

# TOOLOX<sup>33</sup>

PREHARDENED TOOL STEEL

## NOMINAL 33 HRC

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

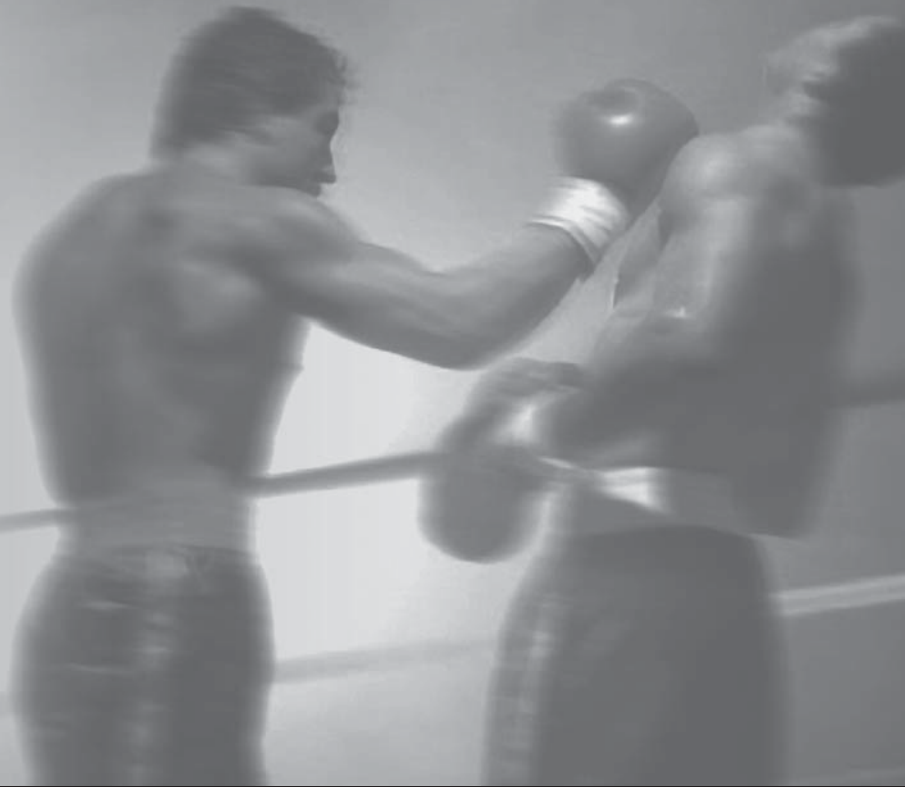
**PLASTIC MOLDS**

**RUBBER MOLDS**

**BENDING TOOLS**

**MACHINE COMPONENTS**

# KNOCK OUT



## *Features*

Especially suited for plastic molds and rubber molds, having excellent polishing and photoetching ability.

Supplied in plate thickness  $\frac{3}{4}$ " -  $5 \frac{1}{8}$ ".

Hardness 30-35 HRC.

*TOOLOX is the registered trademark for tool steels produced by SSAB Oxelösund AB.*

**TITUS**  
STEEL

# Specification

<b>Hardness</b> (Guaranteed values)	HBW 280-330 (Approx. 30-35 HRC)
<b>Impact properties</b> (Guaranteed values)	Testing temperature °C 20-400°C Impact energy, Charpy-V, longitudinal direction; min. ft. lbs. < 74-133
<b>Tensile Properties</b> (Calculated values)	Tensile strength approx. 130 - 142,000 PSI
<b>Milling</b> (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.
<b>Ultrasonic insp.</b> (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.
<b>Etching properties</b> (Guaranteed values)	TOOLOX 33 fulfills the demands according to NADCA 207-97.
<b>Dimensions</b> (Preliminary)	TOOLOX 33 is supplied in plate thickness $3/4''$ - $5 1/8''$ .
<b>Delivery condition</b>	Quenched and tempered at min. 590°C
<b>Heat treatment</b>	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 material will be given.
<b>Testing</b>	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.
<b>Tolerances</b>	According to EN 10 029 - Thickness tolerances to Class C. - Flatness tolerances to Class N, steeltype L.
<b>Surface finish</b>	According to EN 10 163-2 - Surface requirements to Class B. - Repair conditions to Subclass 3.

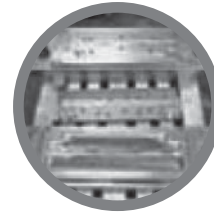
# Usage



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 <sub>5</sub> [%]	16	12		
Compressive Yield Strength				
Strength	116,030 PSI	108,778 PSI	100,526 PSI	85,572 PSI
Impact energy, [FT LBS]	74	125	133	133
Hardness, [HRC]	30			

### Compressive Strength (typical values)

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

### Inclusions (typical values)

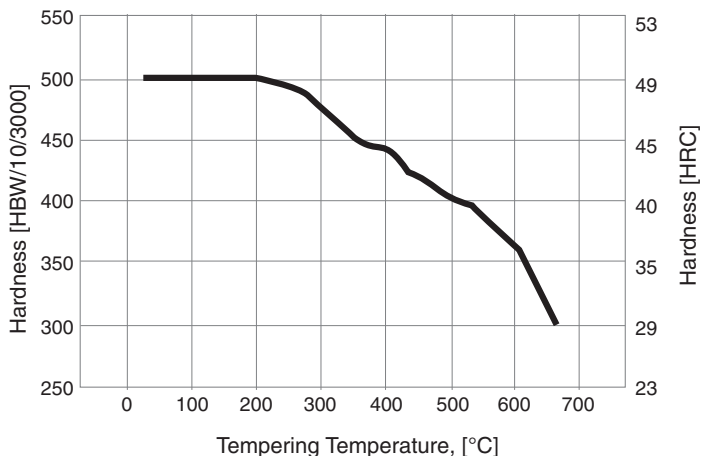
Inclusion size (equiv. diam)	6µm
Area fraction	0.015%
Aspect ratio	1.2

### Physical Properties (typical values)

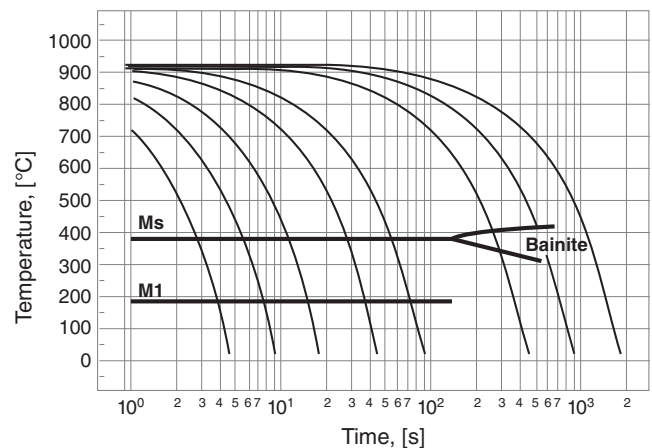
	+20 °C	+200 °C	+400 °C	+600 °C
Thermal Conductivity BTU/FT Hold °F	20	20	17	13
Thermal Expansion Inches/Inch Hold °F	7.27	7.27		

### Tempering curve

No further heat treatment about 590°C should be employed



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



# 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

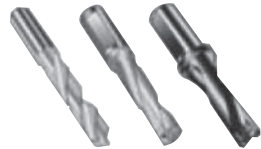
Cutting speed  $V_c = 40-50$  m/min

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

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

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