Industeel

ArcelorMittal

W 1.2344 - AISI H13

2343 - H13: Hot work tool steel for die casting dies

Material properties
Standard hot work tool steel grade suitable for die casting dies and forging applications
Good softening resistance, good polishing properties after hardening.
Good toughness
Good dimensional stability during heat treatment
Good resistance to wear

For which applications
Die casting dies (Sn, Pb, Zn, Al, Mg)
Forging dies
Moulds for plastic injection
Various die for hot working

PROPERTIES

STANDARDS

> JIS SKD61

> Euronorm X40CrMoV5-1

> Werkstoff 1-2344

> AISI H13

> AFNOR X40CrMoV5-1 (Ancienne Z40CDV5)

CHEMICAL ANALYSIS

	C	S	Si	Cr	Mo	V
Min	0.35	-	0.80	4.80	1.20	0.85
Typical	0.40	0.001	1.05	5.00	1.30	1.00
Max	0.42	-	1.20	5.50	1.50	1.15

Typical Industeel analysis is in accordance with international standards

MECHANICAL PROPERTIES

2344 grade is delivered in annealed condition with a hardness <230HB. Is has to be heat treated after rough machining.

PHYSICAL PROPERTIES

Typical values of 2344-H13 after hardening

Thermal conductivity W.m-1.K-1		Thermal expansion Coefficient (10-6.K-1)				
20°C	500 °C	20-100°C	20-200°C	20-300°C	20-400°C	Specific heat J/kg.°C
25	28.5	10.7	11.9	12.2	12.5	460 (20°C) -555 (500°C)

METALLURGICAL PROPERTIES

Internal soundness

All plates & blocks are 100% UT tested and meet following standards:

> Euronorm EN 10228-3 class 4

> ASTM A681 S1.1

> SEP1921 E/e

Grain size

Uniform 7/8 grain size according to ASTM E 112 method.

Cleanliness

Due to the steelmaking process, the content of nonmetallic inclusions is reduced to an extremely low level. Nonmetallic inclusions content is measured in accordance with ASTM E45 A method ("worst field").

A (sulfide)		B (alumina)		C (silicate)		D (Globular oxides)	
Thin	Heavy	Thin	Heavy	Thin	Heavy	Thin	Heavy
2	1	1	1	1.0	0.5	1.5	1

Annealed microstructure

Standard 2344 is delivered without any guarantee on the structure.

2344-H13grade is delivered in a soft annealed condition for easier machining. When machining is completed, it can be hardened with a heat treatment procedure including preheating, austenitizing, quenching and double tempering. Heat treatment should be done under vacuum or under gas protection to avoid surface oxidation and decarburization. Surface and core temperature (Ts/Tc) should be controlled by thermocouples.

Soft annealing

-Heating at 850°C (1560°F)
-Cool down at 20°C (20°F) max per hour until 600°C (1120°F)
-Air cooling

Stress relieving

After rough machining, stress in the tool can be released by heating at 700°C during 2 hours per 25mm followed by air cooling.

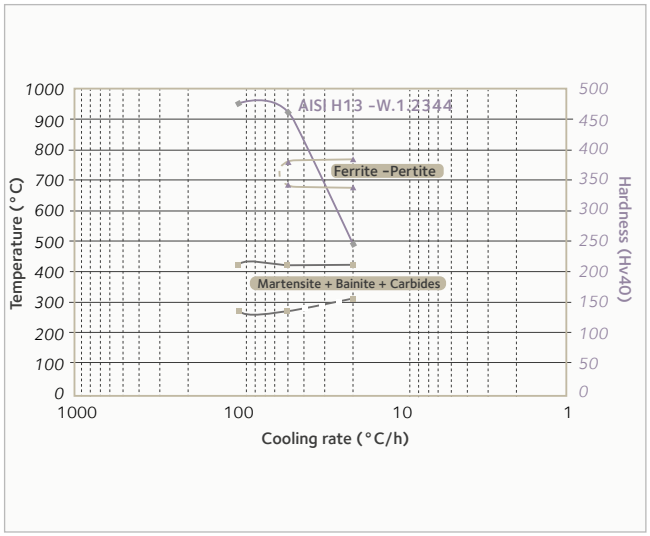
Preheating (before austenitizing)

Heating rate should be limited to 220°C /h (400°F/h), measured in the core of cavity. First preheating has to be done at Ts≈730-780°C (1380°F - 1420°F)

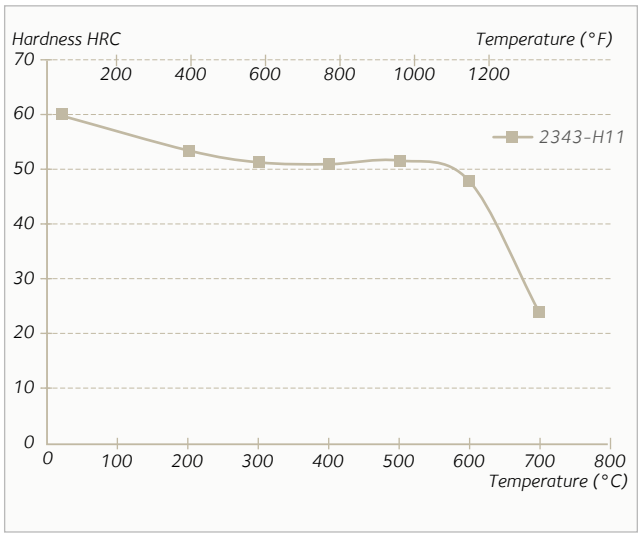
Austenitizing

After second preheating, austenitizing should be rapidly increased up to 1010°C (1850°F) and hold 30 mn after Ts-Tc < 15°C (25°F). In any case, soaking time shall never exceed 90 mn max after Ts reaches 1030°C (1885°F).

CCT Diagram



Tempering curve



Quenching

Quenching shall be performed in oil or pressurized gas. Pressurized gas should be preferred when quenching complex shapes. Fast cooling has to be applied from austenitizing temperature down to 150°C (300°F)
Cooling rate, measured at the surface of the cavity, must be at least 30°C/min (55°F/min) between austenitizing temperature and 530°C (990°F)
To limit stresses, a special attention shall be paid at the temperature difference between surface and core. Especially in the temperature range 400/450°C
(750/840°F), the temperature difference between surface and core shall not exceed 100°C (180°F).
Below 150°C (300°F), cavity should be air cooled to 50/80°C and should then be immediately loaded in a furnace to perform a first tempering.
Martempering bath is possible at 500-550°C to limit distortions.

Tempering

A minimum of 2 tempering should be performed on 2344 immediately after quenching at a temperature depending on required temperature (see tempering curve). The tempering temperature should be hold 2 hours minimum or 30mn per 25 mm of thickness (30mn/inch).
Avoid the brittle range of 430°C-550°C. Temper above 200°C.
After tempering pieces should be air cooled to room temperature.
First temper at 550°C - Second temper between 550°C and 650°C according required final hardness

Dimensional changes during hardening
It's is recommended to leave a machining allowance of 0,2% before heat treatment.

Surface treatments
grade is suitable for nitriding (30µm maximum) at 525 °C and for EDM. After machining by EDM, white layer should be removed by polishing or soft milling - Avoid all sharp angles during roughing

DIMENSIONAL PROGRAM

Thickness	Width
15 - 350 mm	1000 - 2100 mm

YOUR CONTACTS

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