



# OUTOTEC EDMESTON SX<sup>®</sup> SYSTEM

The Outotec Edmeston SX<sup>®</sup> System comprises equipment for the absorption stage of a sulfuric acid plant, manufactured using Edmeston SX<sup>®</sup>, our proprietary acid-resistant stainless steel with excellent corrosion resistance over a wide concentration range at high temperatures. It has significant advantages over other alloys and traditional materials like cast iron, including superior equipment lifetime, low maintenance requirements, and ease of fabrication.

## BENEFITS

- Excellent corrosion resistance over wide concentration range
- Superior equipment lifespan and low maintenance requirements
- Clean acid free from corrosion products
- Light weight speeds up installation and reduces need for foundation work

# RELIABLE, FLEXIBLE, AND SAFE – OUTOTEC EDMESTON SX®

SX®, the original sulphuric acid steel, was developed by Sandvik and launched by its subsidiary Edmeston in 1984. With its combination of corrosion resistance, excellent mechanical properties and weldability, superior equipment lifespan, low maintenance requirements, and increased plant safety, SX® led to a paradigm change in the industry.

When exposed to sulfuric acid, the material forms a very strong passive surface layer of silicon oxide that protects it against corrosion. Under normal plant operating conditions, the steel has excellent corrosion resistance in both static and dynamic conditions (see isocorrosion

diagram, Figure 1). Through its 30-year history, it has also proven capable of handling periods of upset conditions.

Table 1 shows the corrosion resistance of Outotec Edmeston SX® in dynamic conditions over time, while Figure 2 shows comparative test data for Outotec Edmeston SX® against various other alloys.

The Outotec Edmeston SX® System comprises:

- Towers and pump tanks
- Piping
- Distributors
- Coolers

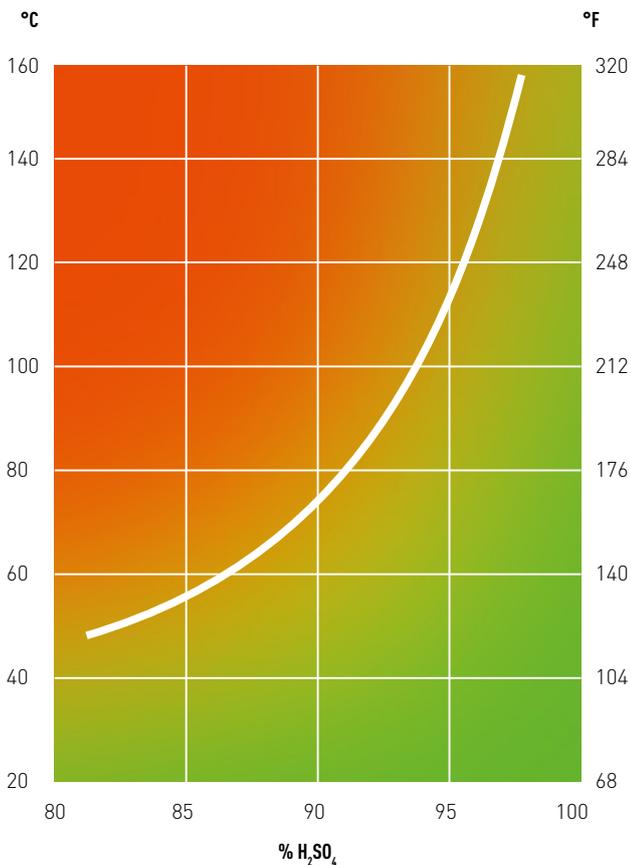


Figure 1. Isocorrosion diagram. Reference line indicates 0.1 mm/year (4 mpy)

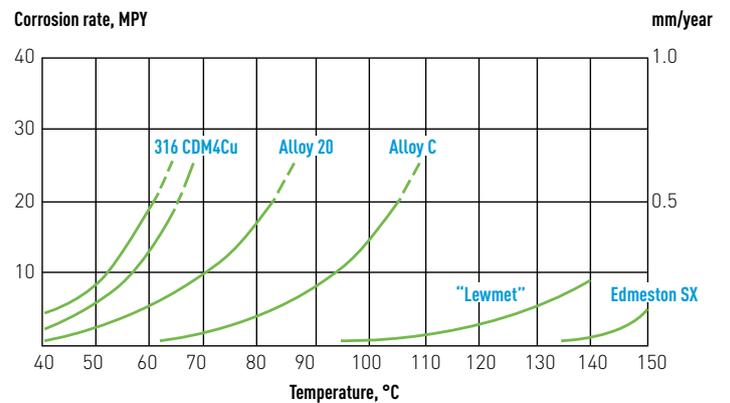


Figure 2. Approximate corrosion rate curves for various alloys in 98% H<sub>2</sub>SO<sub>4</sub>

