

# STULZ-SICKLES STEEL COMPANY

SINCE 1916

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**CREUSABRO®**

The Next Generation of wear resistant steels

## We'll Wear Out



## Your Rocks

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**STULZ-SICKLES STEEL COMPANY**

*Burlington, New Jersey*

**800-351-1776**

[www.stulzsicklessteel.com](http://www.stulzsicklessteel.com)

**MANGANAL STEEL SALES**

*Colton, California*

**800-572-5809**

[www.manganal.com](http://www.manganal.com)

# STULZ-CREUSABRO 4800

*A Modern Solution to Wear*



**SIGNIFICANTLY BETTER WEAR RESISTANCE THAN AR400 DUE TO TRIP EFFECT**

## TRIP Effect (Transformation Induced by Plasticity)

### WORK HARDENS

Fully Austenitic

Creates an Active Surface

Ensures a Sustained Work Life

### TITANIUM CARBIDE

MICROSTRUCTURE

Reduces Chip-Off and Cracking

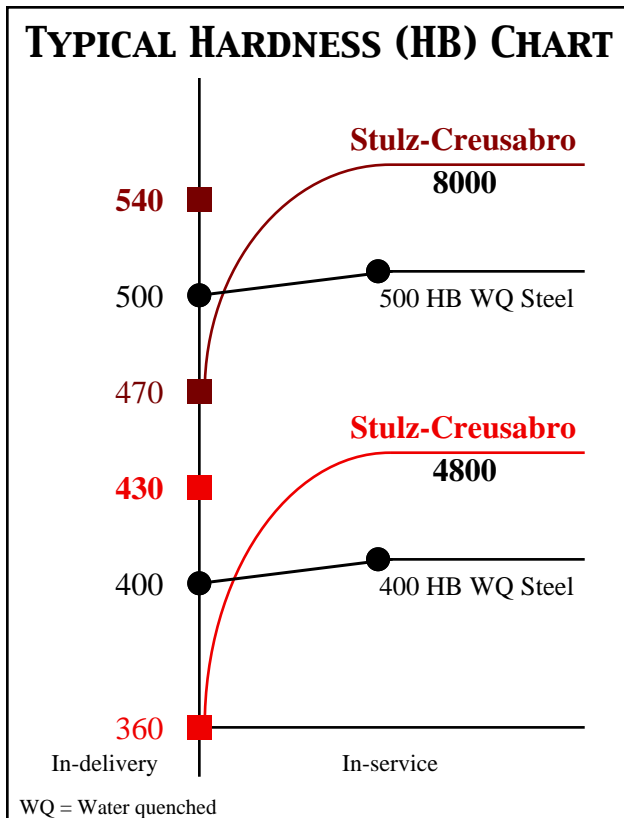
Resists both Impact and Abrasion

### OIL QUENCHED

True Throughout Hardness

Better Flatness

Easy Machining and Processing



### Titanium Carbides

In addition to the fine and homogeneous distribution of chromium and molybdenum carbides (respectively 1500 HV and 1800 HV) common to Stulz-Creusabro steels, Creusabro® 4800 is a new generation steel in the field of wear resistance steels with a significant addition of Titanium resulting in the formation of a structure with very hard particles of titanium carbide, TiC reaching a hardness level of 3200 HV. These carbides give to the steel an increased wear resistance.

#### 400 HB water quenched

Conventional route  
Passive material

#### Creusabro® 4800

Innovative route  
Active material

Just connected  
to supplied hardness

Combining:  
• in service hardening  
• TRIP effect  
• Microcarbides  
+ Titanium effect

#### PASSIVE STEEL

#### REACTIVE STEEL

- Low alloyed steel (C, Mn, B)
- Water quenching

- Specific addition of alloying elements (Cr, Mo, Ti, ...)
- Controlled cooling rate

### CHEMICAL ANALYSIS - % WEIGHT

C	S	P	Mn	Ni	Cr	Mo	Other elements
≤ .20	≤ .010	≤ .020	≤ 1.60	≈ .80	≤ 1.90	≤ .40	Ti ≤ .200

