



Chemineer

Reliability & Technology
in Mixing

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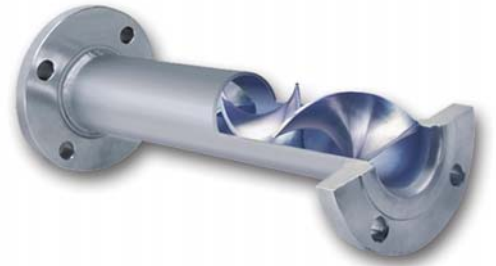
Fluid Management Group

Bringing You Excellence in Mixing Equipment

Chemineer is a supplier of mixing solutions and products to customers in a variety of industries throughout the world.

Founded in 1952, the Chemineer name has come to be known in many markets including chemical & petrochemical, polymers, food & beverage, pharmaceutical, water treatment, FGD/energy, biotechnology, agricultural processing, mineral processing, and pulp & paper.

Chemineer distinguishes itself from competitors with its pioneering spirit, technological innovations, and willingness to partner with customers on mixer solutions. Chemineer's fluid mixing knowledge, supported by the best application software, proprietary mixer designs, and state-of-the-art laboratory, allows it to be the preferred supplier of fluid mixing equipment.



Chemineer's leadership position among mixer suppliers is demonstrated by the way it has revolutionized the agitation industry over the years. The following list describes some of Chemineer's pioneering events:

- The first static mixer – Kenics
- The first to use Particle Image Velocimetry (PIV) and Computational Fluid Mixing (CFM) to visualize flow patterns
- The first expert design software – AgDesign, AgDraw, AgOrder, Maestro, SM Design and AgSolver
- The first high-efficiency gas dispersion impellers – CD-6, BT-6
- The first non-rotating mixers – Nimix and Clean Sweep
- The first manufacturer to produce a gear-box specifically designed for the mixing industry
- Developed ChemScale® to educate the industry and publish to users

Customers look to Chemineer to solve their mixing challenges. The key to Chemineer's success is the belief that business prospers as a result of good customer service. The commitment to quality, service and timely response has earned Chemineer the right to participate in its customers' business.



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What Does Chemineer Offer?

Reliability

Chemineer has been at the forefront of the mixing industry since 1952. Many of the original gearboxes are still in service today. Chemineer is recognized for producing dependable, heavy-duty equipment. As a member of American Gear Manufacturers Association (AGMA), Chemineer is known to have time-trusted reliability. If assistance is ever needed with your mixing equipment, Chemineer has a well-trained field service staff and multiple service centers available throughout the world to assist with any mixing problem. Chemineer's aftermarket services are designed to solve any problem that may arise on short notice.

Diversity

Chemineer offers a wide range of gearboxes, impellers, seals and more to meet the requirements of any application. Chemineer has a combination of heavy duty and small top-entry mixers with parallel or right angle shafts, direct drive or gear reduced. Chemineer is more than just rotating agitators. Brand names include Kenics, Greerco and Prochem. Kenics offers a wide variety of static mixers and heat exchangers. Greerco offers many high shear products including pipeline mixers, colloid mills and homogenizers. Prochem offers belt-driven side- and top-entry mixers suitable for many applications. Chemineer has facilities around the world, with locations in Ohio, Massachusetts, Canada, England, Singapore, China, Mexico, India and representatives covering territories throughout the world.

Flexibility

Does your process require a customized solution? Let our experienced Application Engineering Team design the equipment to

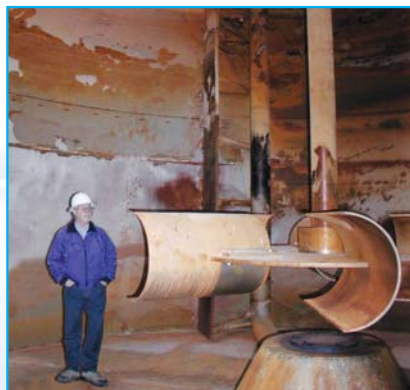
enhance your process. Chemineer offers many standard options, and also has the ability to modify our equipment to meet your specific needs. With over 50 years of agitation experience, Chemineer can customize a solution for any mixing application.

