

TOOLOX 33, 40 AND 44

ENGINEERING & TOOL STEEL

TYPICAL VALUES

| Toolox 33 - Mechanical Properties | +20°C | +200°C | +300°C | +400°C | +500°C |
|-----------------------------------|-------|--------|--------|--------|--------|
| Hardness (HBW) | 300 | | | | |
| Hardness (HRC) | ~29 | | | | |
| Yield strength $R_{p0.2}$ (MPa) | 850 | 690 | 680 | 590 | 560 |
| Tensile strength R_m (MPa) | 980 | 900 | | | |
| Elongation, A5, (%) | 16 | 12 | | | |
| Impact toughness, Charpy-V (J) | 100 | 170 | 180 | 180 | |

| Toolox 40 - Mechanical Properties | +20°C | +200°C | +300°C | +400°C | +500°C |
|-----------------------------------|-------|--------|--------|--------|--------|
| Hardness (HBW) | 400 | | | | |
| Hardness (HRC) | ~40 | | | | |
| Yield strength $R_{p0.2}$ (MPa) | 1150 | 1010 | 990 | 900 | 780 |
| Tensile strength R_m (MPa) | 1260 | 1170 | 1160 | 1060 | 900 |
| Elongation, A5, (%) | 14 | 14 | 14 | 15 | 16 |
| Impact toughness, Charpy-V (J) | 38 | | | | |

| Toolox 44 - Mechanical Properties | +20°C | +200°C | +300°C | +400°C | +500°C |
|-----------------------------------|-------|--------|--------|--------|--------|
| Hardness (HBW) | 450 | | | | |
| Hardness (HRC) | ~45 | | | | |
| Yield strength $R_{p0.2}$ (MPa) | 1300 | 1150 | 1120 | 1060 | 930 |
| Tensile strength R_m (MPa) | 1450 | 1380 | | | |
| Elongation, A5, (%) | 13 | 10 | | | |
| Impact toughness, Charpy-V (J) | 30 | 60 | 80 | 80 | |

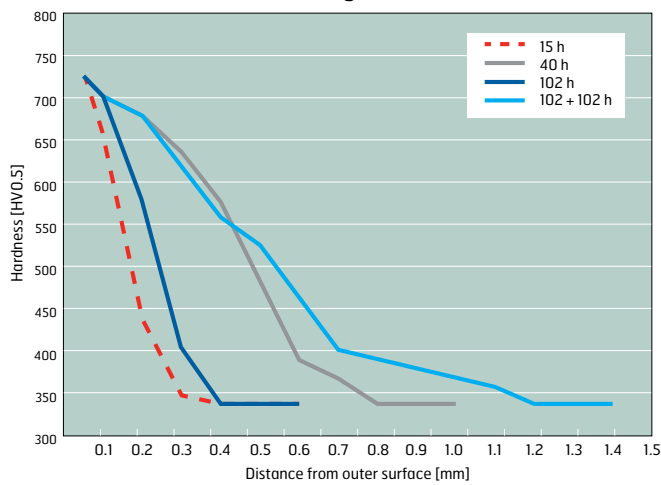
| Physical Properties | +20°C | | +200°C | | +400°C | |
|---|-----------|-----------|-----------|-----------|-----------|-----------|
| | Toolox 33 | Toolox 44 | Toolox 33 | Toolox 44 | Toolox 33 | Toolox 44 |
| Heat conductivity (W/m*K) | 35 | 34 | 35 | 32 | 30 | 31 |
| Thermal expansion coefficient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

| Inclusions | | | |
|-------------------------------|-----------|-----------|-----------|
| | Toolox 33 | Toolox 40 | Toolox 44 |
| 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 |

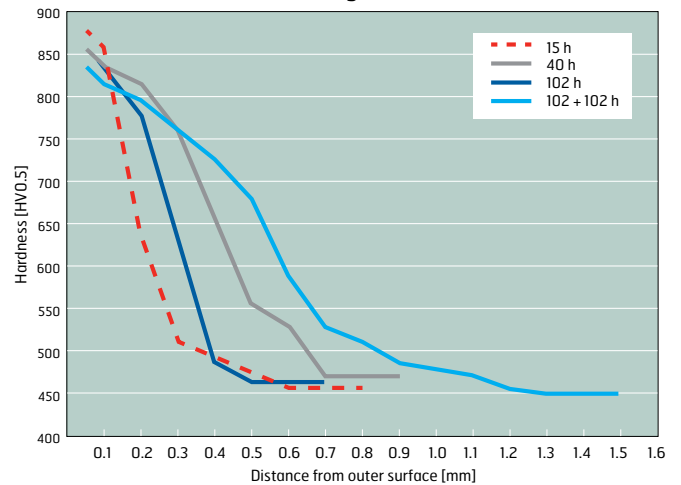
| Chemical composition | Toolox 33 | Toolox 40 | Toolox 44 |
|----------------------|------------|------------|------------|
| C | 0.22-0.24% | 0.28% | 0.32% |
| Si | 0.6-1.1% | 1.1% | 0.6-1.1% |
| Mn | 0.8% | 0.6% | 0.8% |
| P | Max 0.010% | Max 0.010% | Max 0.010% |
| S | Max 0.002% | Max 0.002% | 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

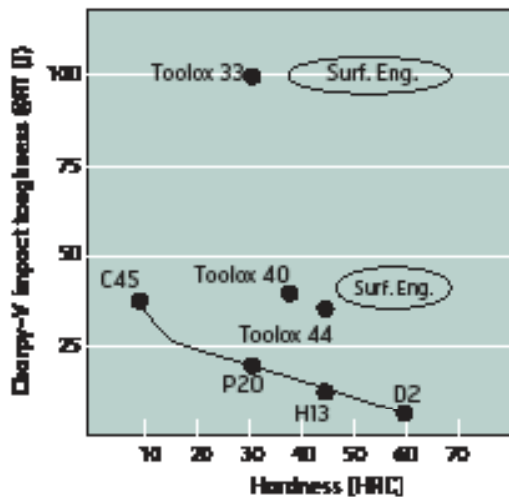
Gas nitriding of Toolox 33



Gas nitriding of Toolox 44



HARD & TOUGH



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