# STULZ-CREUSABRO 8000

*A Modern Solution to Wear*



**SIGNIFICANTLY BETTER WEAR RESISTANCE THAN AR500 DUE TO TRIP EFFECT**

## TRIP Effect (Transformation Induced by Plasticity)

### WORK HARDENS

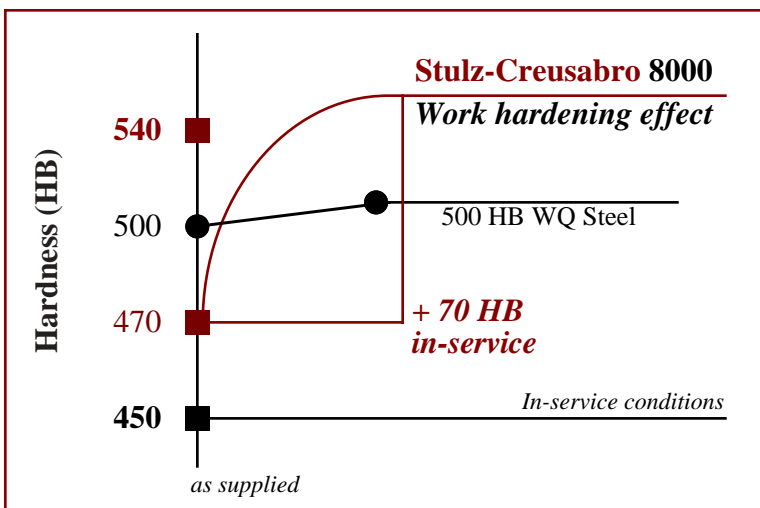
Fully Austenitic  
Creates an Active Surface  
Ductile Interior  
Ensures a Sustained Work Life

### TITANIUM CARBIDE

**MICROSTRUCTURE**  
Reinforced Cell Structure  
Reduces Chip-Off and Cracking  
Eliminates Cracking

### OIL QUENCHED

Excels where Severe Abrasion,  
Impact & High Heat are Factors  
Easy Machining and Processing  
Sensitive to Strain Hardening



**500 HB water quenched steel**  
Conventional route  
Passive material

- » Restricted alloy elements (mainly C, Mn, B)
- » Drastic water quenching
- » Fully martensitic structure

**Creusabro® 8000**  
Alternative route  
Active steel

- » Specific chemical composition
- » Controlled cooling (oil quenching)
- » Mix macrostructure: martensite + bainite + retained austenite
- » Perfect balance : high wear resistance + improvement workability
- » Wear resistance in service is a combination of:
  - > work-hardening effect (TRIP phenomenon)
  - > Presence of micro-carbides (chromium, molybdenum, titanium)
  - > Delayed tearing of metal particles (super-ductility of the retained austenite).

Wear resistance in service is a result of the hardness in the as-delivered state. It is an answer for common applications.

**Stulz-Creusabro 8000** is an answer for intense, specific applications.

### Service life of **STULZ-CREUSABRO 8000** versus 500 HB steels

<b>Mines</b>	External liner of excavator	+ 100%
<b>Foundry</b>	Extracting plates	+ 36%
<b>Quarry</b>	Cheek plates in crusher	+ 50%
<b>Wood</b>	Crushing hammers	+ 38%

### CHEMICAL ANALYSIS - % WEIGHT

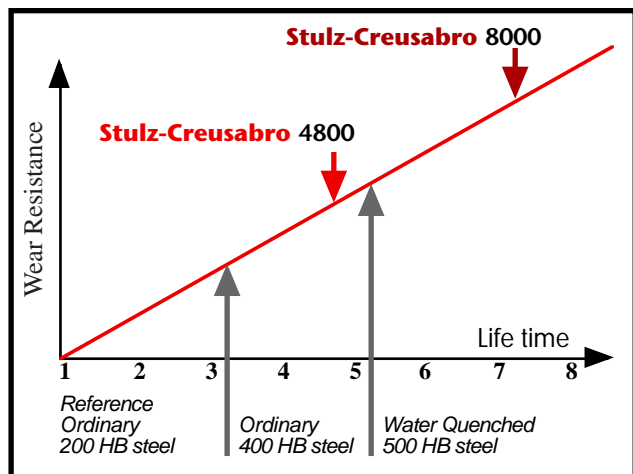
<b>C</b>	<b>S</b>	<b>P</b>	<b>Mn</b>	<b>Ni</b>	<b>Cr</b>	<b>Mo</b>	<b>Other elements</b>
≤ .28	≤ .005	≤ .015	≤ 1.60	≤ 1.0	≤ 1.60	≤ .40	

