WELDING & MANUFACTURING, SX® ALLOY

By

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Costão do Santinho
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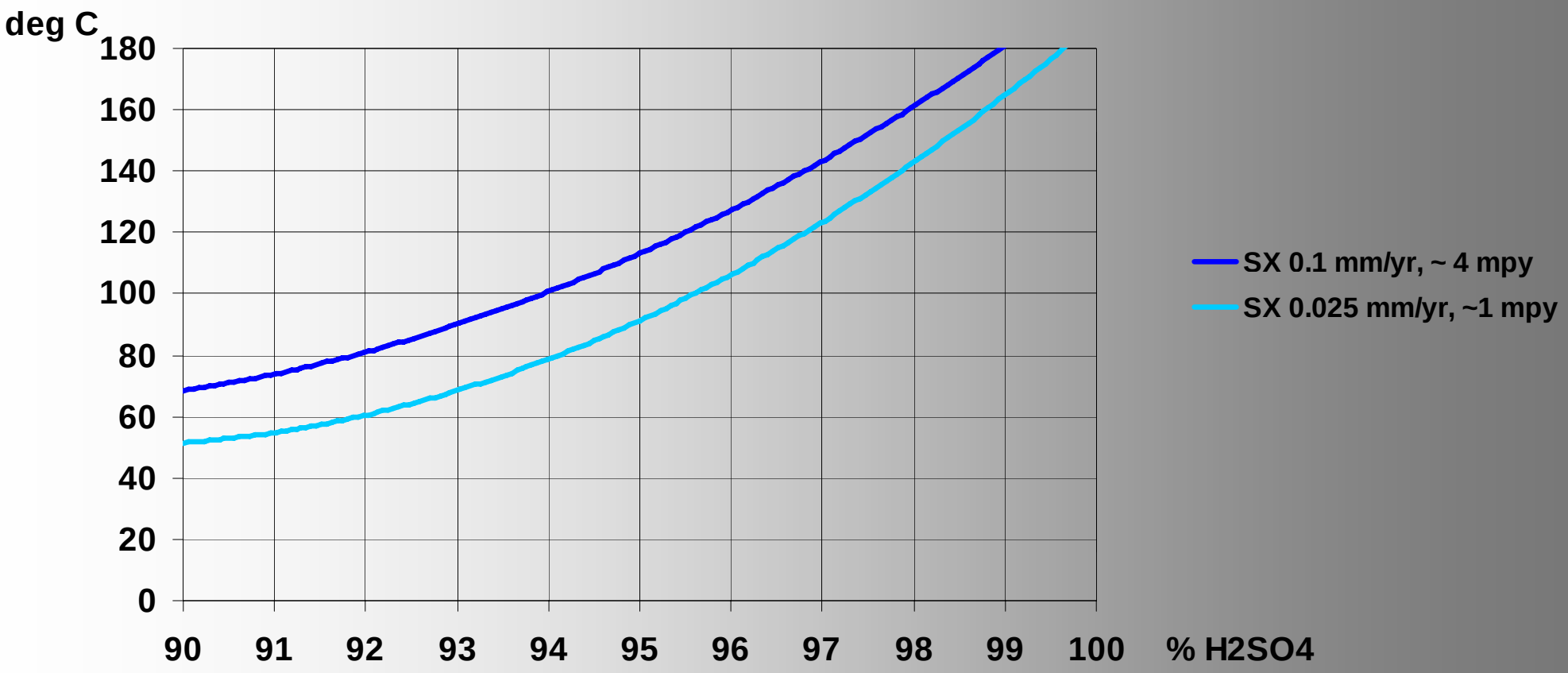
Sandvik SX® – Sulphuric Acid Steel

An austenitic stainless steel developed by Sandvik in the early 70's
Introduced by EDMESTON in 1984.

With approximately 3000 ton of SX equipment in service, the most preferred sulphuric alloy for use in hot concentrated acid today

UNS S 32615, covered by ASME code

SX ® Isocorrosion diagram



Edmeston SX® System

SX® – excellent material of construction for:

- Acid Distributors

- Acid Piping

- Acid Coolers

- Drying & Absorption Towers

- Pump Tanks

- Strainers, inserts etc.

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-What is a stainless steel ?

- What makes a steel stainless ?

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- What makes a steel stainless ?

