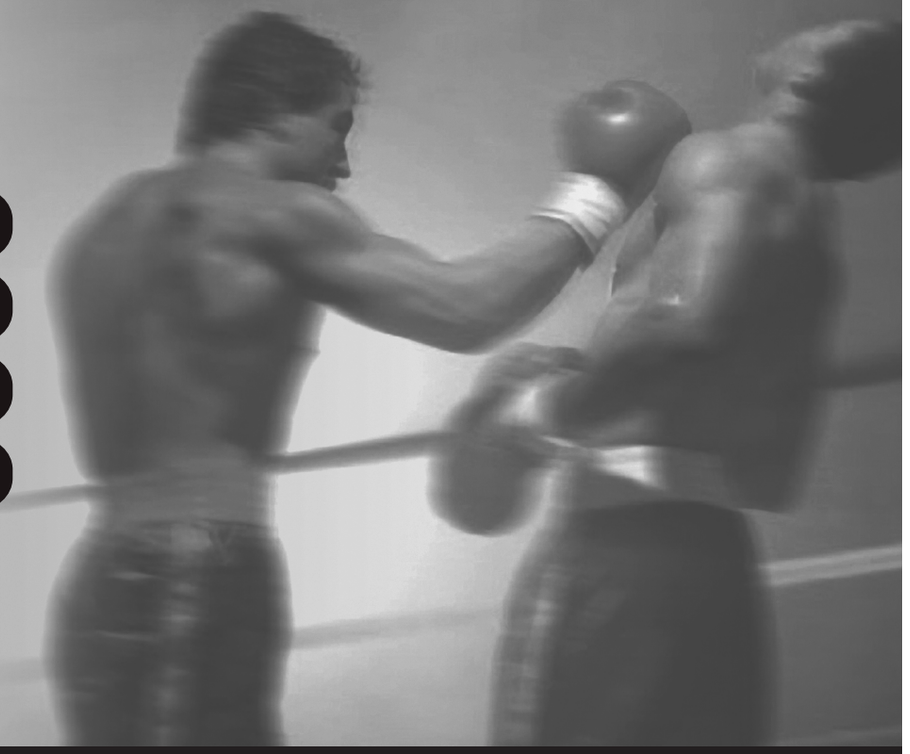
TOOLOX® 33

PREHARDENED TOOL STEEL

NOMINAL 33 HRC

A quenched and tempered tool steel designed to have low residual stresses and extremely good machinability.

KNOCK OUT THE COMPETITION



- PLASTIC MOLDS
- RUBBER MOLDS
- BENDING TOOLS
- MACHINE COMPONENTS

Features

- Especially suited for plastic molds and rubber molds, having excellent polishing and photoetching ability.
- Supplied in plate thickness 3/4" - 5 1/8".
- Hardness 30-35 HRC.

INTERNATIONAL MOLD STEEL, INC.

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Specification

Hardness *(Guaranteed values)*	HBW 280-330 (Approx. 30-35 HRC)
Impact properties *(Guaranteed values)*	Testing temperature ˚C 20-400˚C Impact energy, Charpy-V, longitudinal direction; min. ft. lbs. < 74-133
Tensile Properties *(Calculated values)*	Tensile strength approx. 130 - 142,000 PSI
Milling *(Calculated values)*	At cutting speed of 300 m/mm, feed 0.15 mm, 10 min. effective cutting time using a Sandvik Coromil 200 and inserts GC 1025, we guarantee max 0.3 mm edge wear.
Ultrasonic insp. *(Guaranteed values)*	Discontinuities giving echoes at least equivalent in amplitude to flat bottom hole 1.5 mm shall be reported according to SSAB Standard V6.
Etching properties *(Guaranteed values)*	TOOLOX 33 fulfills the demands according to NADCA 207-97.
Dimensions *(Preliminary)*	TOOLOX 33 is supplied in plate thickness $^{3}/_{4}$" - 5 $^{1}/_{8}$".
Delivery condition	Quenched and tempered at min. 590˚C
Heat treatment	TOOLOX 33 is not intended for further heat treatment If TOOLOX 33 is subjected to any heat treatment above 590˚C, after delivery from SSAB Oxelösund AB, no guarantees concerning the properties of the matrial will be given.
Testing	Testing in accordance with EN 10 137-1, 10 137-2 and EN ISO 6506-1. Hardness measured on a milled surface, 0,5-2 mm below surface.
Tolerances	According to EN 10 029 - Thickness tolerances to Class C. - Flatness tolerances to Class N, steeltype L.
Surface finish	According to EN 10 163-2 - Surface requirements to Class B. - Repair conditions to Subclass 3.

Usage

Machine Components

Plastic Molding

Press Forming

TOOLOX 33 is a new quenched and tempered steel, designed to have low residual stresses. It is characterized by its extremely good machinability, in combination with a hardness of 30 HRC. The steel is especially suited for plastic moulds, having excellent polishing and photoetching ability. Other applications are for example rubber moulds, bending tools, recipient sleeves, etc.

