

MECS® SULFURIC ACID AND ENVIRONMENTAL TECHNOLOGIES



MECS® IS THE LEADING PROVIDER OF PROPRIETARY PROCESS TECHNOLOGY, SPECIALTY PRODUCTS AND TECHNICAL SERVICES TO THE GLOBAL SULFURIC ACID INDUSTRY.

MECS® has provided best-in-class sulfuric acid plant processes, clean technologies, and specialty products to a wide distribution of industries for over 80 years. Our proprietary solutions are engineered to perform and built to last.

MECS® is the global leader in sulfuric acid plant design and technology licensing for the phosphate fertilizer, oil refining, metal smelting, and numerous other industries. Our expert engineers apply the centuries of combined experience MECS® and DuPont have acquired in building over 1000 acid plants worldwide, as well as in producing and safely handling numerous compounds in our own facilities.

ENGINEERED TO PERFORM AND BUILT TO LAST

At the core of our technical expertise are our commitment to quality and our reputation for proven product innovation. Expert MECS® consultants can customize our technical services and proprietary technologies to achieve new performance gains for your organization. We can help you meet and exceed regulatory

requirements or solve crucial plant operating bottlenecks. Our solutions can help you increase process reliability and energy efficiency, even as you lower your operating and maintenance costs.

Our experts bring a practical approach to plant evaluations, troubleshooting, and new technology solutions. A high percentage of MECS® personnel—in process, design and solution engineering, as well as project and product management—have previous plant operating, maintenance and start-up experience. Our design engineering group features all the disciplines needed to create world-class process-related technology. To this end, we employ state-of-the-art tools such as 3D CAD and CFD. Backed by nearly 100 years of experience, our expert consultants can work closely with your team to analyze, recommend, engineer and implement a custom solution for your specific needs.

World-Leading Sulfuric Acid Plant Processes

MECS® has a long and successful history in providing proven and reliable solutions to the sulfuric acid industry. Our solutions feature breakthrough technologies, many of which have revolutionized performance, quality and cost-effectiveness for the sulfuric acid industry. We offer complete processes and plant designs for sulfur burning, metallurgy, spent acid recovery, and wet gas sulfuric acid recovery (SULFOX).

SULFOX Wet Gas Sulfuric Acid Recovery Process

The SULFOX wet gas sulfuric acid process is suitable for a wide range of applications in which wet waste gas, containing H_2S , CS_2 or SO_2 , must be desulfurized. Our expert engineers can deliver results for clients in a vast array of industries, including metallurgical, general chemical, coal gasification, coal-based fertilizer, natural gas processing, steel, power, viscose fibers, pigments production, and refinery and petro-chemical, among others.

Key Benefits to Your Organization

- Recovery of salable concentrated sulfuric acid
- Recovery of valuable high-pressure steam for concentrated H_2S feeds
- Guaranteed ultra-low acid mist emissions exceed the most stringent regulated values
- Low SO_2 emissions, custom-designed per local regulations
- Low operating costs
- Easy and safe equipment inspection and maintenance
- Reliable plant operation

DynaWave® Wet Gas Scrubbers

DynaWave® is the only wet gas scrubbing process that can use a variety of reagents and accomplish multiple functions—including SO_2 acid gas absorption, quenching, particulate removal, and oxidation—all in one scrubber. A unique, high-performance environmental technology, DynaWave® has been implemented by MECS® in over 300 solutions worldwide, in various industries.

Most industry applications require a wet gas scrubber to perform two or more of the following functions.

1. Quench incoming gas
2. Remove acid gases
3. Oxidize sulfites to sulfates
4. Eliminate particulate matter

In many conventional scrubbers or simple caustic scrubbers, each function occurs in a different area of the vessel, or outside the scrubber altogether. The DynaWave® Wet Gas Scrubber is different from conventional scrubbers in that it handles all four of these functions in the same vessel. Three of the functions take place in a unique area known as the *Froth Zone*. The fourth function, oxidation, is achieved in situ in the vessel sump. No other scrubber is capable of this performance.

