Cincinnati Tool Steel Company
Phone #: (815) 226-8800 (800) 435-0717 Fax #: (815) 226-4388

AISI H13

Hot Work Steel

H13 combines good red hardness and abrasion resistance with the ability to resist heat checking. It is an AISI H13 hot work tool steel, the most widely used steel for aluminum and zinc die casting dies. It is also popular for extrusion press tooling because of its ability to withstand drastic cooling from high operating temperatures.

H13 is produced from vacuum degassed tool steel ingots. This manufacturing practice plus carefully controlled hot working provides optimum uniformity, consistent reponse to heat treatment, and long service life.

H13 Is an outstanding die steel for die casting aluminum and manganese. It is used for zinc in long production runs, and also employed successfully for slides and cores in tool assemblies.

H13 in the hardness ranges from 45/52 RC is an excellent steel for plastic molds. It takes a high polish, making it suitable for lens and dinner ware molds.

Consider using this grade of hot work tool steel for applications where drastic cooling is required during the operation, and where high red hardness and resistance to heat checking are important. This grade has found wide acceptance for die casting dies for zinc, white metal, aluminum and magnesium. It is also widely used for extrusion dies, trimmer dies, gripper dies, hot shear blades, casings, and other similar hot work applications.

Machinablllty - In the thoroughly annealed condition, H13 may be machined without difficufty. 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, H13 generally expands 0.001 in./in. of cross section.

Typical Analysis

Carbon 0.400	Chromium 5.250
Silicon 1.000	Molybdenum 1.250
Vanadium 1.050	Manganese 0.400

Annealing

H13 may be annealed by heating to 1600°F. Soak one hour per inch of greatest thickness, and furnace cool at 30 degrees per hour to 900°F. Then air cool. Proper annealing procedure includes packing in a sealed container, using a neutral inert material. Result, maximum Brinell hardness of 207.

Hardening

In a controlled atmosphere, preheat thoroughly at 1300 to 1400°F. Then heat to 1850°F and hold for an hour per inch of greatest cross section. Quench in still air and temper immediately. When maximum hardness is the primary requirement, H13 may be oil quenched, but keep in mind that when oil quenched, this grade is vulnerable to cracking and has the same distortional characteristics as an oil hardening tool steel.

Specimens 1 in. round by 3 in. long were pre-heated at 1350°F. They were then transferred to a high-heat furnace and air-quenched from various temperatures ranging from 1750 to 2000°F.

The hardness and fracture grain size of these specimens were as follows:

Quenching	Fracture	
Temperature - °F	rating	Rockwell C
1750	8-1/2	46
1800	8-3/4	52
1850	9	54
1900	9	54
1950	9	55
2000	8-1/2	56

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Tempering

For hot work applications, H13 is used in the hardness range of HRC 38 to 48. The usual hardness range for die casting dies is HRC 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 HRC 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 of 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 H13 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, keeping in mind that tools of heavy section or mass may be several points lower in hardness.

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