Technology

Chemineer uses the latest in data evaluation and mixing research to provide customers with the proper equipment. Computational Fluid Dynamics (CFD), Laser Doppler Anemometry (LDA), Laser Induced Fluorescence (LIF) and Digital Particle Image Velocimetry (DPIV) assist Chemineer engineers to better predict the performance of any mixing process. Chemineer uses a state-of-the-art on site laboratory to develop proper agitation systems for even the most complex processes.

Innovation

Chemineer application engineers and representatives use technologically advanced software to design a customized mixing solution for every process. The Chemineer website, **www.chemineer.com**, provides customers with direct access to the entire Chemineer product line, the latest in mixing technology, and easy-to-use design tools. Our company does not merely sell fluid mixing equipment, Chemineer sells process solutions and answers to suit all of your needs. We want our customers to walk away understanding WHY our equipment and mixing solutions are the best in the industry!





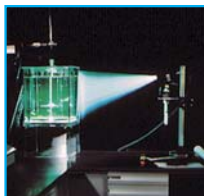
Technology

Digital Particle Image Velocimetry (DPIV)

DPIV keeps Chemineer on the forefront of mixing technology. DPIV uses an Argon-Ion laser light to illuminate neutrally-buoyant fluorescent particles.

The result is a visual description of the agitated system, allowing engineers to see the actual flow patterns within the system. When used

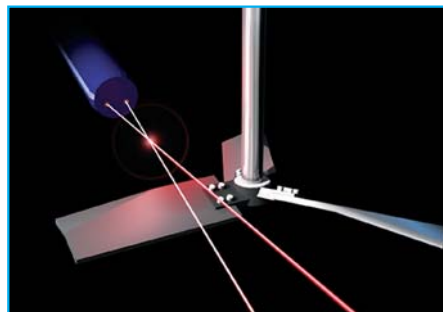
in conjunction with Computational Fluid Mixing, DPIV provides the most accurate application evaluation possible.



Laser Doppler Anemometry (LDA)

LDA is recognized as the best method of non-intrusively measuring mean velocity and turbulence data with pinpoint accuracy.

Chemineer uses LDA measurements to verify experimental ChemScale values as well as illustrate the flow pattern generated in multi-impeller systems.

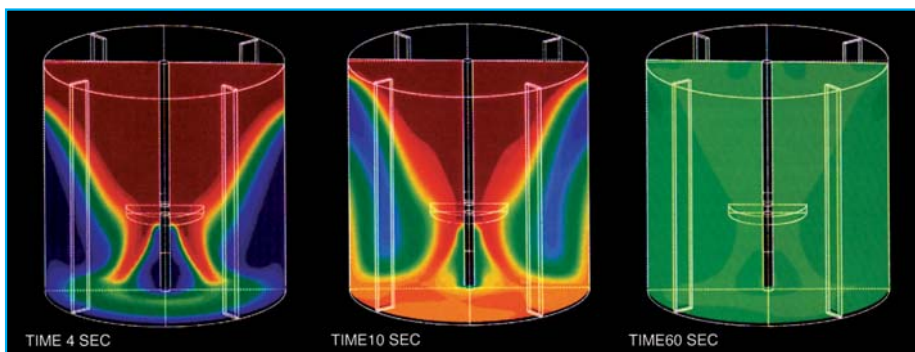


Computational Fluid Mixing (CFM)

CFM is a powerful fluid flow modeling tool that provides visual analysis of agitated systems. CFM uses mathematical fluid flow models to analyze blending and motion, solids-suspension, chemical reaction and heat transfer processes.

Our application engineers can produce 2-dimensional CFM simulations for rectangular

and cylindrical tanks as well as turbulent and laminar flow static mixers. Three-dimensional CFMs can be designed for non-symmetrical applications such as multi-reaction designs. The Chemineer Expert Design System (CEDS) can produce CFM simulations in as little as ten minutes.



Design Tools and Lab Capabilities

Chemineer R&D Lab

The Chemineer R&D Laboratory is located next door to our Dayton manufacturing facility. Our laboratory provides research and development support as well as application-specific customer testing.

Customer Test Facility

Many applications require a more in-depth analysis of the fluid mixing challenge. