AISI A6

Air Hardening Die Steel

Typical Analysis
Carbon 0.70; Manganese 2.00; Silicon 0.30; Chromium 1.00; Molybdenum 1.35

Advantages
Air hardening from low temperature
Excellent size stability in heat treatment
Deep hardening

Applications
Use for general purpose cold work tooling that requires more safety in hardening and better dimensional control than obtainable from oil hardening grades. Apache is well suited for blanking and forming dies, punches, coining and bending dies, master hubs and plastic molds.

Thermal Treatment Summary
Critical Points
Heating (Ac) - 100ºF/Hr. – begins 1360ºF, ends 1415ºF
Cooling (Ar) - 25ºF/Hr. – begins 1275ºF, ends 1225ºF
Forging – 2000 to 2050ºF, stop at 1600ºF, cool slowly
Annealing – 1350 to 1380ºF, furnace cool at 20ºF/Hr. to 1000ºF, air cool to room temp. BHN 235 max
Hardening - 1550ºF, air quench to 150ºF
Tempering – 350 to 400ºF Rc 59-60

FABRICATION

Forging
AISI A6 should be heated slowly to the forging temperature of 2000-2050ºF. Do not hot work below 1600ºF. After forging, cool slowly in the furnace or bury in fine dry ashes, lime, expanded mica, or other insulating material.

Annealing
AISI A6 may be annealed in either a controlled atmosphere furnace or packed in spent pitch coke, spent cast iron chips, or in lime, fine dry ashes, sand, or ground mica with approximately 10% burned charcoal added. Heat to 1325-1380ºF and hold approximately 4 hours for each inch of thickness. Cool very slowly at a rate of 20º per hour to approximately 1000ºF. Annealed hardness range is normally 212 to 235 Brinell.

Machinability
AISI A6 is readily machined in the annealed condition. Its machinability is about 65% of 1% carbon tool steel.

HEAT TREATMENT

Hardening
The hardening temperature range for AISI A6 is from 1500-1600ºF. Tools with simple shapes may be heated directly to the hardening temperature from room temperature. A preheat of 1200-1250ºF should be used for tools of intricate shape. A furnace atmosphere for hardening should be slightly oxidizing. Cool in still air or an air blast.

Tempering
To obtain high hardness with minimum distortion, AISI A6 should be tempered at 350-400ºF. Tempering time will vary with the size of the piece being hardened, but even the smallest tools should be tempered for a minimum of 1 hour. Reference to the hardening and tempering chart will give approximate hardnesses obtained from various tempering temperatures.

Hardening and Tempering Series
Specimens 1 inch round by 2 inches long were held at the hardening temperature of 1550ºF for 5 minutes in a controlled atmosphere furnace. The samples were air cooled, fractured, and subsequently tempered for 2 hours at the indicated temperatures.

Air Cooled from 1550ºF		**Air Cooled from 1550ºF**	
Single Tempered	**RC Hardness**	**Single Tempered**	**RC Hardness**
As Quenched	62.0	700	53.5
300ºF	60.5	800	51.5
400	59.0	900	49.0
500	57.0	1000	45.0
600	55.5		