

KAL 11- (H11 / W. Nr. 1.2343 / X37CrMoV5-1)



- **KAL 11** is a standard hot work tool steel grade suitable for hot forging dies and die casting dies applications.
- It has good softening resistance, good polishing properties after hardening, good toughness and good dimensional stability during heat treatment.

Applications

- Forging dies
- Die casting dies
- Extrusion tooling
- Hot punches
- Moulds for plastic injection
- Aircraft landing gear

Physical Properties

Property	Metric
Thermal conductivity (W/m K) @ 20°C	25
Coefficient of Thermal Expansion (10 ⁻⁶ / K)	
20-100°C	11.6
20-201°C	11.8
20-302°C	12.4
20-400°C	12.7
Specific Heat J/Kg°C	460

Non Metallic Inclusions (ASTM E45)

Route	A (Max)		B (Max)		C (Max)		D (Max)	
	T	H	T	H	T	H	T	H
VD route	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Equivalent Grades **KAL 11**

Country	USA	Germany/UK/France	Japan
Standard	ASTM A681	DIN EN ISO 4957	JIS G4404
Grades	H11/T20811	1.2343X37CrMoV5-1	SKD6

Chemical Composition (% Wt)

	Element	C	Mn	Si	Cr	V	Mo	P	S
ASTM A681-H11	Min	0.33	0.2	0.80	4.75	0.3	1.10	-	-
	Max	0.43	0.6	1.25	5.5	0.6	1.60	0.03	0.03
EN ISO 4957-X37CrMoV5-1	Min	0.33	0.25	0.80	4.80	0.30	1.10	-	-
	Max	0.41	0.50	1.20	5.50	0.50	1.50	0.030	0.020
JIS G4404- SKD 6	Min	0.32	-	0.8	4.5	0.3	1.2	-	-
	Max	0.42	0.5	1.2	5.5	0.5	1.5	0.03	0.02

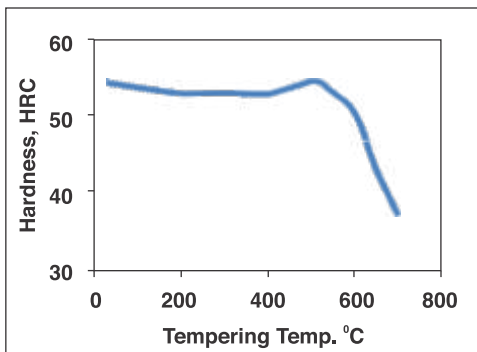
Heat Treatment

H11 grade is supplied in spheroidized annealed condition for easier machining. After 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



Annealing	Heating at 850°C - Cool down at 10°C per hour until 650°C - Air cooling
Stress relieving	After rough machining, stresses in the tool can be released by heating at 650°C during 2 hours followed by air cooling
Preheating	Heating rate should be limited to 160°C /h (400°F/h), Preheating can be done in two stages with first at ~650°C and second at 850°C followed by holding for homogenization of temperature
Austenizing	After second preheating, temperature should be rapidly increased up to 1010°-1030°C and hold 30 minutes
Quenching	Quenching shall be performed in air/oil/pressurized gas.
Tempering	Tempering is carried out on H11 tool steels at temperature ranging from 535 to 645°C to obtain Rockwell C hardness of 38 to 54. Double tempering is preferred.

Tempering curve: Austenized at 1030°C and tempering (Refer below curve)



Machinability

Machinability of H11 is medium to high when compared to water hardening tool steel which is generally has good machinability

Forming

H11 has good ductility and may be formed by conventional means, machining and forging

Forging

H11 steel is forged at 1121°C. For this type of steels, forging below 899°C is not preferable.

Welding

This alloy is readily weldable by conventional methods.

Nitriding

H11 tool steel can be nitrided to give a hard surface case.

Supply Condition

- Sph. Annealed or Hardened and tempered condition or as per customer requirement

- Bars : 20 -750 mm Dia.

- Blocks: 2 m X 1 m X 12 m max (max. Forging wt. 20 MT)