

NORAM GAS DUCTING





With more than 25 years experience in designing ducting for sulfuric acid retrofit projects, NORAM has designed hundreds of ducting systems in sulfuric acid service. NORAM has experience in the design of the ducting segments and splice bands location to account for imprecision in location estimates which helps construction contractors have a better field fit-up. NORAM offers low pressure drop and corrosion resistance ducting at lower cost for the sulfuric acid industry.

Scope of Work

Design, fabrication, and supply of:

- Complete ducting system for new plants
- Retrofit ducts when replacing equipment •
- Replacement, repair and improvement of existing • ducting systems

Materials of Construction

- Carbon Steel (ASTM A516 Grade 70)
 - For gas stream temperature 70 850°F

- 1/4" - 3/8" thickness

- Nominal 1/8" corrosion allowance
- 304L Stainless Steel •
 - For gas stream temperature <380°F
 - 1/8" 1/4" thickness
 - No corrosion allowance required
- 304H Stainless Steel
 - For gas stream temperature 700 1250°F
 - 1/8" 3/8" thickness
 - No corrosion allowance required
 - High tensile yield strength
 - High carbon content gives the material
 - greater heat resistant gualities
 - Greater short and long term creep strength
- **Refractory Lined Carbon Steel** •
 - For gas stream temperature >1250°F
 - 3/8" or 1/2" thickness
 - No corrosion allowance required

Design Code and Standard

NORAM ducting follows the following design code and standards:

- ASME BPV VIII, div 1, B31.3
- EJMA

Features of NORAM Ducting

- Low pressure drop •
- Corrosion resistance
- Safety allows for thermal expansion •
- Manways and inspection ports for dampers/ • equipment



Sulfuric Acid Plant Ducting

Design Principles

Process

 Minimize pressure drops in designing routing, transition shapes, elbow types with aid of computational fluid dynamics (CFD) analysis

Mechanical

- Protect nozzle-to-vessel connections while maintaining the mechanical integrity
- Make best use of the mechanical strength of the • connecting equipment and spring support
- Use thick wall single or double convolution expansion joints for their versatility to handle axial, lateral and rotational movements, as well as durability and ease to repair

Ducting Design

NORAM uses these strategies to achieve low pressure drop across ducting:

- Sizing duct diameter up to 9' or higher
- Designing using gradual turning elbows R/D equal • to or less than 1
- Using "Y" instead of "T" for ducts connections •
- Ensuring gradual entrance to use all of the nozzle cross sectional area for transitions to nozzles



Ducting Design: Nozzle Connections

- Designing ducting to accommodate thermal • movement
- Using expansion joints to handle axial, lateral, and angular movement
- Minimizing number of expansion joints and tierods



Ducting Around a Converter

NORAM ENGINEERING AND CONSTRUCTORS LTD.

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SERVICE TO THE SULFURIC ACID INDUSTRY

NORAM GAS DUCTING

Design Tools

Various tools are used to analyze and optimize NORAM's ducting design, including:

- NORAM's proprietary Heat and Mass Balance
- 3D CAD software models for optimal layout •
- Computational Fluid Dynamics (CFD) ٠
- Finite Element Analysis (FEA)
- Caesar II

Expansion Joints

NORAM offers two designs for expansion joints:

1. Single Convolution

- Typically made out of 304 stainless steel
- 1/8" thickness
- Limited handle movement
- Easy to repair

2. Multiple Convolution

- Stainless steel or RA 253 material
- Thin walled, 1/16" 1/32"
- More handle movement
- Difficult to repair due to thin walls



Single Convolution

Multiple Convolution



Expansion Joints

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

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