Our straightforward approach reduces both capital and operating costs. Most importantly, it allows for minimal equipment inside the vessel, making DynaWave® an extremely reliable and low-maintenance scrubber.

Brink® Mist Eliminators

MECS® offers the industry's broadest range of products designed to remove virtually any type of mist from any gas stream, including elusive submicron-sized aerosol mists. Thousands of our systems have been installed in hundreds of applications: from sulfuric acid to asphalt manufacturing, plastic extrusions, metalworking, and beyond.

From the invention of Brink® Fiber Bed Mist Eliminators in 1958, MECS® has set the standard for offering the widest array of designs and materials in mist eliminators worldwide. Today, we meet the needs of global clients in a broad range of industries, from sulfuric acid to asphalt manufacturing, plastic extrusion, metalworking, and many other industries. Brink® Fiber Bed Mist Eliminators feature the latest technology, to effectively remove fine aerosol mists, submicron oil smoke, and soluble solids from process gas streams and stack effluents. Our solutions protect valuable downstream equipment, optimize operations, and minimize environmental impact, while delivering the highest efficiency, lowest pressure drop, and longest effective life available today.

Brink® mist elimination solutions for over 300 applications have been installed in over 5000 facilities around the globe. Our engineers can help your organization select and optimize a Brink® solution for your application needs, whether you wish to improve process equipment design, operation, and product quality, or seek to reduce stack opacity to avoid environmental citations.

Brink® AutoDrain™ Fiber Beds for Sulfuric Acid Plants

New from MECS® is Brink® AutoDrain™ providing effective draining of acid from Brink® mist eliminators without the use of expensive and complex seal leg piping systems.

For new installations, Brink® AutoDrain™ offers a significant initial cost reduction and life cycle maintenance cost and a shortened project schedule. Additional value can be realized by eliminating the

hanging mist eliminator seal system design: deletion of stainless steel piping, reduced field labor for installation, enhanced safety and no need for future seal system inspection or maintenance repairs. In addition, plate and vessel savings from a smaller diameter tower design may be realized, should that option be pursued.

For existing plants, all of the benefits noted above can be realized, except the option for smaller tower design. In addition, for new Brink® element replacement in existing facilities, the extra height available can allow for longer functional process length on the Brink® AutoDrain™ elements, resulting in de-bottlenecking opportunities. Lower pressure drop and/or increased plant rates may be realized. Fast track turnarounds can be achieved due to less field work required.

For retrofits/re-packs, the same benefits noted for existing plants can be realized. Modification to element screen cages and the addition of proprietary embedded drainage devices will be installed to incorporate the Brink® AutoDrain™ design during an element re-pack. The retrofit elements will operate like new Brink® AutoDrain™ mist eliminators without the need for filling seal cups, materials and labor for seal cups and/or drain piping.

Brink® eXtra Performance XP™

Following a decade of research and over 5 years of commercial acid plant experience, MECS® now designs and builds the eXtra Performance XP™ for all acid towers. The eXtra Performance offers the lowest pressure drop available in one to one match-ups when compared to other elements. The pressure drop per XP element is 1/3 less than a typical element of the same size and efficiency. As a result, a sulfuric acid plant may use up to one third fewer filter elements at the same delta P, and fewer filter elements means lower life-cycle maintenance costs. New installations can benefit from lower initial capital cost due to smaller vessel size



and footprint. New installations may also benefit from using standard design vessel sizes with element blank offs for future expansion capability.

Innovative Heat Exchange Technologies

MECS® gas-to-gas heat exchangers offer one of the most efficient means on the market for recovering heat from energy-consuming applications in a wide range of industries. Both our fully welded plate and non-welded "floating" plate units have delivered results in sulfuric acid plant, fertilizer, refining, non-ferrous metals, general chemicals, and coal gasification installations, as well as many others.

