

Ameralloy[®]-13

HOT WORK DIE STEEL
VACUUM DEGASSED

AISI H-13



Color code:
MAROON-13

Ameralloy-13 is a chromium-molybdenum-vanadium hot work steel with high vanadium content which increases its wash resistance. In addition, the alloy content minimizes heat checking at high operating temperatures.

Ameralloy-13 is best used for long run zinc and magnesium die casting dies; also in

forging, heading, and extruding applications where toughness, impact, strength and hot work steel qualities are essential.

Ameralloy-13 requires a relatively simple heat treatment and can be quenched in air with a minimum of distortion. It may also be quenched in oil with satisfactory results.

Typical Analysis

- Carbon .40
- Manganese .40
- Chromium 5.25
- Silicon 1.10
- Molybdenum 1.50
- Vanadium 1.10

Features And Advantages

- High resistance to heat checking
- Good red hardness
- Good shock resistance
- Good machinability
- Good dimensional stability
- Excellent hardenability

Heat Treatment

- **Forging** 2050°–2150°F, stop at 1650°F and cool slowly
- **Annealing** 1600°F, then furnace-cool. Brinell 207 max.
- **Preheating** 1350°F, soak before heating for hardening
- **Hardening** 1850°F, air-quench
- **Tempering** 1050°–1150°F, avg. Rockwell C 38/46, die casting dies should be hardened to Rockwell C 44/48

Applications

Die Casting

(aluminum, long run zinc, magnesium)

- Cylinder liners
- Die casting nozzles (aluminum)
- Cams (die casting machines)
- Plunger and tip
- Dies
- Cores
- Ejector pins
- Sleeves

Forging And Heading

(steel, brass, and aluminum)

- Cold heading dies, hot press dies
- Drop forging die inserts
- Forging machine dies and plungers
- Hot heading dies, hot trim dies
- Hot work rolls
- Bolt dies, rivet dies, bull dies, gripper dies, bending dies, swagging dies
- Shear blades, punches, nut piercers

Extrusion

- Extrusion dies
- Extrusion press liners
- Extrusion rams
- Rolls
- Dummy blocks, backer blocks
- Cylinders

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Characteristics

- **Machinability** In the thoroughly annealed condition Ameralloy-13 may be machined without difficulty. Where a 1% carbon steel is rated at 100, Ameralloy-13 has a rating of 75.
- **Dimensional stability** When air-quenched from proper hardening temperature, Ameralloy-13 generally expands .001 in./in. of cross section.
- **Critical points** Critical point ranges obtained by dilatometer test when heating and cooling at a rate of 400°F/hour:

Heating – Ac range 1600° to 1665°F
Cooling – Ar range 1460° 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 steel's resistance to heat checking.

When heat treating Ameralloy-13, maintain as near a neutral atmosphere as possible, preferably by vacuum heat treating or by wrapping the piece in stainless steel foil. If this is not possible, working surfaces should be ground after heat treatment.

General Instructions

- **Forging** Large pieces of Ameralloy-13 should be preheated slowly to 1300°–1500°F, and thoroughly soaked before heating rapidly to the forging temperature of 2050°–2150°F. The steel should be thoroughly heated before beginning the forging operation. Do not forge below 1650°F, but reheat as many times as necessary. After forging is completed, the steel should be slowly cooled by burying in a heat-insulating material such as dry ashes, lime, or vermiculite.
- **Annealing** Ameralloy-13 may be annealed by heating to 1600°F. Soak 1 hour per inch of greatest thickness, and furnace cool at 30°F per hour to 900°F. Then air cool. Proper annealing procedure includes packing in a steel container using a neutral inert material. Maximum Brinell hardness of 207.
- **Hardening** In a controlled atmosphere, preheat thoroughly to 1300°–1400°F. Then heat to 1850°F and hold for 1 hour per inch of greatest cross section. Quench in still air and temper immediately.

When maximum hardness is the primary requirement, Ameralloy-13 may be oil-quenched. But keep in mind that when oil-quenched this grade is as vulnerable to cracking as and has the same distortional characteristics as an oil hardening tool steel.

Ameralloy-tested Rockwell hardness and fracture grain ratings for specimens 1" round by 3" long, preheated to 1350°F. Various quenching methods and temperatures listed.

