

# TOOLOX<sup>44</sup>

45 HRC WITH ESR PROPERTIES

## NOMINAL 45 HRC

A new quenched and tempered steel designed to have high impact and low residual stresses and therefore good dimensional stability.

**MACHINE COMPONENTS**

**WEAR COMPONENTS**

**PLASTIC MOLDS**

**RUBBER MOLDS**

**PRESS FORMING**

**DIE CAST DIES**

**FORGING DIES**

**COREBOXES**

**PERMANENT MOLDS**

# KNOCK OUT THE COMPETITION



## *Features*

- Despite hardness of Nominal 45 HRC, this new steel is easy to machine.
- Particularly suitable for manufacturing plastic molds because it can be polished and etched with very good results.
- Great for guide rails, bending tools, etc. when stability materials are required.
- Supplied as plate in thickness between .200" - 5 1/8".

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

**INTERNATIONAL MOLD STEEL, INC.**

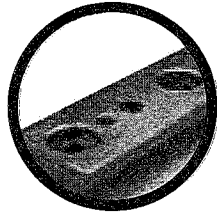


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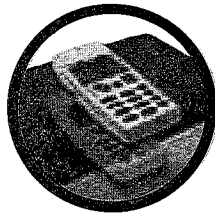
# Specification

<b>Hardness</b>	Hardness range 41 - 47 HRC		
<b>Impact toughness</b>	<table> <tr> <td>Test temperature °F 68</td> <td>Impact energy, Charpy-V-test for plate, direction; Guaranteed minimum Ft. lbs. 14</td> </tr> </table>	Test temperature °F 68	Impact energy, Charpy-V-test for plate, direction; Guaranteed minimum Ft. lbs. 14
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<b>Milling</b>	At cutting speed of 140m/mm, feed 0.15 mm and 10min effective machining time using Sandvik Coromil 200 and inserts GC 1025, we guarantee maximum edge wear of 0.3 mm		
<b>Etching</b>	TOOLOX 44 fulfills the etching requirements of NADCA 207-2003		
<b>Dimensions</b>	TOOLOX 44 is supplied as plate in thickness between .200" - 5 1/8"		
<b>Heat treatment</b>	TOOLOX 44 is not intended for further heat treatments. If TOOLOX 44 is heated above 590°C, no guarantees for the properties of the steel can be given		
<b>Nitriding/coating</b>	Below tempering temperature <590°C / 1094°F		

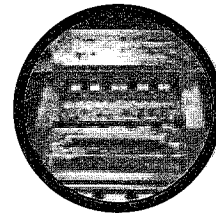
# Usage



Machine Components



Plastic Molding



Press Forming

TOOLOX 44 is a new quenched and tempered steel designed to have high impact resistance and low residual stresses and therefore good dimensional stability. Despite a hardness of 45 HRC, the new steel is easily machined. TOOLOX 44 is particularly suitable for manufacturing plastic molds because it can be polished and etched with very good results. Fields of application: plastic molds, rubber molds, wear components and machine components, such as guide rails, bending tools, etc., where stability materials are required.

## Technical Information (Typical Values)

### Chemical Composition (typical values)

C	0.31%
Si	0.60%
Mn	0.90%
S, max	40 ppm
Cr	1.35%
Ni	0.70%
Mo	0.80%
V	0.145%

### Mechanical Properties (typical values)

	+20°C	+200°C
Tensile strength, PSI	210,300	200,150
Yield strength, PSI	188,500	174,045
Elongation, A <sub>5</sub> [%]	13	10
Impact Toughness, Typical	22 ft. lbs.	
Hardness, [HRC]	45	

