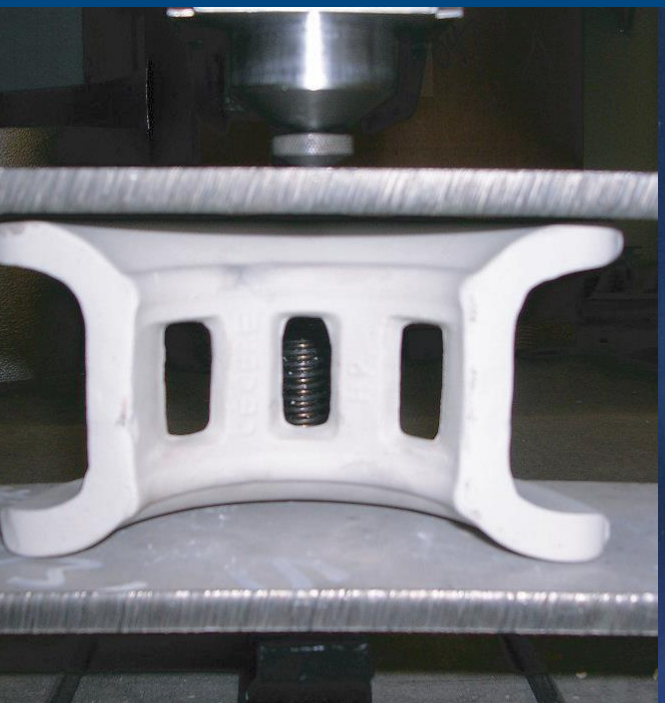
NORAM

SULFURIC ACID

Products and Services

NORAM HP™ SADDLE PACKING



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NORAM HP™ SADDLE PACKING

Uniform Shape

The NORAM HP™ (High Performance) Saddle Packing is made through a slip casting process which produces saddles of uniform shape within a narrow range of dimensional tolerances.

Accurate Prediction of Packing Volume Requirements

The uniform shape of the HP™ saddle and its low breakage rate result in an accurate measure of the number of saddles required to fill an acid tower. In all projects, NORAM warrants that sufficient packing will be provided to fill a tower to the required height.

Pressure drop predictions based on acid plant operating data

Correlations used by NORAM to predict and guarantee the pressure drop and the mass transfer efficiencies for NORAM HP™ Saddle Packing are based on data obtained from measurements made in operating acid plants.

High Capacity and Low Pressure Drop

NORAM HP™ Saddle Packing is ideally suited to debottleneck acid towers. It has a pressure drop which is typically half that of a conventional 3" saddle. The gas throughput in an existing acid tower can conservatively be raised by 25 percent.

High Mass Transfer Rates at Low Pressure Drop

NORAM HP™ Saddle Packing has the proven semi-toroidal saddle shape which provides random interlocking and uniform void space. This conventional shape has been modified to reduce pressure drop and promote mass transfer efficiency. Large apertures are provided at the hub of the saddle to break up the gas and acid streams, thereby reducing gas flow resistance and improving acid phase surface renewal for enhanced mass transfer. Notches at the edges of the saddle wings provide additional acid drip points and promote surface renewal. These modifications and a slight increase in the NORAM HP™ saddle size, relative to the standard 3" saddle, result in significantly reduced flow resistance. The height of the NORAM HP™ packing needed to achieve the necessary mass transfer efficiency remains the same as that of the conventional, lower-capacity 3" saddle.

Typical Chemical Composition

SiO_2	63-64%
Al_2O_3	30-31%
TiO_2	<1.0%
CaO	<0.5%
MgO	<0.5%
Na_2O	<2.5%
K_2O	<1.5%
Fe_2O_3	<1.0%

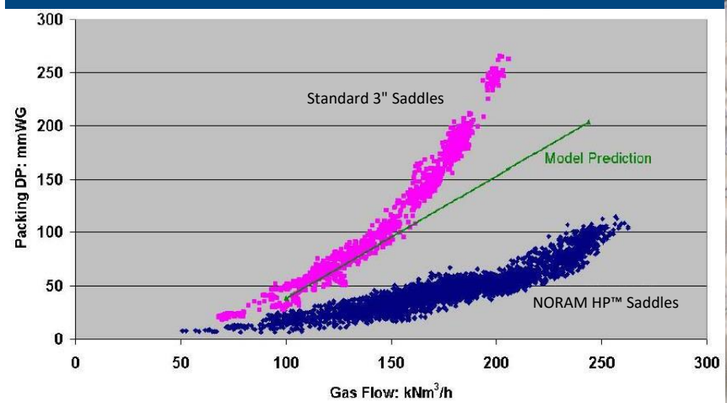
Physical Properties

Specific Gravity	2.30-2.45
Water Absorption, % (ASTM C373)	<0.1
Acid Resisting Property, % Weight Loss (ASTM 279)	<4.0
Porosity, % (ASTM C373)	<0.5
Weight per Saddle, (lb)	1.06-1.12
Crush Strength – Arch Position (lbf)	~2000
Crush Strength – Side Position (lbf)	~700

Performance Related Features

No. of Pieces per ft^3	36
Bulk Density, lb/ft^3	39
Specific Surface Area, ft^2/ft^3	20
Void Fraction, %	75
Shape Tolerance, %	± 1

Operating data Comparison of HP™ vs. Conventional Packing



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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

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