

SSAB



*A stronger,
lighter and more
sustainable world*

Toolox

High Temperature Wear Resistance

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Toolox 44 – High Temperatures

When steel is exposed to heat, it loses its hardness and also its resistance to wear. For many years, Hardox has been the solution for all wear situations and has become almost synonymous with wear plate as a concept. What if we could offer you a Hardox that endures heat?

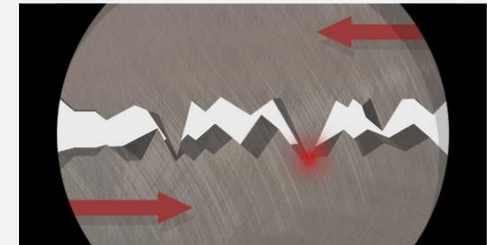
In our wide product portfolio there is Toolox – a steel that serves as a tool for molds and parts subjected to extreme stress and heat. The secret behind Toolox is a unique chemical composition that allows it to retain its properties throughout its tough life. At 500 °C, it retains about 80% of its original hardness . In addition to this, the material is “dead” – it does not hold any inner stresses and is therefore a dream come true in the workshop.

Factors

- Elevated working temperature

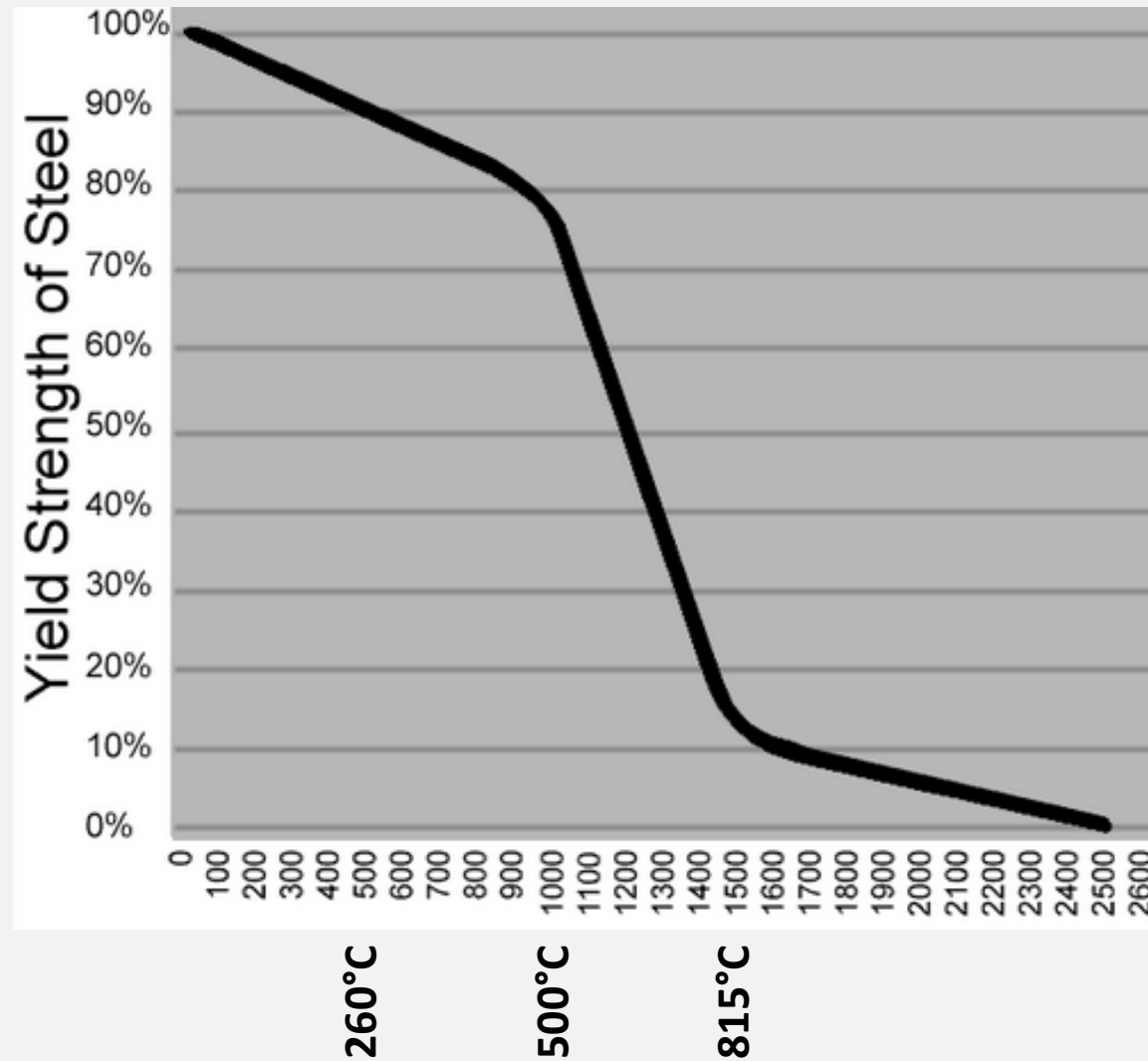


- Friction heat



$$Q = F_N \mu v$$

Temperature x YS



High Temperature Wear – Hardox x Toolox

HARDOX[®]
WEAR PLATE

Hardness drops over
200-250°C

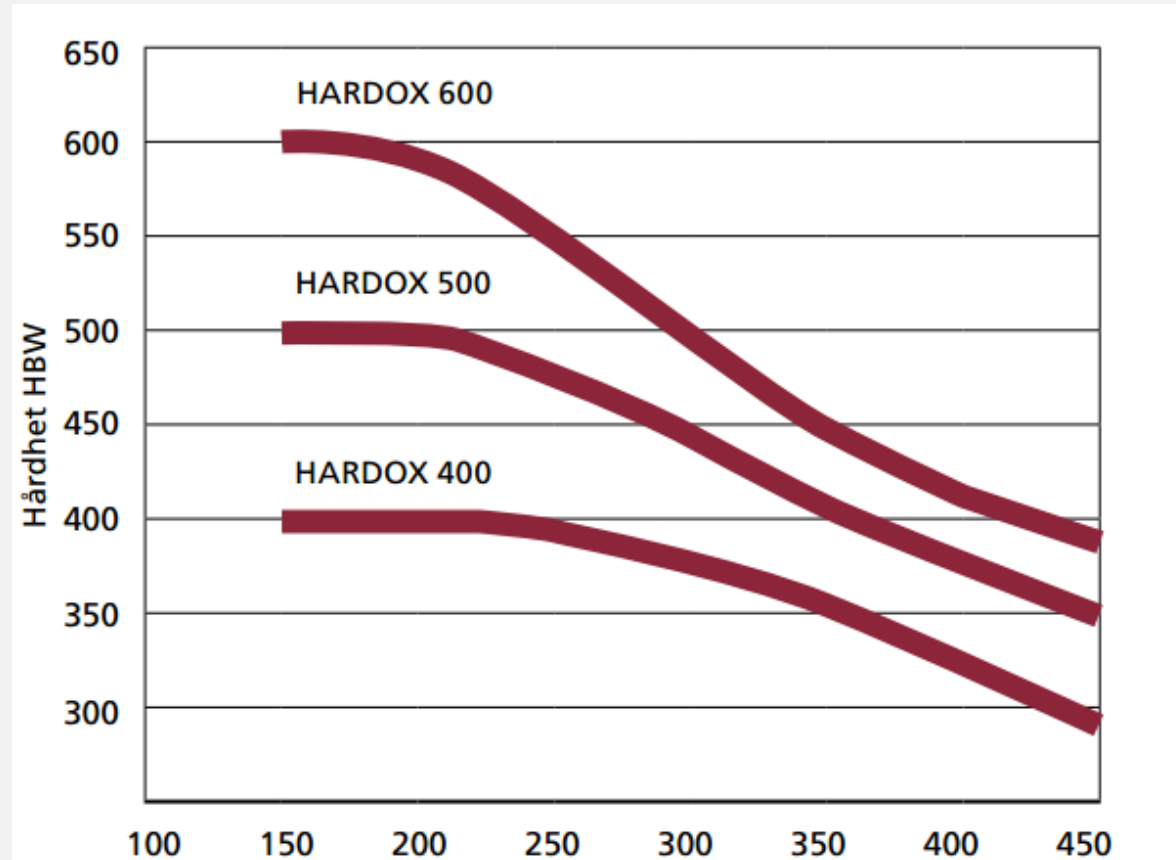
X

TOOLOX[®]
ENGINEERING & TOOL STEEL

Retains 90% hardness up