All MECS® gas-to-gas heat exchangers feature a compact, modular design and long service life. The units are shop-fabricated to ensure quality, and trucked as individual blocks or complete modules. With their compact size and weight, installation and field setup are much simpler than with conventional shell and tube heat exchangers.

MECS® gas-to-gas heat exchangers are available in both cross-flow and counter-flow configurations. Our modular approach enables us to offer one of the most flexible and efficient flow arrangements available, as well as the flexibility to expand to accommodate future increases in capacity. This modular approach also enables significant design and operational customization, including the freedom to select distinct materials of construction for each heat transfer zone. Each module can be fabricated from a variety of heavy-gauge carbon steel and stainless steel plates, including COR-TEN®, 304L, 316L, and 309S. Heavy-duty MECS® gas-to-gas heat exchangers, built with robust materials, can deliver reliable and efficient performance in the most demanding, corrosive, and high-temperature applications, up to 1500 °F (816 °C).

Heat Recovery System

The MECS® Heat Recovery System is a proven technology that is well positioned for today's value, energy and environmentally conscious world and few industrial process investments can both save money plus reduce greenhouse gases. The MECS® HRS captures and re-uses waste heat from the sulfuric acid process and converts it to medium pressure steam. In addition to producing

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electricity in turbine-generators, for sale or use, the HRS supplemental steam may be utilized within the process, in the plant proper and adjacent facilities with no net consumption of fossil fuel or energy.

The newest breakthrough is the SteaMax HRS™ System. It provides for a significant increase in medium pressure steam, adding to the flexibility of the steam's use and customization for site specific energy requirements and other local conditions. When the unit cost for energy is high, and if the local requirements for steam are met, commercial opportunities for production of electricity can provide electrical grid offsets or a revenue stream from the sale of the electrical energy. Sulfuric acid plants throughout the world can utilize and profit from the recovered heat and enhanced steam generation provided by the MECS® SteaMax HRS™ System.

Engineered Alloy Products

We revolutionized the sulfuric acid industry with a full line of corrosion-resistant equipment in our cost-effective ZeCor® family of alloys, exclusively available from MECS®. All of our specialty products, from high-performance alloys to innovative tower packing, join distinctive materials with MECS® process and design expertise, to deliver solutions that keep plants operating safely and smoothly.

Controlling corrosion in sulfuric acid equipment ranks among the top concerns of every acid plant owner. MECS® ZeCor® products apply our decades of acid plant experience and technology innovation to solve the problem of corrosion. The superiority of our designs resides in our attention to fine details and our quality fabrication. The superiority of our performance lies in our exclusive ZeCor® alloys. This unique line of specialty metal alloys is proven to provide long-lasting resistance to corrosion and durable service against the unforgiving abuse of sulfuric acid.

ZeCor® replacement parts and sulfuric acid plant equipment help our clients quickly and cost-effectively strengthen weak links. We offer a complete line of ZeCor®-fabricated major components and accessories.

- Nozzle assemblies or sleeves are available in ZeCor®-Z, ZeCor®-310M and ZeCor®-C to repair damage and significantly reduce the safety hazards of acid leaks.
- Inline Strainers are available, as well as side and bottom Outlet Nozzles with Vortex Breakers.
- Packing Support Grids in ZeCor®-Z and ZeCor®-310M are designed with more than 80% open flow area, resulting in excellent gas distribution, and can replace ceramic grid bars and locks.
- Prefabricated Grating makes handling and installation easier, while providing enhanced performance over ceramic systems.
- TowerGARD® Mesh Pads offer outstanding mesh pad mist elimination with a longer service life.
- UniFlo® Acid Distributors ensure uniform acid distribution and less pressure drop.
- Towers and Pump Tanks can be shop-fabricated prior to plant shutdown, and staged on site for insertion of UniFlo® Acid Distributors, Brink® Mist Eliminators, and tower packing such as WavePak™, which dramatically increases efficiency.
- Piping Systems and Fittings come standard or custom-fabricated in various sizes, to quickly and cost-effectively upgrade or repair acid piping systems.
- Replacement Acid Cooler parts and our FILMGARD® 5 system can upgrade any existing anodic protection (AP) acid coolers with a common, centrally controlled system that monitors up to three coolers with one operator interface.