# Technical specificities of **STULZ-CREUSABRO 4800 and 8000**

## Lifetime is increased

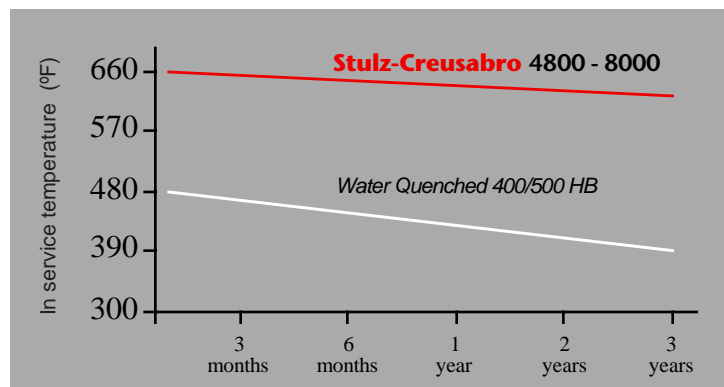
Against conventional water quenched steels, wear resistance of **STULZ-CREUSABRO** grades is increased and maintenance costs reduced.

Usually, choice of material is made on a price and hardness basis. However, users have to face difficulties of wear parts replacement. One must therefore add to the material price both the **costs of maintenance and production downtime**, in order to establish the **true cost-effectiveness** of a material.



## Resistance to high temperature is guaranteed...

... which allows the use of **STULZ-CREUSABRO** grades in high conditions ( $\leq 450^{\circ}\text{C}$  -  $840^{\circ}\text{F}$ ) such as met in Cement Works, Foundries, Steel Industry, Asphalt Plants...



## **STULZ-CREUSABRO 4800**

Typical 360 HB → Work harden to  $\geq 430$  HB

Delivery condition : Guaranteed 340/400 HB

**STULZ-CREUSABRO 4800** is ideal for applications in mines and quarries, cement and the steelmaking industries, public works and agricultural machinery. It is suitable for all types of abrasion, sliding or impact, dry or wet media including high temperature abrasion.

## **STULZ-CREUSABRO 8000**

Typical 470 HB → Work harden to  $\geq 540$  HB

Delivery condition : Guaranteed 430/500 HB

**STULZ-CREUSABRO 8000** is known as the best compromise for severe applications where exceptional abrasion, impact, heat and moderate corrosion are requested in service. It is currently used in Mining, Quarries, Cement and Concrete industries, Asphalt Plants, Steel Recycling, Earthmoving, Dredging...

### **“TRIP effect”**

#### **TRansformation Induced by Plasticity**

Due to its initial structure not fully martensite (a mix of martensite, bainite and retained austenite), **STULZ-CREUSABRO** has the ability to work-harden when submitted to local plastic deformation induces a surface hardening phenomenon by transformation of retained austenite into fresh and very hard martensite while the material remains ductile underneath, makes it a most effective to withstand both abrasion and heavy impact in service.



# Liebherr Abrasion Test Program

This major manufacturer of heavy equipment put **STULZ-CREUSABRO 8000** to the test in the *Assarel Copper Mines in Bulgaria*.

Typical 400 & 500 water-quenched steel is used on the 771 Shovel bucket.

## **STULZ-CREUSABRO 8000**

*6 months in the wet season*

After 2600 hours:

**NO MAINTENANCE NEEDED**

After 3,700 hours:

**ONLY CLEANING AND BUILDUP NEEDED**

## **400/500 HB Water-Quenched steel**

*6 month in the dry season*

After 2540 hours:

**SEVERE WEAR, REQUIRING REBUILD**



Rock Crusher Hopper Panel  
**STULZ-CREUSABRO 8000**



Excavator Rebuild with  
**STULZ-CREUSABRO 4800**

Use **STULZ-CREUSABRO 4800 and 8000** throughout crushers and screeners

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*Most Effective Low-Hydrogen Welding Electrode*

## **STULZ-SICKLES SPECIAL ALLOY**

83/18 • Ductile • Rod or All-position Wire

ALLOWS WELDS TO FLEX AND REMAIN STRONG UNDER HIGH STRESS!

Use on our **STULZ-CREUSABRO 4800** and **STULZ-CREUSABRO 8000**

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SINCE 1916

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*Stulz-Sickles Steel and Manganal Steel Sales  
offer hands-on, full service at your site.*

*Call your local District Manager to have us  
come out and help solve your wear issues.*

**MEASUREMENTS • TEMPLATES • CUT DESIGNS  
PLATE USAGE • MACHINING NEEDS**