to 590°C

Tempering temperature
Alloying composition

High Temperature Wear – Hardox x Toolox



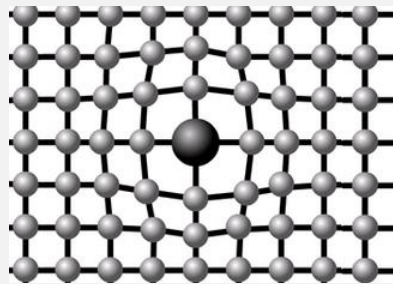
High Temperature Wear – Hardox x Toolox

HARDOX® WEAR PLATE

%C	%Si	%Mn	%Cr	%Ni	%Mo	%B	%V
0,22	0,27	0,7	0,57	0,04	0,006	0,0012	0,007

Precipitation hardening

Carbides!

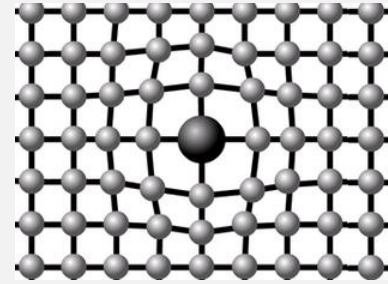


TOOLOX® ENGINEERING & TOOL STEEL

%C	%Si	%Mn	%Cr	%Ni	%Mo	%B	%V
0,3	1,1	0,8	1,37	0,05	0,82	0,0021	0,14

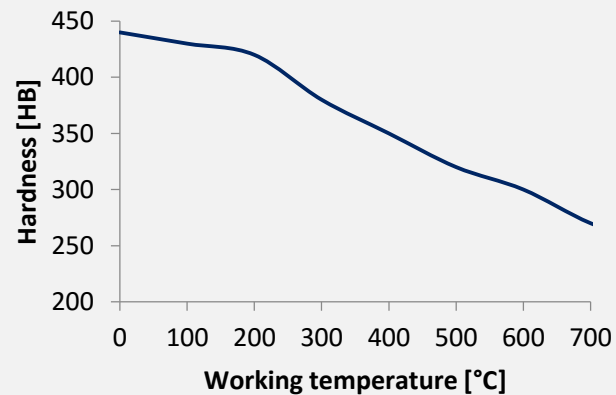
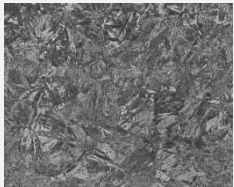
Solution hardening

Atoms!

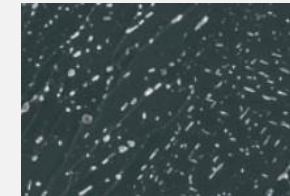
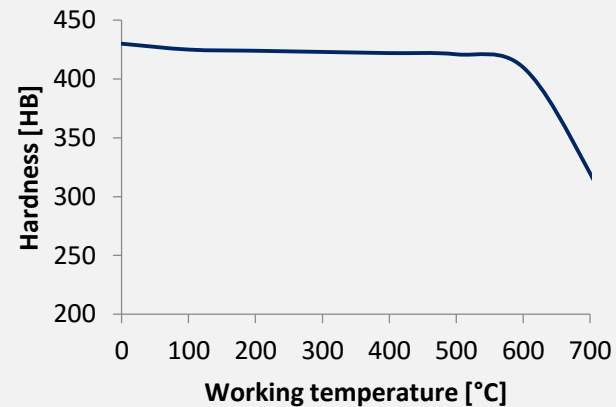


