

FORMAX

Holder steel

COLD WORK

PLASTIC MOULDING

HOT WORK

HIGH PERFORMANCE STEEL



This information is based on our present state of knowledge and is intended to provide general notes on our products and their uses. It should not therefore be construed as a warranty of specific properties of the products described or a warranty for fitness for a particular purpose.

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.

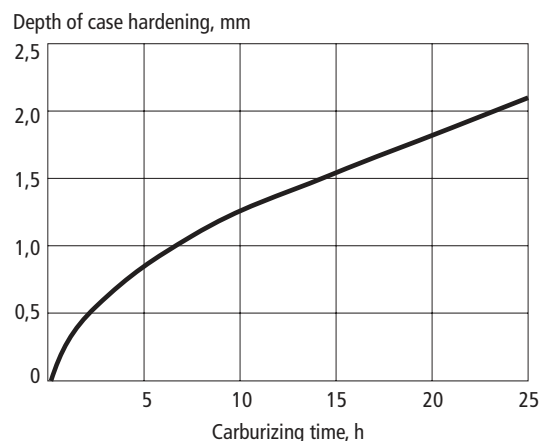
CASE HARDENING

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.	210–260 690–850	260–320 850–1050	28–32 90–105
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	2–4 0,08–0,16	0,5–2 0,2–0,08	0,5–3 0,2–0,1
Carbide designation ISO	P20–P30 Coated carbide	P10 Coated carbide or cermet	—

MILLING

Face- and square shoulder milling

Cutting data parameters	Milling with carbide	
	Rough milling	Fine milling
Cutting speed (v_c) m/min f.p.m.	220–320 720–1050	320–370 1050–1210
Feed (f_z) mm/tooth inch/tooth	0,2–0,4 0,008–0,016	0,1–0,2 0,004–0,008
Depth of cut (a_p) mm inch	2–4 0,08–0,16	0,5–2 –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.	100–130 330–425	210–250 690–820	40–45 ¹⁾ 130–150 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 $v_c = 60–65$ m/min. (200–215 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	22–25*	70–100*	0,08–0,20	0,003–0,008
5–10	3/16–3/8	22–25*	70–100*	0,20–0,30	0,008–0,012
10–15	3/8–5/8	22–25*	70–100*	0,30–0,35	0,012–0,014
15–20	5/8–3/4	22–25*	70–100*	0,35–0,40	0,014–0,016

* For coated HSS drill $v_c = 38–40$ m/min. (125–130 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.	250–270 820–885	130–160 425–525	90–110 295–360
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 HV
Face grinding segments	A 24 GV	A 36 GV
Cylindrical grinding	A 46 LV	A 60 KV
Internal grinding	A 46 JV	A 60 JV
Profile grinding	A 100 KV	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 Uddeholm Machining, which is a company owned by Uddeholm Tooling.

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