

# TOOLOX

## READY TO USE ENGINEERING & TOOL STEEL

### TYPICAL VALUES

<b>Toolox 33 - Mechanical Properties</b>	<b>+20°C</b>	<b>+200°C</b>	<b>+300°C</b>	<b>+400°C</b>	<b>+500°C</b>
Hardness (HBW)	300				
Hardness (HRC)	~29				
Yield strength R <sub>p0.2</sub> (MPa)	850	690	680	590	560
Tensile strength R <sub>m</sub> (MPa)	980	900			
Elongation, A5, (%)	16	12			
Impact toughness, Charpy-V (J)	100	170	180	180	

<b>Toolox 40 - Mechanical Properties</b>	<b>+20°C</b>	<b>+200°C</b>	<b>+300°C</b>	<b>+400°C</b>	<b>+500°C</b>
Hardness (HBW)	400				
Hardness (HRC)	~40				
Yield strength Rp0.2 (MPa)	1150	1010	990	900	780
Tensile strength Rm (MPa)	1260	1170	1160	1060	900
Elongation, A5, (%)	14	14	14	15	16
Impact toughness, Charpy-V (J)	38				

<b>Toolox 44 - Mechanical Properties</b>	<b>+20°C</b>	<b>+200°C</b>	<b>+300°C</b>	<b>+400°C</b>	<b>+500°C</b>
Hardness (HBW)	450				
Hardness (HRC)	~45				
Yield strength Rp0.2 (MPa)	1300	1150	1120	1060	930
Tensile strength Rm (MPa)	1450	1380			
Elongation, A5, (%)	13	10			
Impact toughness, Charpy-V (J)	30	60	80	80	

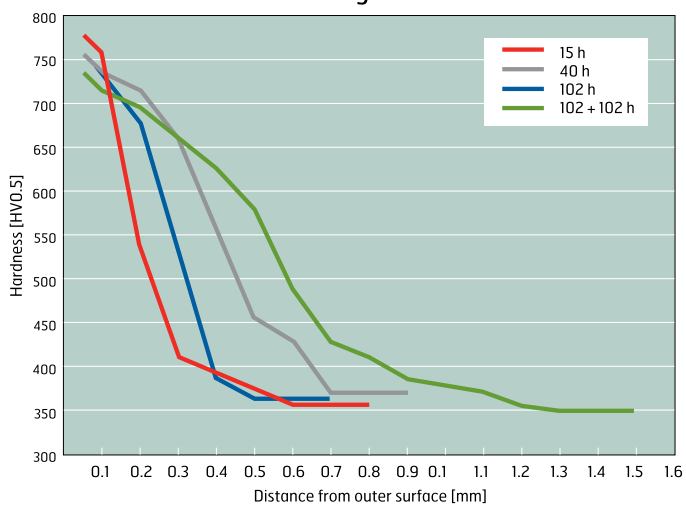
<b>Physical Properties</b>	<b>+20°C</b>		<b>+200°C</b>		<b>+400°C</b>	
	<b>Toolox 33</b>	<b>Toolox 44</b>	<b>Toolox 33</b>	<b>Toolox 44</b>	<b>Toolox 33</b>	<b>Toolox 44</b>
Heat conductivity (W/m*K)	35	34	35	32	30	31
Thermal expansion coefficient (10 <sup>-6</sup> /K)	13.1	13.5	13.1	13.5	13.1	13.5

<b>Inclusions</b>			
	<b>Toolox 33</b>	<b>Toolox 40</b>	<b>Toolox 44</b>
Inclusion size (equiv. diam.)	6 micron	6 micron	6 micron
Area fraction	0.015%	0.015%	0.015%
Aspect Ratio	1.2	1.2	1.2

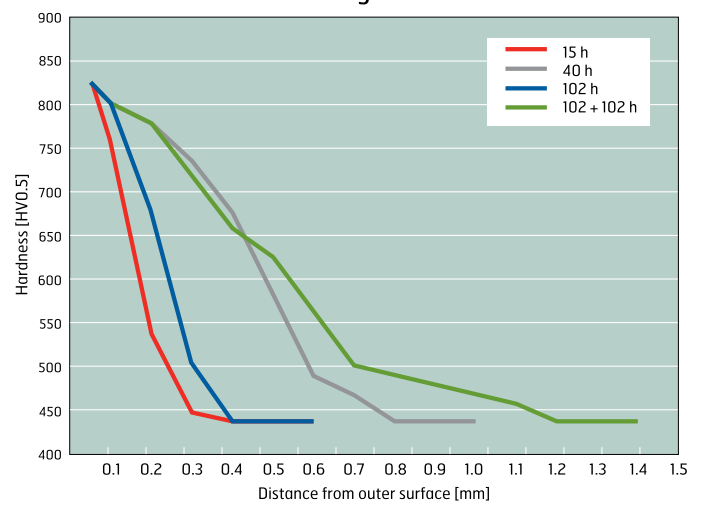
Chemical Composition	Toolox 33	Toolox 40	Toolox 44
C	0.22-0.24%	0.28%	0.32%
Si	0.6-1.1%	1.1%	0.6-1.1%
Mn	0.8%	0.6%	0.8%
P	Max 0.010%	Max 0.010%	Max 0.010%
S	Max 0.002%	Max 0.002%	Max 0.002%
Cr	1.0-1.2%	1.22%	1.35%
Mo	0.30%	0.5%	0.80%
V	0.10-0.11%	0.12%	0.14%
Ni	Max 1.0%	Max 1.0%	Max 1.0%
CEIIW	0.62-0.71	0.77-0.81	0.94-0.98
CET	0.40-0.44	0.45-0.50	0.55-0.57

## SURFACE TECHNOLOGY

Gas nitriding of Toolox 33



Gas nitriding of Toolox 44



## HARD & TOUGH