A steel is defined as stainless if it contains at least 12% Chromium

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At 12% Cr, or higher, a very thin and dense oxide film will be formed on the steel surface, which:

- Protects the steel from corrosive attack
- Is instantly restored, if damaged

(Stainless steel was “discovered” by Mr. Harry Brearly, Sheffield, England, while he was developing cannon barrels.)

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SX® Chemical Composition:

Cr	16.5 – 19.5 %	**C**	0.07 %
Mo	0.3 – 1.5 %	**Si**	4.8 – 6.0 %
Ni	19.0 – 22.0 %	**Mn**	2.0 %
Cu	1.5 – 2.5 %		

Alloying elements	Impact on steel properties
C	Increases the mechanical strength and the hardening properties of a steel. Decreases ductility, forging, welding and cutting properties. Has no impact on corrosion resistance to water, acids or hot gases.
Cr	Increases hardness and strength. Reduces ductility insignificantly. Makes steel corrosion resistant at levels over 12%. Increases resistance to pitting corrosion. Forms wear resistant carbides.
Ni	Stabilizes austenite and makes Cr-Ni-steels ductile.

Alloying elements	Impact on steel properties
Mo	Provides good resistance to general corrosion in acid environments and good resistance to pitting corrosion.
Cu	Increases general corrosion resistance in acidic environments. Promotes passivation if the material has been activated
Si	Forms a very hard and acid resistant Silicon oxide layer on the material surface. Extremly efficient passivating properties.
Mn	Used for metallurgical purposes (reacts with sulphur)

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A Stainless steel is not more difficult to weld than any general construction steel…

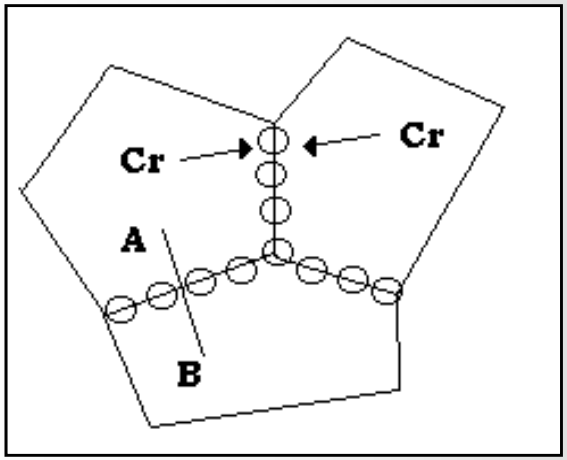
… you just do it a little bit differently

Three hints…

- Do not mix mild and stainless steel fabrication
- Beware of high heat input
- Clean joints before and after welding

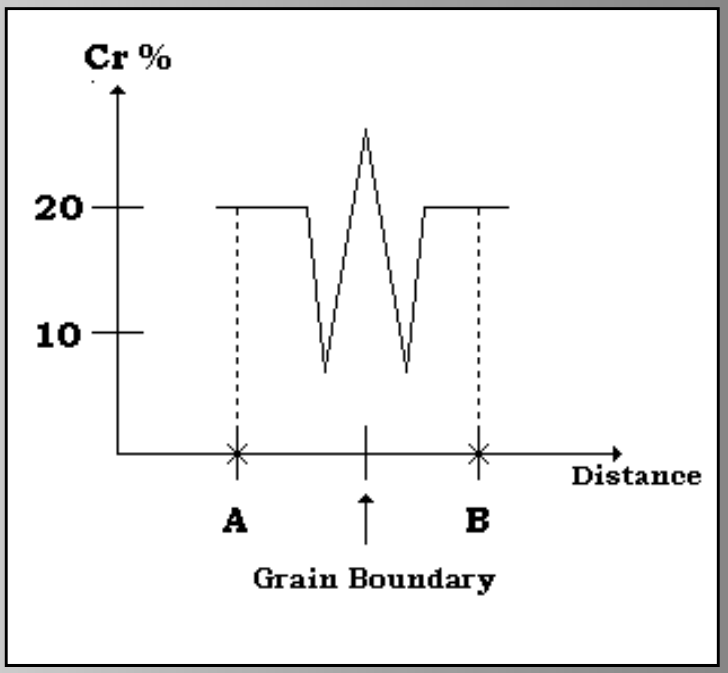
.. and you will be successful with 99% of all stainless steel welding

Carbide precipitation



⬭ = Cr - Carbide

Chromium depletion



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- Welding SX is similar to welding normal stainless steel

Applicable welding processes:

SMAW	Covered Electrode welding
GTAW	TIG welding
GMAW	MIG welding
PAW	Plasma welding

Gas – clean Argon

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The service environment for the alloy involves an increased risk for inter crystalline corrosion, if welded in a wrong way.