Quenching Temperature (°F)	Fracture Grain Size	Rockwell C
1750°	8½	46
1800°	8¾	52
1850°	9	54
1900°	9	54
1950°	9	55
2000°	8½	56

- **Tempering** For hot work applications, Ameralloy-13 is used in the hardness range of HRC 38–48. The usual hardness range for die casting dies is HRC 44–48, requiring a temper at approximately 1100°F. For improved shock resistance, the steel is often tempered at temperatures approaching 1150°F, resulting in a hardness range of HRC 40–44. The steel should be held at tempering temperature for at least 2 hours per inch of greatest cross section. All hot work steel should be tempered at a minimum of 50°F above the expected maximum operating temperature of the tool or die. Double tempering, with the second temper 25°–50°F lower than the first temper, is always advisable, particularly where heat checking is a problem.

Resulting Rockwell hardness for various tempering temperatures. Obtained from 1" round quenched from 1850°F and tempered for 2 hours.

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

Above results on 1" diameter specimens may be used as a guide in tempering tools to desired hardness. Tools of heavy section or mass may be several points lower in Rockwell hardness for a given treatment.

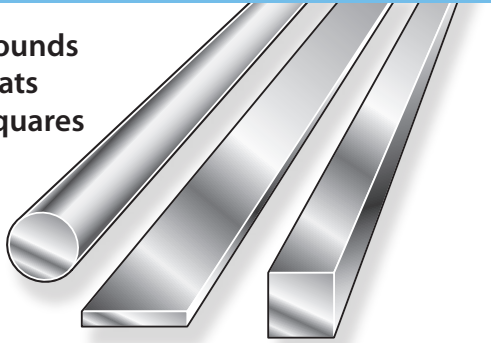
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Available Shapes And Sizes

Rounds
Flats
Squares



ROUNDS: Standard lengths 8'–10' R/L. **FLATS & SQUARES:** Standard lengths 8'–12' R/L. Specify O.D. and I.D. Modified and special sizes available upon request. Prompt forging service available.

Flats Pre-machined / Annealed

3/4	x 3	3-1/4	x 18	x 30
x 1-1/4	x 3-1/2	x 3-1/2	x 20	x 36
1	2-1/2	3-1/2	5-1/2	10-1/4
x 4	x 2-3/4	x 6	x 20	x 24
x 6	x 3	x 10	6	11
x 8	x 4	x 12	x 12	x 25
x 16	x 5	x 14	x 14	x 28
1-1/2	x 6	x 16	x 16	11-1/2
x 2	x 8	4	x 18	x 26-1/2
x 3	x 10	x 5	x 20	12
x 4	x 12	x 8	x 25	x 25
x 5	x 14	x 10	x 28	x 36
x 6	x 18	x 12	7	x 40
x 8	2-3/4	x 14	x 18	13
x 12	x 3	x 16	x 25	x 28
x 14	x 4	x 18	8	14
2	3	x 20	x 16	x 28
x 3	x 3-1/2	x 25	x 20	x 28-1/2
x 4	x 4	4-1/2	x 25	14-7/8
x 5	x 6	x 14	x 28	x 19
x 6	x 7	x 16	x 30	15
x 8	x 8	x 18	9	x 28
x 10	x 10	x 24	x 12	x 30
x 12	x 12	5	x 25	16
x 16	x 14	x 10	x 36	x 24
2-1/4	x 16	x 12	10	
x 2-1/2	x 18	x 14	x 20	
x 2-3/4	x 20	x 16	x 25	

Rounds Hot Roll/Annealed/Decarb Free/Oversize

1/2	2	4	7	11
5/8	2-1/8	4-1/8	7-1/2	11-5/8
3/4	2-3/16	4-1/4	7-3/4	12
7/8	2-1/4	4-1/2	8	12-1/2
1	2-3/8	4-3/4	8-1/2	13
1-1/8	2-1/2	5	8-3/4	13-1/2
1-1/4	2-5/8	5-1/4	9	14-18
1-3/8	2-3/4	5-1/2	9-1/4	20
1-7/16	3	5-3/4	9-1/2	22
1-1/2	3-1/8	6	9-3/4	
1-5/8	3-1/4	6-1/4	10	
1-3/4	3-1/2	6-1/2	10-7/16	
1-7/8	3-3/4	6-3/4	10-1/2	

Centerless Ground Rounds Annealed

.250	1.506	2.1935	3-1/4	4-1/2
.3125	1.5685	2-1/4	3-1/2	4-3/4
.820	1.631	2-1/2	3.506	5
.881	1.756	2.506	3.990	5-1/2
1.006	1.881	2.756	4	5-3/4
1.256	2.010	3	4.006	6
1.3185	2.131	3.006	4-5/16	7.795

Squares Annealed

2-1/4	3	6
2-1/2	3-1/4	8
2-3/4	4	10
	5	

Billets

6	12
8	14
10	16