High Temperature Wear – Hardox x Toolox

HARDOX[®]
WEAR PLATE

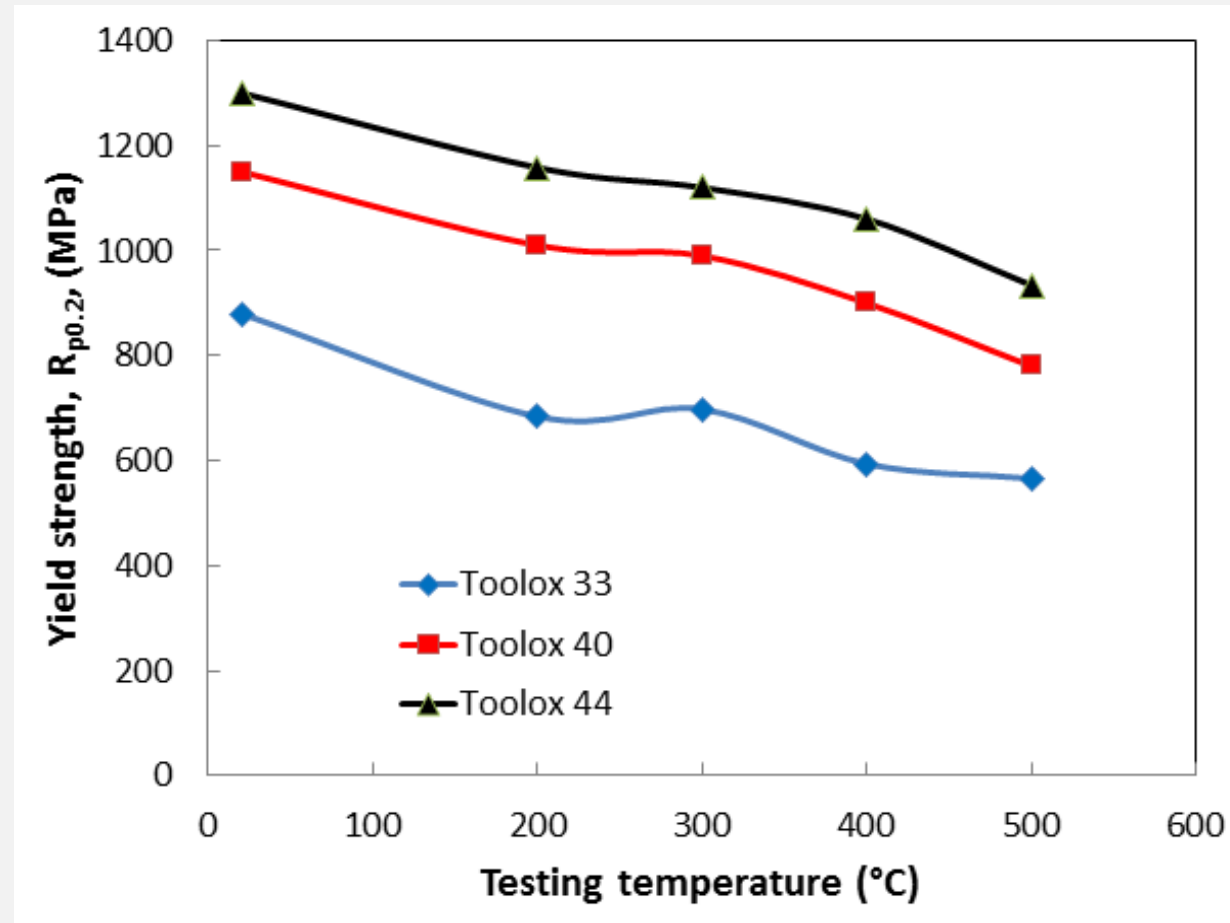


TOOLOX[®]
ENGINEERING & TOOL STEEL

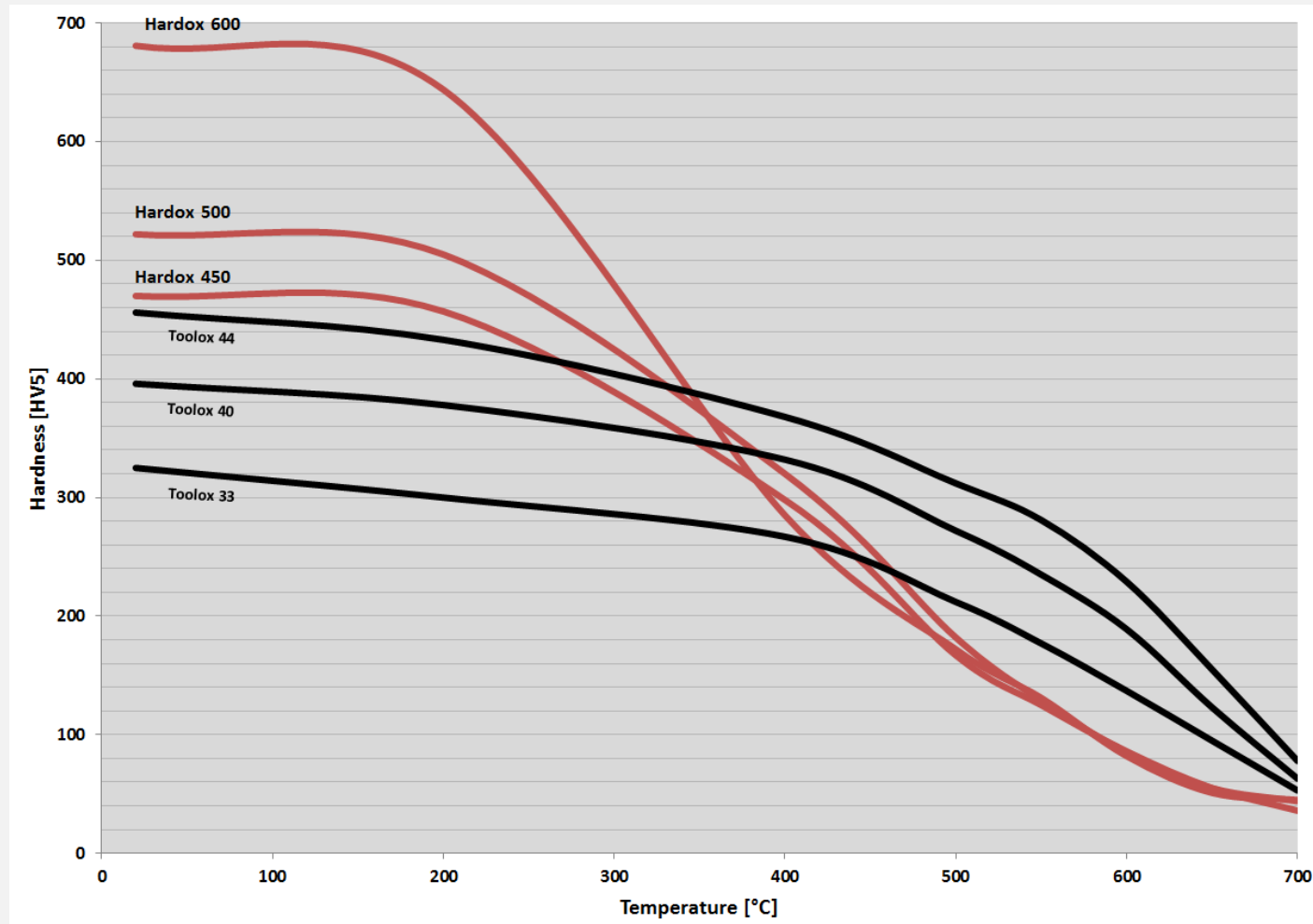


~6% carbides

High Temperature Wear – Hardox x Toolox



High Temperature Wear – Hardox x Toolox



Examples – Sliding Shoes



DESCRIPTION

Sliding shoe of pressure pole in coking plant.

Pushes ready coke out of the blast furnace oven.

Abrasion due to sliding on hot coke on top of a bed of heat resistant bricks.

Surrounding temperatures of approximately 1050 °C.

Shoe is at temperatures of around 500 °C. Stays in oven 60 seconds per push.

Hardox 400 – 25 mm / lasts for 2 months

Examples – Sliding Shoes



Problems

High temperature ruins hardness.
After service life below 250 HB.

Expensive formatting.
Require extreme bending forces.



Examples – Sliding Shoes



25 mm Hardox 400: 2 months

Measured hardness on surface: ~ 230 HB

20 mm Toolox 44: 8 months



5x wear rate

Longer service life.

Will not back-temper at 500 °C.

Less maintenance, less downtime.

Lower formatting costs.

Examples – Bucket (Brazil)



- Bucket used in to move hot slag ($\sim 350^{\circ}\text{C}$) from a Brazilian Fe-Nb production process.
- Before completely done with structural steel 350 Mpa YS and AR 400 on the front lip.
- Customer demand was to improve service life and reduce weight if possible.