### Compressive Strength (typical values)

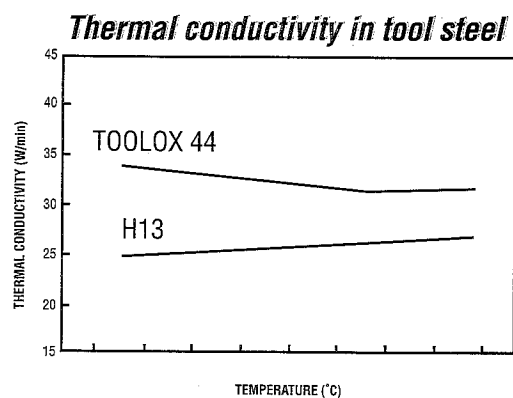
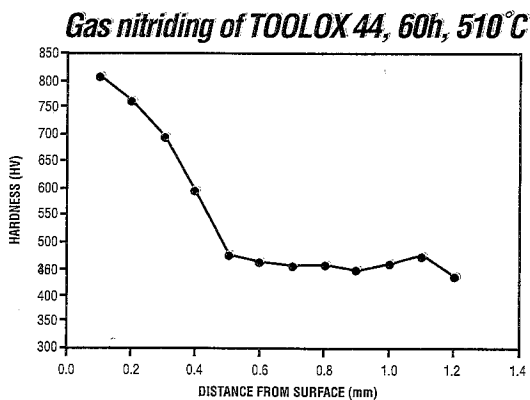
Yield strength, PSI	PSI
at + 20°C	181,300
at + 200°C	165,340
at + 300°C	162,400
at + 400°C	150,840

### Physical Properties (typical values)

Thermal expansion coefficient	Inch/inch F
68°F → 750°F	7.5

### Inclusions (typical values)

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



# Machining

TOOLOX 44 can be machined on conventional machines. It is important that sharp tools are used with a positive cutting angle and that vibration is avoided. Use the following recommendations as guidelines and the starting point for your own evaluation of best practice.

## MILLING

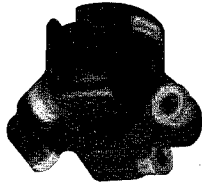
### Cemented carbide cutter ISO class P 20

Always use a positive cutting angle

$V_c = 100-150$  m/min

Feed (f) = 0.10-0.15 mm/tooth

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

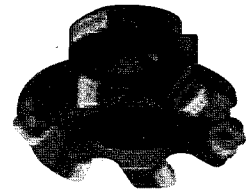


### Roughing

Use milling cutters with circular inserts.

### Finishing

Use milling cutters with a 45° setting angle.



## DRILLING

### Carbide

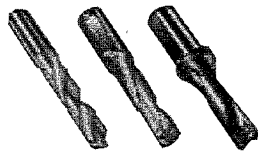
Cutting speed  $V_c = 30-40$  m/min

f = 0.10-0.15 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  $V_c = 6-8$  m/min

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

Use coolant



D (mm)	Feed, f (mm/revolution)
5	0.05
10	0.09
15	0.15
20	0.20
25	0.25
30	0.30

## THREADING

### Thread milling

Cutting speed  $V_c = 30$  m/min

Feed (f) = 0.03 mm/tooth



### Thread HSS-Co

Cutting speed

$V_c = 2.5-4$  m/min



Dimension	Speed (rpm)
M6	160
M8	120
M10	95
M12	80
M16	60
M20	50

## GAS CUTTING/WELDING

Recommended preheat temperature when gas cutting and welding **Minimum 250°C**

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



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# Technical information

## TOOLOX44



### Usage

TOOLOX 44 is a new steel delivered quenched and tempered with high impact toughness and very low residual stresses to get good dimensional stability. Despite its hardness of 45 HRC, TOOLOX 44 is easily machined.

TOOLOX 44 has high strength at elevated temperature and is suitable for dies and tools such as plastic, rubber, die casting, bending and sheet forming tools. TOOLOX 44 is also well suited as machine components such as wear parts, guide rails, hot applications.

With proper surface treatment, the service life of the tool/component can be prolonged.

### Typical values

Chemical composition	
C	0.32%
Si	0.6-1.1%
Mn	0.8%
P	max 0.010%
S	max 0.003%
Cr	1.35%
Mo	0.80%
V	0.14%
Ni	max 1%
CE <sub>IIW</sub>	0.92-0.96
CET	0.55-0.57

Mechanical properties					
	+20°C	+200°C	+300°C	+400°C	+500°C
Tensile strength, $R_m$ [MPa]	1450	1380			
Yield strength, $R_{p0.2}$ [MPa]	1300	1200			
Elongation, $A_5$ [%]	13	10			
Compressive yield strength, $R_{c0.2}$ [MPa]	1250	1120	1120	1060	930
-after 170 h soaking time				1060	910
Impact toughness [J]	30	60	80	80	
Hardness, [HBW]	450				
Hardness, [HRC]	45				

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

Physical properties				
	+20°C	+200°C	+400°C	+600°C
Heat conductivity [W/m·K]	28	29	29	21
Thermal expansion coefficient [10 <sup>-6</sup> /K]	13.5	13.5	13.5	

### Surface technology

