

- Kal13 grade gives an excellent combination of hot strength, wear resistance and toughness.
- Durable mechanical property in thermal cycling.
- Hardness retention at high temp, high resilience.
- Excellent for plastic moulds used at temperature > 300°C and for casting dies operated at temperature of the order of 500°C.
- Good compressive strength for extrusion dies with pressure ~300MPa. With excellent combination of thermal fatigue and toughness and can be used as hot forging dies.

Applications

- Forging Dies • Die casting dies • Cores and inserts • Shot sleeves • Shear blades for hot work
- Piercers & mandrels for hot work • Hot extrusion tooling • All types of dies for hot work involving shock;
- Ultra-high strength structural parts • Plastic moulding dies • Punches,

Physical Properties

Property	Value
Thermal Conductivity (W/m K) @ 25° C	17.6
Coefficient of Thermal Expansion (10 ⁻⁶ K)	
21 -200°C	11.3
21 -536°C	13.5
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 Designations of KAL 13

Country	USA	Germany/UK/France	Japan	ISO
Standard	ASTM A681-08 Alloy Tool Steel	EN ISO 4957:1999 Tool Steel	JIS G4404 Alloy Tool Steel	ISO-4957: 1999 Tool Steel
Grades	H13(T20813)	X40CrMoV5-1/1.2344	SKD61	X40CrMoV5-1

Chemical Composition (% Wt)

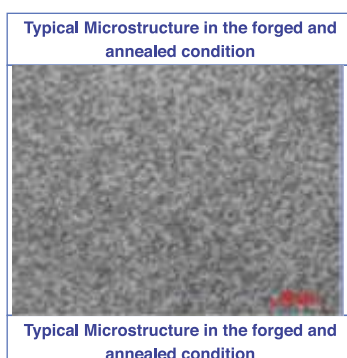
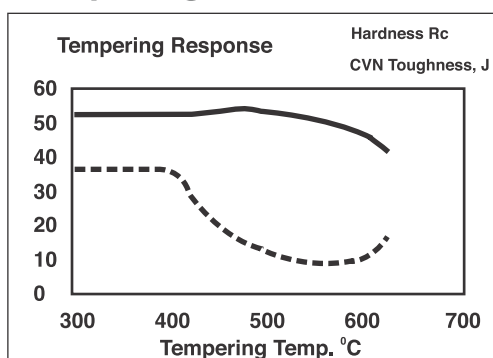
	Element	C	Mn	Si	Cr	V	Mo	P	S
ASTM A681	Min	0.32	0.2	0.8	4.75	0.8	1.10	-	-
	Max	0.45	0.6	1.25	5.5	1.2	1.60	0.03	0.03
EN ISO 4957:1999	Min	0.35	0.25	0.8	4.8	0.85	1.10	-	-
	Max	0.42	0.5	1.2	5.5	1.15	1.50	0.030	0.020
JIS G4404 SKD 61	Min	0.35	0.25	0.8	4.8	0.85	1.2	-	-
	Max	0.42	0.5	1.2	5.5	1.15	1.5	0.03	0.02



Heat Treatment

Preheating	Heat at a rate less than 160°C/h. to 650°C. Equalize. Raise the temperature to 815 to 870°C.
Annealing	Heat at rate of 160°C to a temperature between 850 to 870°C. Hold for 60 min per 25mm thickness for minimum 2 hours. Then furnace cool at the rate of 103°C/h to 550°C. Discharge from furnace and cooling in air. The resultant hardness will be of the order of 235 HB.
Stress relieving	Heat slowly to 550°-676°C, allow equalizing, and then cooling in still air (Stress Relieving).
Austenizing	From preheat temperature rapidly heat to a temperature between 980 to 1030°C. For higher toughness choose 980°C and for higher hardness, wear resistance and thermal fatigue resistance choose 1020°C. Soak for 30 min per inch. Followed by quenching in oil/pressurized gas
Tempering	Temper immediately after quenching in a temperature range of 540 to 640°C. Hold the sample for 60 minutes for every 25 mm section thickness but with a minimum 120 minutes. Temper twice. The second tempering may be carried out at 10°C below first tempering.

Tempering Curve



Machinability

Machinability of H13 is medium to high. It rates as 75% that of the W group water hardening tool steels which are low alloy and of generally good machinability.

Forming

H13 has good ductility and may be formed by conventional means, machining and forging.

Forging

Forge at 1079 °C down to 926 °C. Do not forge below 899 °C

Welding

This alloy is weldable in annealing condition

Nitriding

H13 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. 9 MT)