooth	0.001- 0.008 <sup>2)</sup> 0.03-0.20 <sup>2)</sup>	0.003-0.008 <sup>2)</sup> 0.08-0.20 <sup>2)</sup>	0.002-0.014 <sup>2)</sup> 0.05-0.35 <sup>2)</sup>
Carbide designation US ISO	C3, C5 K10, P40	C6-C5 P20-P30	— —

1) For coated HSS end mill  $v_c \sim 150$  f.p.m./min. (45 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	56*	17*	0.003-0.008	0.08-0.20
3/16-3/8	5-10	56*	17*	0.008-0.012	0.20-0.30
3/8-5/8	10-15	56*	17*	0.012-0.014	0.30-0.35
5/8-3/4	15-20	56*	17*	0.014-0.016	0.35-0.40

1) For coated HSS drill  $v_c \sim 80$  f.p.m./min. (24 m/min.)

### • Carbide Drill

Cutting data parameters	Type of drill		
	Indexable insert	Solid carbide	Brazed carbide <sup>1)</sup>
Cutting speed ( $V_c$ ) f.p.m. m/min	600-635 180-220	265 80	200 60
Feed (f) i.p.r. mm/r	0.001-0.004 <sup>2)</sup> 0.03-0.10 <sup>2)</sup>	0.004-0.01 <sup>2)</sup> 0.10-0.25 <sup>2)</sup>	0.006-0.01 <sup>2)</sup> 0.15-0.25 <sup>2)</sup>

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 H13 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 regarding elevated temperature, joint preparation, choice of consumables and welding procedure.

## 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