## PLANT DATA FOR EDMESTON SX®

Position	Conc. % H <sub>2</sub> SO <sub>4</sub>	Temp °C	Velocity m/s	Exposure time years	Corr. rate mm/year
Absorption acid piping	97–99%	80–120	1–3	-20	0.0
Drying acid piping	93–97%	60–100	1–3	-20	0.0
DT/IAT/FAT acid cooler	98.5%	80–130	1–4	5–20	0.0
HR piping	99%	180	1–3	>10	<0.1
Acid pump	96–99%	80–120	25	>5	0.0

Table 1. Corrosion resistance in dynamic conditions over time



## ACID TOWERS AND PUMP TANKS

Outotec Edmeston SX<sup>®</sup> towers and pump tanks have a proven track record, each with approximately 50 successful reference installations around the world, with tower diameters ranging from 1 to 10 m. The first tower was installed in 1987 and remains in operation.

The corrosion resistance properties of SX<sup>®</sup> stainless steel mean that the traditional brick lining can be eliminated from the towers and pump tanks, which substantially reduces their weight. Removing the need for a brick lining also eliminates the risk of loose bricks entering the system and damaging the pumps or blocking the heat exchangers.

Due to the lightweight material, the tower – including the packing, mist eliminators, and distributor – can be preassembled before lifting it into position, thereby speeding up installation and minimizing plant downtime. The decreased weight also reduces the need for foundation work.

### BENEFITS

- Lightweight equipment that can be prefabricated before installation
- Quick installation minimizes plant shutdown time
- Low installation cost and low maintenance requirements compared to traditional brick-lined towers and pump tanks
- Flexibility in design and installation
- Clean acid free from debris from corroding bricks



## DISTRIBUTORS

Outotec Edmeston SX<sup>®</sup> acid distributors are tailored for your specific application and can be used to replace cast-iron distributors in old towers, in high-efficiency towers, or in towers with structured packing. Our distributors eliminate all the well-known disadvantages associated with cast iron distributors, including poor corrosion resistance and heavy weight. As a result of the superior corrosion resistance properties of SX<sup>®</sup>, hole and orifice sizes remain constant throughout the life of the distributor, ensuring that optimal performance is maintained.

### BENEFITS

- Quick and easy installation
- Lightweight equipment with excellent corrosion resistance
- Uniform distribution
- Low maintenance requirements
- Clean acid free from corrosion products
- Operational lifespan exceeding 20 years

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**Outotec's high-performance acid distributors are tailored for your specific application.**



### Outotec FiDi Acid Distributor

The Outotec FiDi Acid Distributor uses a design based on film distribution technology to minimize carryover and mist generation while simultaneously ensuring high gas flow rates – a key factor in maintaining the performance of drying and absorption towers. The simplified design increases the free gas-flow area while maintaining smooth and homogenous acid distribution into the packing, regardless of any misalignment issues.



### Trough distributors

Trough distributors are normally used in high-performance towers, or when your application demands a high irrigation point density – a typical distributor incorporates up to 44 points per m<sup>2</sup>. The latest-generation distributors feature fewer troughs combined with an improved irrigation point pattern. Compared to previous-generation equipment, the spacing between the troughs has been increased. As well as being more cost-effective, this design also enables a lower tower pressure drop, leading to a completely uniform acid distribution pattern.



### Pipe distributors

Pipe distributors are an equally cost-efficient choice for both new installations and modernization projects. The simple design is particularly suited to towers with a diameter of 5 m or less. The patented threaded coupling connecting the branch pipes to the header allows for quick and easy installation. The density of irrigation points can be adjusted according to your process requirements.



### Deflection plate distributors

The deflection plate distributor is mainly used as a replacement for old cast iron distributors where the acid is deflected on bricks towards the packing.

## ACID COOLERS

As a result of the superior corrosion resistance properties of Outotec Edmeston SX® stainless steel, our shell and tube acid coolers require no anodic protection. Because it is suitable for use in high acid temperatures and high acid velocities, the material also eliminates typical design constraints for anodically protected coolers, allowing for a compact design with optimal thermal properties and a long operational lifespan. Our coolers have a 30-year track record of providing maximum availability with low maintenance and lifecycle costs.

