

# TECHNICAL BULLETIN

## AISI H-13 Hot Work Tool Steel Annealed

Typical Analysis:	Carbon 0.40	Chromium 5.25	Silicon 1.00	Moly. 1.25	Vanadium 1.05
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Color Code: Yellow with Black Stripe

### HEAT TREATMENT

<b>Forging</b>	2050°F to 2150°F, stop at 1650°F, cool slowly.
<b>Annealing</b>	1600°F, furnace-cool, max Brinell 207.
<b>Preheating</b>	1350°F, soak before heating, for hardening.
<b>Hardening</b>	1850°F, air-quench.
<b>Tempering</b>	1050°F to 1150°F, average Rockwell C38/46; die-casting dies should be hardened to Rockwell C 44/48

### CHARACTERISTICS

**Machinability** — In the thoroughly annealed condition, H-13 may be machined without difficulty. It has a rating of 75 as compared with a 1% carbon tool steel, which has a rating of 100.

**Dimensional Stability** — When air quenched from the proper hardening temperature, H-13 generally expands 0.001 in./in. of cross section.

**Critical Points** — Critical point ranges obtained for H-13 by dilatometer tests when heating and cooling at the rate of 400°F per hour are as follows:

Heating — Ac range	1600°F to 1665°F
Cooling — Ar range	1460°F to 1350°F

**Surface Chemistry** — This grade does not decarburize as readily as other types of tool steels having higher carbon content. However, care must be taken to maintain surface chemistry during heat treatment since either carburization or decarburization are possible and would affect the steels resistance to heat checking. When heat treating H-13, maintain as near a neutral atmosphere as possible, preferably by vacuum heat treating or wrapping the piece in stainless steel foil. If this is not possible, working surfaces

should be ground after heat treatment.

### INSTRUCTIONS FOR WORKING

**Hardening** — In a controlled atmosphere, preheat thoroughly at 1300°F to 1400°F. Then heat to 1850°F and hold for one hour per inch of greatest cross section. Quench in still air and temper immediately. When maximum hardness is the primary requirement, H-13 be oil quenched, but keep in mind that when oil quenched, this grade is as vulnerable to cracking and has the same distortional characteristics as an oil hardening tool steel.

**Tempering** — For hot work applications, H-13 is used in the hardness range of ROCKWELL C 38 to 48. The usual hardness range for die casting dies is ROCKWELL C 44 to 48, requiring a temper at approximately 1100°F. For improved shock resistance, the steel is often tempered at temperatures approaching 1150°F, resulting in hardnesses of ROCKWELL C 40 to 44. The steel should be held at the tempering temperature for at least two hours per inch of greatest cross section. All hot work steel should be tempered at a minimum of 50 degrees above the expected maximum operating temperature of the tool or die. Double tempering, with the second temper 25 to 50 degrees lower than the first temper is always advisable, particularly where heat checking is a problem.

Hardness tests were made on 1 in. round specimens of H-13 which were air quenched from 1850°F and tempered for two hours at various temperatures. The results below may be used as a tempering guide. Keep in mind that tools of heavy section or mass may be several points lower in

Tempering Temperature-°F	Rockwell C
400	54
500	53
600	53
700	53
800	53
900	54
1000	52
1100	46
1200	36



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