Examples – Bucket



old

Material	A36/ AR400 front lip
Weight	364 kg
Service life	-320 hrs (average) -530 hrs (best one)
Production Cost (Ref)	1



new

Material	Weldox 700/Toolox 44
Weight	274 kg
Service life	1655 hrs
Production Cost (Ref)	1,40

Examples – Bucket

► Old Bucket



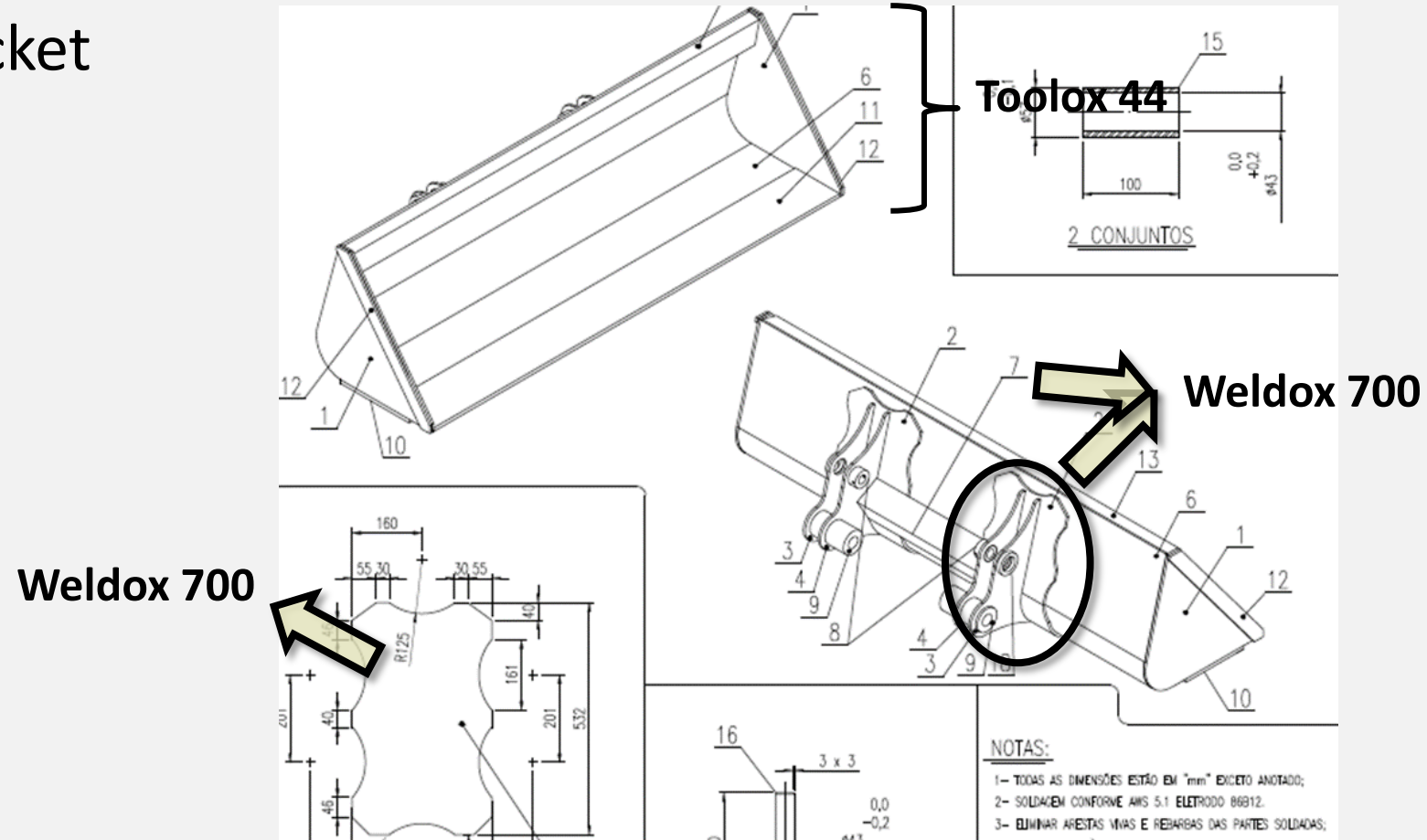
Deformation of front lip

-Cracks in the structure
after ~200hrs
-severe wear of the front
lip



Examples – Bucket

► New Bucket



Examples – Bucket



- **Weight: 274 Kg**
- **Weight reduction : 24%**
- **Service life: 1655 h**



Advantage	%
Weight reduction	24,3
Working hours cost reduction	- 53,3
Improved service life	188

Examples – Cone from Brazilian Steel Mill



- ▶ Cone used to load iron ore into the blast furnace
- ▶ Temperature reaches 300 C.

