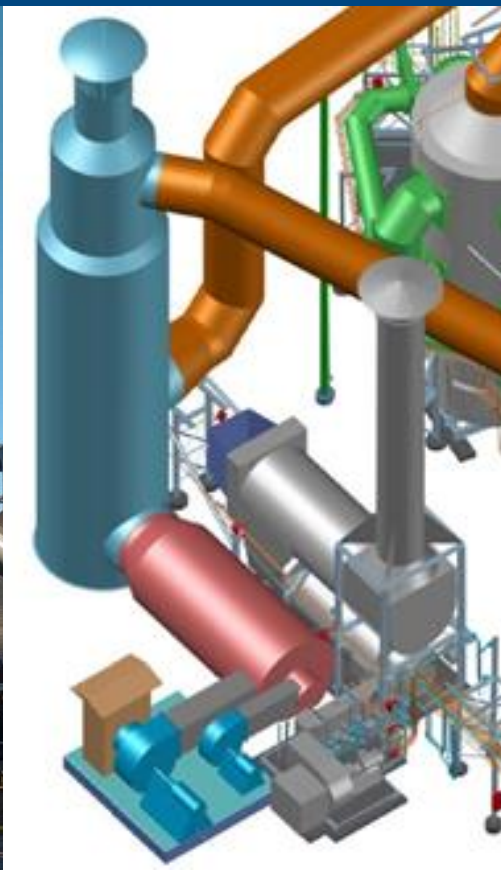


PLANT PREHEATING SYSTEMS



Using a dedicated **NORAM Plant Preheating Systems** for the initial start-up or to adjust the heat balance of a plant may be necessary to reach temperatures suitable for catalytic conversion and plant operation.

Preheating is required to prevent condensation of sulphuric acid on equipment, and heat input is necessary to maintain operation with low SO₂ gas concentrations. In the NORAM Preheating System, hydrocarbons are burned in a combustion chamber then delivered to gas-to-gas heat exchanger, which transfers heat into process gas as required.

NORAM Preheating Systems reduce the plant start-up time, lower maintenance and equipment costs, and are effective in reducing the SO₂ emissions to the environment during startup.

The preheat system can address the following challenges:

- High SO₂ stack emissions due to cold catalyst at start-up
- Difficulty heating the converter, particularly beds 3 and 4
- Preheater duty and gas flow limitations
- Low preheat gas temperature
- Long start-up times
- High maintenance requirements and reliability issues in equipment



NORAM Preheat System

Equipment Requirement

The key process equipment required for acid plant preheat systems are:

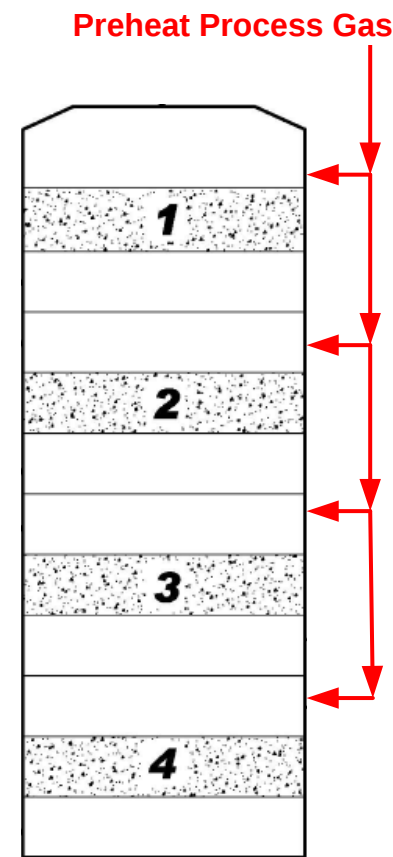
- Preheating furnace
- Preheat gas-to-gas heat exchanger
- Air fans
- Hot gas delivery system and controls

Preheating Furnace

The preheating furnace is the combustion chamber for burning hydrocarbon fuel. NORAM's Preheating System can be operated at 800 to 1000°C in the furnace outlet by using a proprietary design that lowers the metal temperature and protects the heat exchanger. Higher furnace gas temperatures result in higher energy recovery from the flue gas, lower fuel consumption, and may result in a smaller heat exchanger because of a higher LMTD.



