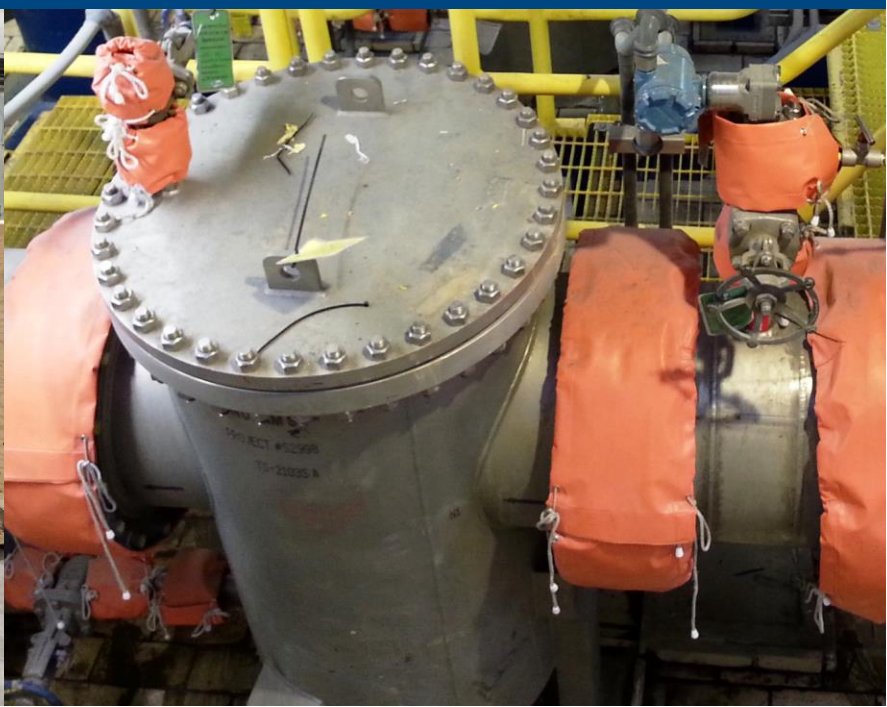


NORAM
SULFURIC ACID
Products and Services

NORAM SX™ CHIPGUARD CG™ ACID STRAINER



NORAM SX™ ChipGuard CG™ Acid Strainer offers significant improvements to sulfuric acid plants:

- Protects the acid plant equipment
- Reduces unscheduled shut-downs
- Reduces the maintenance required to clean acid equipment
- Improves the reliability and operability of the acid equipment

The Problem

Sulfuric acid circulation systems often experience problems caused by entrainment of solids into critical pieces of equipment. Solids can be entrained into the hot sulfuric acid circuits from a number of sources, including: construction debris, ceramic packing chips, breakage from brick-lined equipment, and corrosion byproducts. If the solids are not contained, they are conveyed into the acid plant equipment with the acid circulation flow. This can cause the following issues:

- Plugging of acid coolers – increases pressure drop
- Plugging acid distributors – increases SO₃ emissions
- Erosion of equipment – reduces service life

Design Requirements

There are strategies to improve the situation described above:

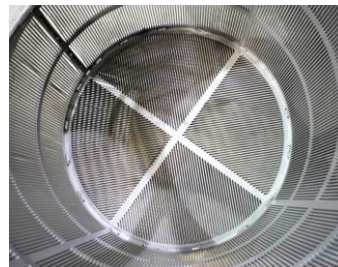
- Perform regular maintenance activities in the acid system to clean all major pieces of equipment
- Monitor and trend the pressure drop of acid equipment to identify and correct fouling issues early
- Use dedicated acid pump tanks with a deep seal leg
- Use high quality ceramic packing (such as NORAM HP™ packing) and high-silicon alloy equipment (such as NORAM SX™ piping, coolers and distributors)

While these reduce the effects of solids entrainment, they do not fully resolve the root cause of the problem: **the conveying of solids with acid flow**. NORAM SX™ ChipGuard CG™ Acid Strainer can catch small solids (approximately 6mm, depending on requirements), which protects the plant equipment, specifically:

- Acid pumps
- The downcomers in the acid distributor (such as a trough, or pipe distributor)
- Acid coolers



External Basket for Basket-Type Strainer



Acid Strainer Slotted Drain



Acid Tower Internal Strainer



External In-line Basket Strainer

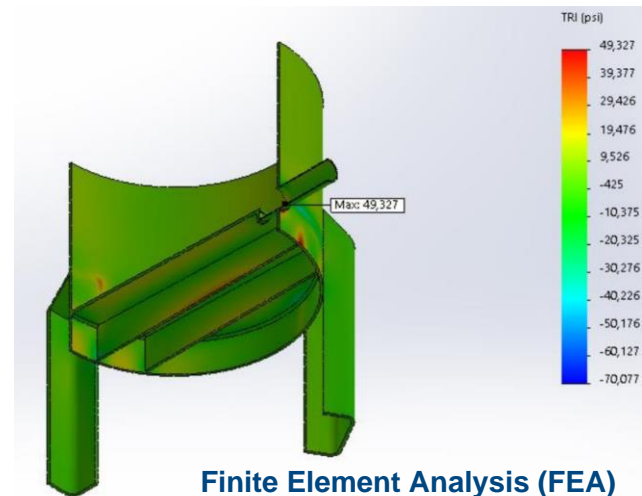


Acid Pump Suction Strainer

The Solution

NORAM improved the design of acid strainers to remove solids from the circulating acid, with **high efficiency, high reliability, and low pressure drop**. Some of the features of NORAM's acid strainer are:

- Made out of high silicon alloy NORAM SX™
- Very small pressure drop to prevent hydraulic issues and pump NPSH issues
- Can be located at ground level, and upstream of the acid pumps to simplify cleaning and to protect as many pieces of equipment as possible
- Options for draining, isolation, and cleaning
- Robust mechanical design to tolerate the service conditions, including:
 - Pressure: up to 8 bar
 - Temperature: up to 120°C
 - Concentration: 92-100 wt% H₂SO₄

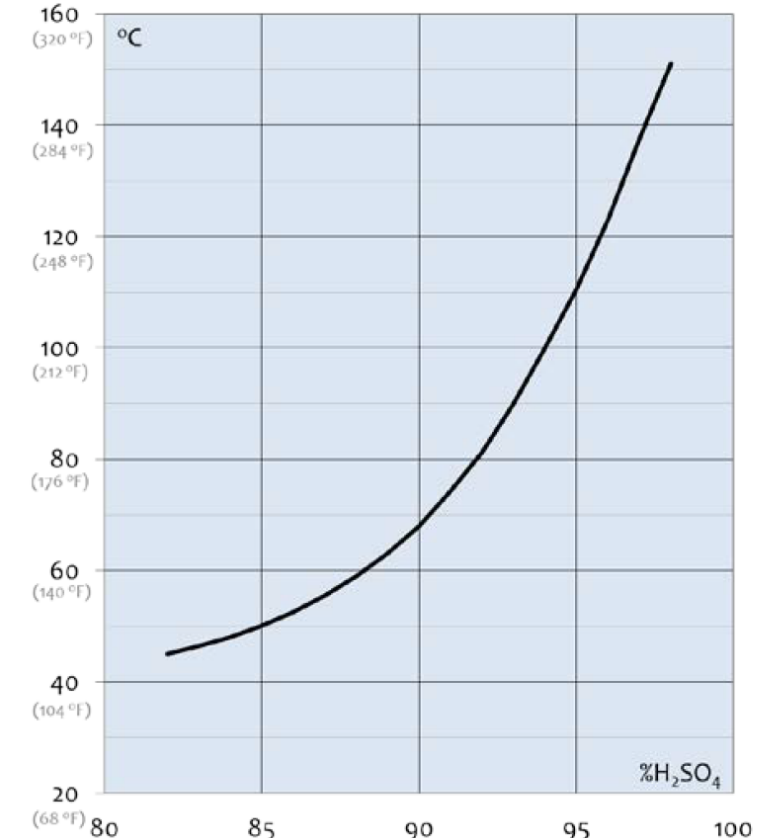


Finite Element Analysis (FEA)

Types of Acid Strainer

NORAM offers 3 different types of acid strainer:

- **External In-line Basket Strainer:** fitted with a removable metal basket, this strainer is separate from the acid tower and sits in-line with the acid piping
- **Acid Pump Suction/Basket Strainer:** this strainer is attached to the acid pump inlet nozzle to protect the pump from chips and other debris inside of an acid tank
- **Acid Tower Internal Strainer:** Installed inside the acid tower at the drain nozzle, this strainer is mounted by entering the tower and placing the strainer into the drain nozzle opening. It can also be 'pulled out' to be cleaned without ever needing to enter the tower



NORAM SX™ Iso-Corrosion Curve



External In-line Acid Strainer Installation

NORAM ENGINEERING AND CONSTRUCTORS LTD.

Suite #1800 – 200 Granville Street
Vancouver, British Columbia, Canada, V6C1S4
Tel: 604-681-2030 Fax: 604-683-9164

E-mail: acid@noram-eng.com Website: www.noram-eng.com

SERVICE TO THE SULFURIC ACID INDUSTRY

Ask about the products and services
NORAM supplies to the sulfuric acid industry:

NORAM PLANTS, PROCESSES, SYSTEMS, AND PROCESS EQUIPMENT

NORAM PLANT UPGRADE AND DEBOTTLENECKING ENGINEERING STUDIES
NORAM/CPPE HYBRID SULFURIC ACID PROCESS (HSAP)
NORAM CLEAN START™ PROCESS
NORAM PLANT PREHEATING SYSTEMS
NORAM'S TURBOSCRUBBER FOR GAS SCRUBBING
NORAM STAINLESS STEEL CATALYTIC CONVERTERS
NORAM RF™ RADIAL FLOW GAS-TO-GAS HEAT EXCHANGERS
NORAM SF™ SPLIT FLOW GAS-TO-GAS HEAT EXCHANGERS
NORAM BRICK-LINED ACID TOWERS
NORAM SULFUR & SPENT ACID BURNERS
NORAM CELLCHEM SULFUR BURNERS
NORAM ANODICALLY PROTECTED ACID COOLERS
NORAM SX™ ACID COOLERS
NORAM SX™ TOWERS AND NORAM SX™ PUMP TANKS

NORAM EQUIPMENT INTERNALS, PERIPHERALS AND ANCILLARY EQUIPMENT

NORAM HP™ SADDLE PACKING FOR ACID TOWERS
NORAM SMART™ ACID DISTRIBUTORS FOR ACID TOWERS
NORAM TROUGH ACID DISTRIBUTORS FOR ACID TOWERS
NORAM SX™ CHIPGUARD CG™ ACID STRAINER
NORAM ENTRAINMENT MITIGATION DEVICE (EMD)
NORAM ACID DILUTION SYSTEMS
NORAM SX™ MATERIAL
NORAM SX™ ACID DISTRIBUTORS
NORAM SX™ PIPING
NORAM SX™ VALVES
NORAM GAS DUCTING
NORAM DAMPER
NORAM SULFUR GUNS

NORAM ENGINEERING AND CONSTRUCTORS LTD.

Suite #1800 – 200 Granville Street
Vancouver, British Columbia, Canada, V6C1S4
Tel: 604-681-2030 Fax: 604-683-9164
E-mail: acid@noram-eng.com Website: www.noram-eng.com