- Always use filler metal

-Very low heat input

-Low interpass temperature

Heat input; Q

-MAX 1 KJ/mm

Heat Input; Q
U = Voltage (V)
I = Current (A)
V = Travel speed (mm/min)

$$Q = \frac{U*I*60}{V*1000}$$

Interpass temperature

-MAX 60°C (140°F)

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And also….

-Clean joints before welding

-Avoid re-melting of base metal specially in root runs, not to induce hot cracks.

-No weaving! (Only exception is vertical up position)

-Post weld cleaning important (mechanical / pickling paste)

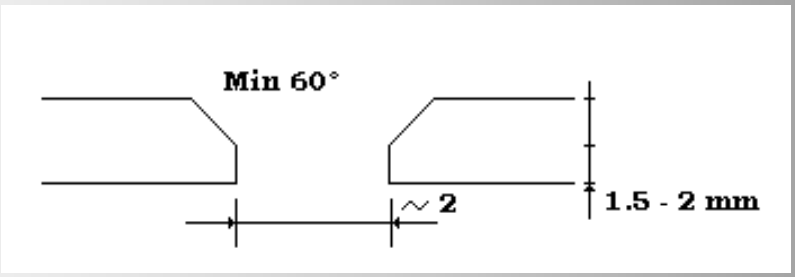
-Forced cooling is allowed

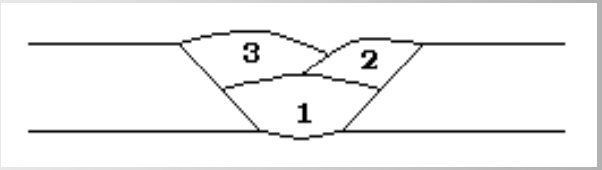
-Flame straightening forbidden

-No striking marks!

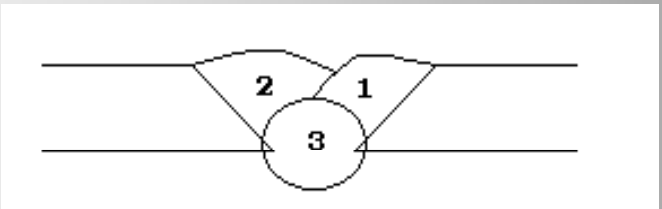
WPS (MMA)

SMAW





-If possible, Last bead towards acid!



-Root grinding before bead 3

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Dissimilar Joints

Joint	Filler Metal
Carbon steel / SX	SX
Stainless steel / SX	SX
High alloy steels / SX	SX

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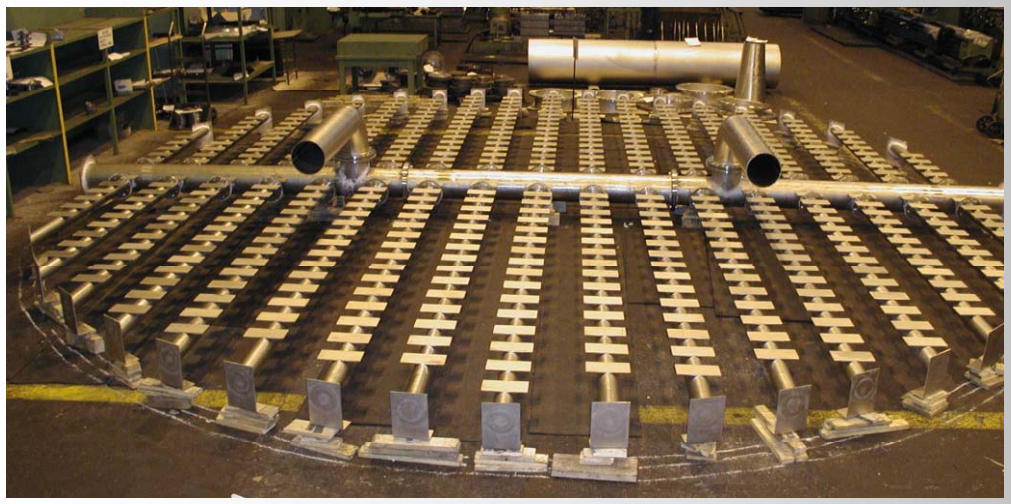

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Thank you for your attention !

Find out more…

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