NORAM Preheat System



Converter with heating at 4 locations

Preheat Gas-To-Gas Heat Exchanger

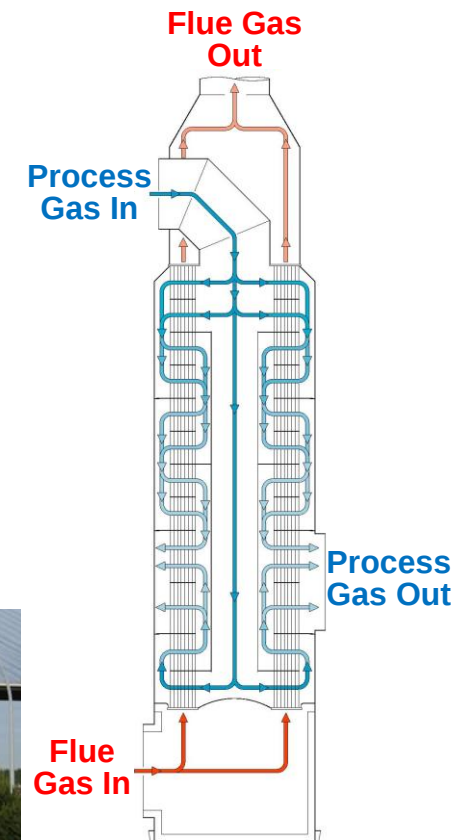
NORAM's RF™ Radial Flow SF™ Split Flow with Cold Sweep exchanger design can achieve higher heat transfer efficiency and even heat transfer through the equipment tubes. A portion of the cold gas is sent past the hot tubesheet to lower the tubesheet temperature which increases the overall fuel efficiency and results in a smaller and less expensive heat exchanger, preheat furnace, and air blower.

Hot Gas Delivery System and Controls

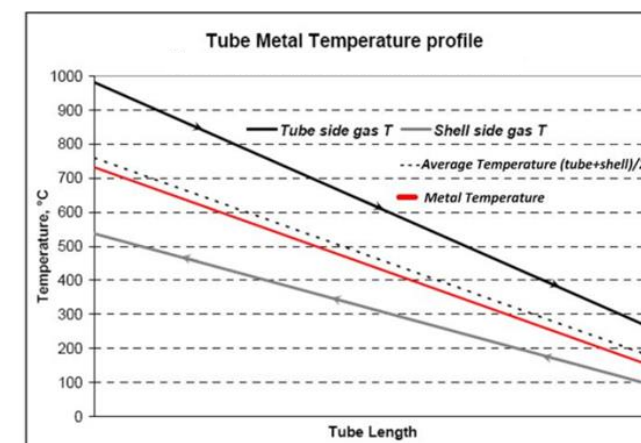
NORAM's Preheating System can feed hot process gas to all beds in parallel, which allows for higher catalyst bed temperatures in beds 2, 3 and 4, and the ability to start faster with a high conversion efficiency. It also allows an adjustable rate of heat to each bed independently to achieve the required temperature profile.



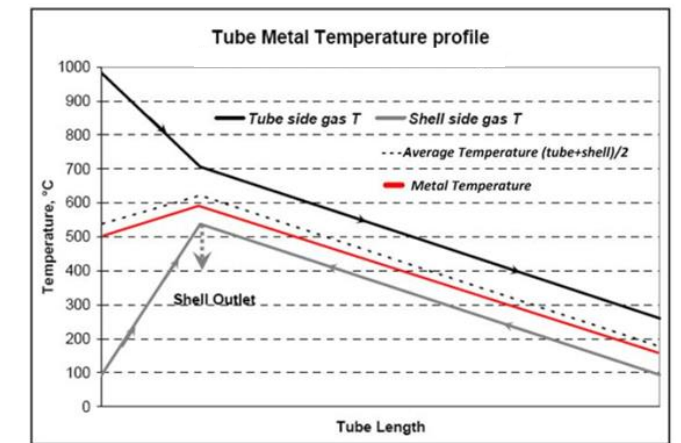
Preheat Exchanger



NORAM RF™ SF™ preheat exchanger



Typical Counter-Current preheat exchanger



NORAM RF™ SF™ preheat exchanger

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