Examples – Cone from Brazilian Steel Mill



- ▶ Old one made with Hardox 500
- ▶ It lasts for 45 days

Examples – Cone from Brazilian Steel Mill

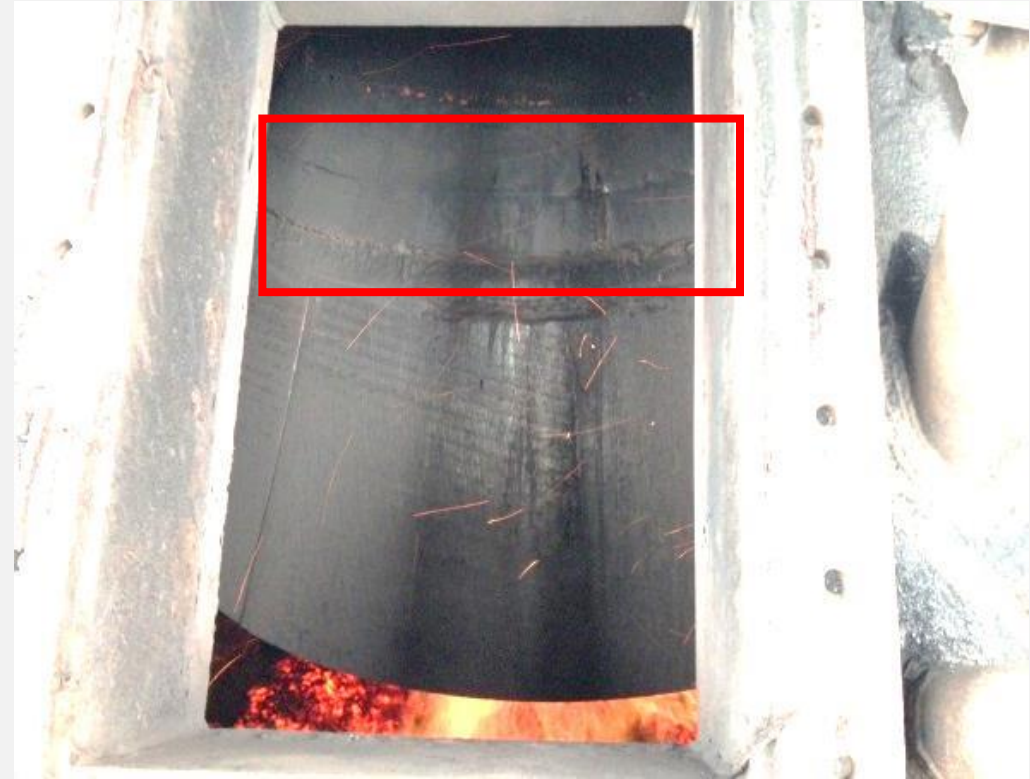


- ▶ Solution Toolox 44
- ▶ Increasing lifetime more than 3x

Examples – Cone from Brazilian Steel Mill



Hardox 500 after 60 days



Toolox 44 after 60 days

Examples – Brazilian Cement Slab Dryer Drum



Examples – Slab Dryer Drum



Pictures taken after 18 months of usage

- ▶ Old one made with Hardox 500
- ▶ Wear Problems at work temperature of 350 - 400 °C
- ▶ Hardox 500 lasts for less than 18 months

Examples – Slab Dryer Drum



- New drum made with Toolox 44

Examples – Slab Dryer Drum



Pictures taken after 18 months of usage

- ▶ Checked with 18 months of usage and no damages were verified.
- ▶ Customer is happy and expect to double the lifetime of the parts.
- ▶ Less maintenance and downtime

Examples – Roll Up Container Germany



- ▶ Old Solution after 6 months, using standard steel
- ▶ Used to transport Slag from steel mills

Examples – Roll Up Container Germany



- ▶ New solution using Toolox 44 – 8 mm
- ▶ Reinforcements use Strenx 700 MC

Examples – Roll Up Container Germany



► New Solution after 7 months of usage

Examples – Roll Up Container Germany



► Old Solution x New Solution