Technical Information (Typical Values)

Chemical Composition *(typical values)*

C	0.25%
Si	0.60%
Mn	0.90%
P, max	100 ppm
S, max	40 ppm
Cr	1.20%
N	0.70%
Mo	0.40%
V	0.125%
B	20 ppm
CEV (nw)	0.81
CET	0.48

Mechanical Properties *(converted from metric)*

	+20˚C	+200˚C	+300˚C	+400˚C
Tensile strength [PSI]	142,137	130,534		
Yield strength [PSI]	123,282	116,030		
Elongation, A_5 [%]	16	12		
Compressive Yield				
Strength	116,030 PSI	108,778 PSI	100,526 PSI	85,572 PSI
Impact energy, [FT LBS]	74	125	133	133
Hardness, [HRC]	30			

Physical Properties *(typical values)*

	+20˚C	+200˚C	+400˚C	+600˚C
Thermal Conductivity BTU/FT Hold °F	20	20	17	13
Thermal Expansion Inches/Inch Hold °F	7.27	7.27		

Compressive Strength *(typical values)*

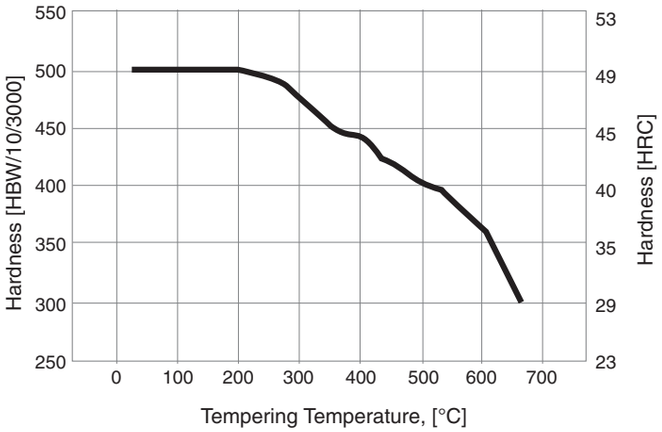
Yield strength	[PSI]
at + 20˚C	127,721
at + 200˚C	108,853

Inclusions *(typical values)*

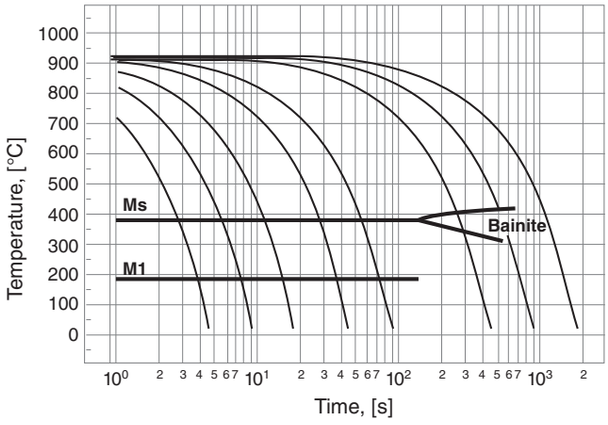
Inclusion size (equiv. diam)	6µm
Area fraction	0.015%
Aspect ratio	1.2

Tempering curve

No further heat treatment about 590°C should be empoloyed



Continuous time-temperature curve for quenching from 925°C. *TOOLOX 33 should not be requenched.*



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Machining

TOOLOX 33 can be machined in conventional, stable machines. It is important to use sharp tools and to avoid vibrations. Use the recommendations below as guidelines and as the start-point for evaluating your own best practice.

MILLING

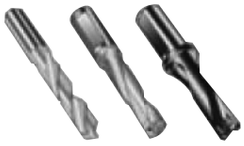
Cemented carbide cutter ISO class P 20
Always use a positive cutting angle
V_c = 250-225 m/min
Feed (f) = 0.10-0.20 mm/tooth

Speed (rpm) $n = \frac{V_c \times 100}{\pi \times D}$

Roughing
Use milling cutters with circular inserts.
Finishing
Use milling cutters with a 45° setting angle.

DRILLING

Carbide
Cutting speed V_c = 40-50 m/min
f = 0.10-0.18 mm/revolution
Feed (f) and speed (rpm) (n) are dependent on the drill bit diameter (D).
Use coolant.



High speed steel HSS-Co
Cutting speed V_c = 15 m/min

Speed (rpm) $n = \frac{V_c \times 100}{\pi \times D}$

Use coolant

D (mm)	*Feed, f (mm/revolution)*
5	0.10
10	0.10
15	0.16
20	0.23
25	0.30
30	0.35

THREADING

Thread milling
Cutting speed V_c = 30 m/min
Feed (f) = 0.03 mm/tooth

Thread HSS-Co
Cutting speed
V_c = 8 m/min

Dimension	*Speed (rpm)*
M6	?
M8	?
M10	255
M12	210
M16	160
M20	125

GAS CUTTING / WELDING

Recommended preheat temperature when gas cutting and welding **Minimum 175˚C**

Recommended stress relief annealing (after slow cooling to room temperature) after gas cutting and welding **580˚C**

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