

Formax

Produktfakta og anvendelsesområder

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General

FORMAX is a low carbon steel which can be supplied in as-hot-rolled or fine-machined condition. FORMAX is characterized by:

- Good machinability
- Easy to flame-cut
- Good mechanical strength
- Can be case hardened
- Good weldability.

Typical analysis %	C 0,18	Si 0,3	Mn 1,4
Standard specification	(W.-Nr. 10050, SS 2172)		
Delivery condition	Hot rolled. Hardness approx. 170 HB		
Colour code	Black		

Applications

- Bolsters
- Punch holders
- Die holders
- Backing plates
- Guide plates
- Support plates
- Jigs
- Fixtures
- Constructional parts.

Properties

TENSILE STRENGTH

Approximate values at room temperature.
Hardness 170 HB.

Tensile strength R _m	N/mm ² ksi	560 80
Yield strength R _{p0,2}	N/mm ² ksi	320 45
Reduction of area Z	%	40
Elongation A ₅	%	20

Heat treatment recommendations

FORMAX is intended for use in the as-delivered condition, i.e. not heat treated.

For applications where the material must be hardened to a higher hardness, the following instructions should be followed;

STRESS RELIEVING

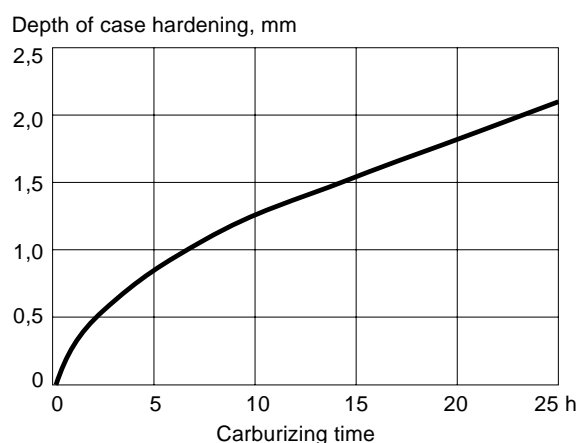
Temperature approx. 550–650°C (1020–1200°F). After rough machining with chip-cutting tools, stress relieving may be advisable to minimize distortion if the tool is to be hardened. Holding time: 2 hours after the entire piece has attained a temperature of approx. 650°C (1200°F). Cool in furnace to approx. 500°C (930°F), followed by cooling in air.

CASE HARDENING

The composition of FORMAX makes it highly suitable for case hardening. Case hardening can be carried out as follows:

Carburizing temperature 850–920°C (1560–1690°F). The time and temperature must be adapted to the required depth of hardening. Quench in salt water from 800–820°C (1470–1510°F).

The following chart shows the rough relationship between the carburizing time and the depth of case at 900°C (1650°F).



TEMPERING

Tempering at 200°C (390°F) gives a surface hardness of approx. 60 HRC.

FLAME HARDENING

FORMAX can be flame/induction hardened to 40 ±3 HRC. Cooling in water. Case depth 1–2 mm. Temper immediately after hardening.

Cutting data recommendations

The cutting data below are to be considered as guiding values which must be adapted to existing local condition.

TURNING

Cutting data parameters	Turning with carbide		Turning with high speed steel Fine turning
	Rough turning	Fine turning	
Cutting speed (v_c) m/min f.p.m.	200–300 665–1000	300–350 1000–1165	50 165
Feed (f) mm/r i.p.r.	0,3–0,6 0,01–0,024	–0,3 –0,01	–0,3 –0,01
Depth of cut (a_p) mm inch	2–6 0,08–0,24	–2 –0,08	–2 –0,08
Carbide designation ISO	P20–P30 Coated carbide	P10 Coated carbide or cermet	—

MILLING

Face- and square shoulder milling

Cutting data parameters	Milling with carbide		Milling with high speed steel Fine milling
	Rough milling	Fine milling	
Cutting speed (v_c) m/min f.p.m.	200–275 665–915	275–375 915–1250	45 150
Feed (f_z) mm/tooth inch/tooth	0,2–0,4 0,008–0,016	0,1–0,2 0,004–0,008	0,1 0,004
Depth of cut (a_p) mm inch	2–5 0,08–0,20	–2 –0,08	–2 –0,08
Carbide designation ISO	P20–P40 Coated carbide	P10–P20 Coated carbide or cermet	—

End milling

Cutting data parameters	Type of milling		
	Solid carbide	Carbide indexable insert	High speed steel
Cutting speed (v_c) m/min f.p.m.	80 265	150–200 500–665	45 ¹⁾ 150 ¹⁾
Feed (f_z) mm/tooth inch/tooth	0,03–0,20 ²⁾ 0,001–0,008 ²⁾	0,08–0,20 ²⁾ 0,003–0,008 ²⁾	0,05–0,35 ²⁾ 0,002–0,014 ²⁾
Carbide designation ISO	K20	P20–P40	—

¹⁾ For coated HSS end mill $v_c \sim 60$ m/min. (200 f.p.m.).

²⁾ Depending on radial depth of cut and cutter diameter.

DRILLING

High speed steel twist drill

Drill diameter		Cutting speed (v_c)		Feed (f)	
mm	inch	m/min	f.p.m.	mm/r	i.p.r.
– 5	–3/16	25*	100*	0,08–0,20	0,003–0,008
5–10	3/16–3/8	25*	100*	0,20–0,30	0,008–0,012
10–15	3/8–5/8	25*	100*	0,30–0,35	0,012–0,014
15–20	5/8–3/4	25*	100*	0,35–0,40	0,014–0,016

¹⁾ For coated HSS drill $v_c \sim 40$ m/min. (135 f.p.m.).

Carbide drill

Cutting data parameters	Type of drill		
	Indexable insert	Solid carbide	Brazed carbide ¹⁾
Cutting speed (v_c) m/min f.p.m.	200–250 665–830	90 300	80 265
Feed (f) mm/r i.p.r.	0,05–0,25 ²⁾ 0,002–0,01 ²⁾	0,10–0,25 ²⁾ 0,004–0,01 ²⁾	0,15–0,25 ²⁾ 0,006–0,01 ²⁾

¹⁾ Drill with internal cooling channels and brazed carbide tip.

²⁾ Depending on drill diameter.

GRINDING

A general grinding wheel recommendation is given below. More information can be found in the Uddeholm publication “Grinding of Tool Steel”.

Wheel recommendation

Type of grinding	Soft annealed condition	Hardened condition
Face grinding straight wheel	A 46 HV	A 46 GV
Face grinding segments	A 24 GV	A 36 GV
Cylindrical grinding	A 46 LV	A 60 JV
Internal grinding	A 46 JV	A 60 IV
Profile grinding	A 100 LV	A 120 JV

Flame-cutting

FORMAX is suitable for flame-cutting. Normally, no tempering of the cutting edge is needed before machining, since the machinability is not affected.

Welding

FORMAX has extremely good weldability and normally it needs no heat treatment in connection with the welding operation. However, if there is a risk of an abnormally high cooling rate, holding at 100–200°C (210–390°F) is recommended. Stress relieving, if any, is carried out at 550–600°C (1020–1200°F).

The low carbon content reduces hardness variations in the material after welding to a minimum.

Further information

Please, contact your local Uddeholm office for further information on the selection, heat treatment, application and availability of Uddeholm tool steels.



Gas cutting of FORMAX can be made by Hagfors Mekaniska Verkstad, (HMV), which is a company owned by Uddeholm Tooling.