### BENEFITS

- No anodic protection required
- Excellent corrosion resistance
- Capable of handling periods of upset conditions
- Low maintenance requirements
- Flexibility in design
- Long operational lifespan

Our coolers are designed and optimized according to your specific operating conditions. Coolers are typically manufactured according to the requirements of ASME or EN standards, but we can fulfill the requirements of almost any standard. We supply acid coolers for all types of demanding applications, including:

- Boiler feed water preheating
- District heating
- Seawater and high-chloride cooling water
- Process cooling water



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**Our coolers have a 30-year track record of providing maximum availability with low maintenance and lifecycle costs.**

# PIPING SYSTEMS

Outotec Edmeston SX<sup>®</sup> piping systems for sulfuric acid plants eliminate all the disadvantages of traditional materials such as cast iron – including poor corrosion resistance, large number of flanges, and heavy weight – and offer numerous benefits compared to other alloys. Our piping systems set the standard for sulfuric acid piping, with more than 35,000 meters in service around the world, and are available in accordance with ISO and ASME standards. We stock sizes DN 25 (1") to DN 600 (24") and can supply larger dimensions on demand.

## BENEFITS

- Welded system with minimum number of flange connections eliminates risk of leaks
- Warehoused stock ensures fast delivery
- Low maintenance requirements
- Enable use of smaller-diameter piping
- Clean acid free from corrosion products
- No need to stock inventory of spare parts
- Operational lifespan equal to that of plant
- High quality assured through extensive quality control and non-destructive testing
- Excellent corrosion resistance
- No sensitivity to erosion or increased acid velocities
- Lightweight components with high ductility

We manufacture tailor-made parts according to your specific needs, including:

- Vortex breakers
- Inserts, thimbles
- Dip pipes
- Orifice plates
- Thermo wells
- Strainers
- Complete pre-fabricated spools for fast and cost-effective installation

## GENERAL WELDING GUIDELINES

1. When welding SX<sup>®</sup> to SX<sup>®</sup>, or to other materials, always use SX<sup>®</sup> filler material
2. Weld with low input (max. 1.0 kJ/mm).
3. Maximum interpass temperature is 60°C/140°F.

Typical guidelines for Welding Procedure Specifications (WPS) are available on request.



## AVAILABLE EDMESTON SX<sup>®</sup> WELDING MATERIAL

WELD ELECTRODES, SMAW				
Diameter (mm)	2.0	2.5	3.25	4.0
Pack weight (kg)	3.6	3.6	4.1	4.5
TIG RODS, GTAW				
Diameter (mm)	2.0	2.4	3.25	–
Pack weight (kg)	5.0	5.0	5.0	–
MIG WIRE, GMAW				
Diameter (mm)	0.9	1.14	1.6	–
Pack weight (kg)	15.0	15.0	15.0	–

# OUTOTEC EDMESTON SX<sup>®</sup> TECHNICAL DATA

## Approvals:

- ASME II section D/VIII, div. 1, app. 34
- UNS S32615
- PMA-PED, TÜV Nord, Einzelgutachten

## Specifications:

- Seamless tubes: ASTM A213
- Welded pipes: ASTM A312, A530
- Plates: ASTM A240, ASTM A480

## CHEMICAL COMPOSITION

Cr	Mo	Ni	Cu	Si	Mn
16.5–19.5%	0.3–1.5%	19–22%	1.5–2.5%	4.8–6%	2%

## MECHANICAL PROPERTIES

YIELD STRENGTH			TENSILE STRENGTH		ELONGATION	
R <sub>p</sub> 0.2, MPa, min	0.2% offset, ksi, min	R <sub>p</sub> 1.0, MPa, min	R <sub>M</sub> , MPa, min	ksi, min	A%, min	A <sub>2</sub> %, min
220	32	250	550	80	45	25

At 20 °C (68 °F)

## AT ELEVATED TEMPERATURES

TEMPERATURE	50 °C	100 °C	150 °C	200 °C
R <sub>p0.2</sub> , MPa, min	196	175	160	148
R <sub>p1.0</sub> , MPa, min	220	200	185	173

TEMPERATURE	100 °F	200 °F	300 °F	400 °F
Stress, ksi, min	21.3	17.6	16.5	15.4

## THERMAL EXPANSION, MEAN VALUES

TEMPERATURE	20–100 °C	100–200 °C	200–300 °C
m/mK x 10 <sup>-6</sup>	15	15.5	16

## MODULUS OF ELASTICITY

TEMP	20 °C	100 °C	200 °C
MPa x 10 <sup>3</sup>	200	194	186

## THERMAL CONDUCTIVITY

TEMP	20 °C	100 °C	200 °C
W/mK	11	13	14
Kcal/mhK	9.5	11	12

## PHYSICAL PROPERTIES

Density 7.9 g/cm<sup>3</sup>, 0.28 lb/in<sup>3</sup>

Outotec develops leading technologies and services for the sustainable use of Earth's natural resources. Our 4,000 top experts are driven by each customer's unique challenges across the world. Outotec's comprehensive offering creates the best value for our customers in the mining, metal, energy, and chemical industries. Outotec had sales of approximately EUR 1.3 billion in 2018, and its shares are listed on NASDAQ Helsinki.

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