

2344 - 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

According to standards

> JIS SKD6 1

> EURONORM X40CrMoV5.1

> WERKSTOFF W 1.2344

> AISI H13

> AFNOR X40CrMoV5-1 (old Z40CDV5)

Chemical Analysis (% Weight).

	C	S	Si	Cr	Mo	V
Min	0.35	-	0.80	4.80	1.20	0.85
Typical	0.40	0.002	1.05	5.00	1.30	1.00
Max	0.42	-	1.20	5.50	1.50	1.15

Mechanical properties

2344 grade is delivered in annealed condition with a hardness <230HB.

It 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.

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.

Heat treatment

2344-H13 grade 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 (T_s/T_c) should be controlled by thermocouples.

Soft annealing

- Heating at 850°C (1560°F)
- Cool down at 20°C (20°F) 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.

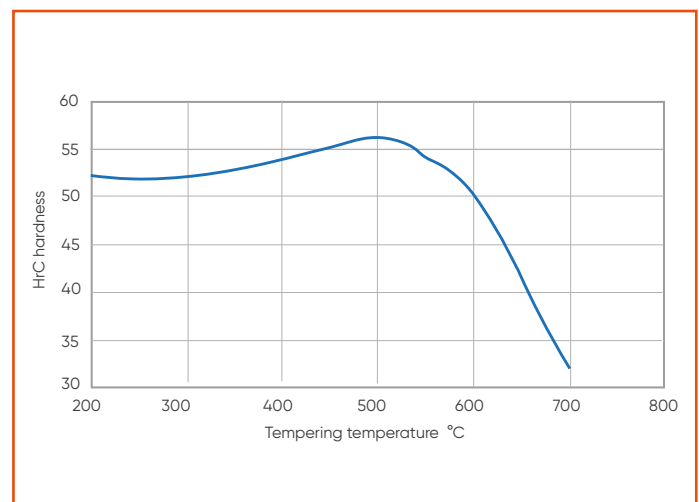
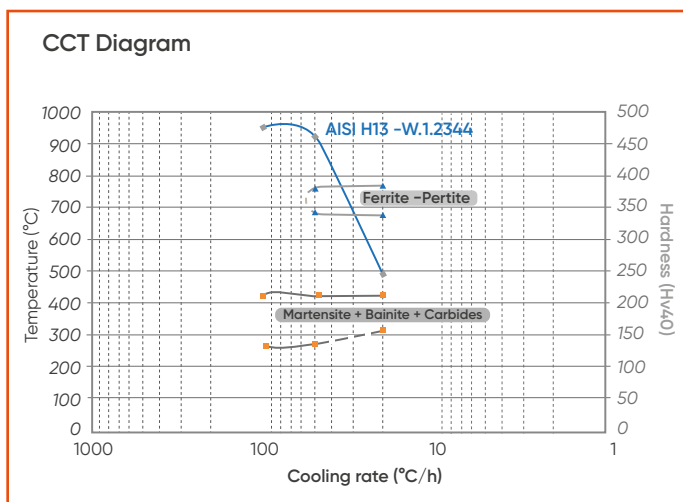
Preheating (before austenitizing)

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 $T_s \approx 730-780°C$ (1380°F - 1420°F).

Austenitizing

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



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 recommended to leave a machining allowance of 0,2% before heat treatment.

Surface treatments

2344 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.

Dimensions

Typical delivery sizes

Thickness	Width
15 - 350 mm	1000 - 2100 mm

Your contact

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Technical data and information are to the best of our knowledge at the time of printing. However, they may be subject to some slight variations due to our ongoing research program on steels. Therefore, we suggest that information be verified at time of enquiry or order. Furthermore, in service, real conditions are specific for each application. The data presented here are only for the purpose of description, and considered as guarantees when written formal approval has been delivered by our company. Further information may be obtained from the address opposite.