High-Performance Catalyst for Sulfuric Acid Plant Applications

High quality MECS® catalyst, derived from our research and development efforts, balance and optimize the key attributes of activity, pressure drop, hardness, and service life. MECS® has the complete technical expertise, proven catalyst performance, and overall sulfuric acid plant production knowledge to specify the

proper type of catalyst to maximize value for your sulfuric acid plant.

High-Performance GEAR™ Series

Our latest catalysts feature a hexa-lobed ring shape and higher activity to reduce pressure drop and improve performance. The GEAR™ Series' distinctive design helps increase energy savings, extend operating time, boost acid production, and reduce overall plant SO₂ emissions.

This innovative sulfuric acid catalyst is characterized by its:

- Geometrically optimized shape
- Enhanced surface area
- Activity improvement
- Reduced pressure drop

Designated as GR-330 and GR-310, GEAR™ catalysts allow interchangeable use in all passes of the converter. GR-330 is produced in a 13 mm diameter size, while GR-310 is 12 mm in diameter.

Extended Surface Area — XLP Series

Our XLP Series enables low pressure drop and high conversion performance in all beds of the converter. XLP catalyst is the industry standard in sulfuric acid plants today.

Rings — LP Series

This series offers moderate pressure drop and high activity.

Pellet Type

Our pellet design is ideal for low gas velocity converters and applications where maximum durability is required for lower screening losses.

Cesium Promoted

This catalyst series enables low plant stack emissions and lower ignition temperatures for faster plant start-ups.

Sulfuric Acid Plant Services and Solutions

Whether you're considering an acid plant expansion, or seek to improve plant reliability or optimize plant operation, our Global Engineered Solutions (GES) professionals are an integral extension of the MECS® sulfuric acid technology teams. Backed by over two centuries of combined experience, the design and construction of over 1000 acid plants, and the current operation and ownership of ten acid plants, DuPont and MECS® bring real-life, proven solutions to your facility.



GES offers operational consulting and equipment designs, supplies, and repairs focused on reliability, operability, the environment, and safety. Our experts can help your sulfuric acid facility with everything from throughput and yield optimization to uptime and reliability improvements. We offer turnaround, revamp and troubleshooting services, as well as mechanical integrity assessments, process-critical equipment replacements, process troubleshooting, energy optimization, capital project effectiveness, safety assessments, operator training, and more.

Our comprehensive consulting programs are designed to follow a progressive three-phased approach, improving your organization's performance and maximizing asset utilization until world-class performance is obtained. Our team works with you every step of the way to sustain and build on your gains. We can help your unit operations to quickly start realizing these benefits:

- Step-change improvements in acid plant reliability and uptime
- Significant reductions in annual maintenance and capital expenses
- Reduction of sulfur oxide (SOx) and nitrogen oxide (NOx) emissions

Consulting services for sulfuric acid plants and acid handling systems

- Turnaround consulting, planning and management
- Commissioning support
- Mechanical integrity assessments
- Acid plant design, performance and reliability studies
- Acid handling, storage, and transfer systems design and performance reviews
- HAZOP and troubleshooting services
- Startup and shutdown consulting

Process-critical equipment design, supply and repair

- Proprietary equipment supply and repair
- Specialized instrumentation and analyzers
- Alloy valves and acid gas damper valves
- Steaming equipment and boiler ferrules
- Plate heat exchangers
- Burners and burner management systems (BMS)
- Specialized pumps, hoses, expansion joints, bellows, and tower internals

Training products, services and solutions

- Operator training simulators programmed with real-life scenarios
- Interactive training sessions
- Customized training programs



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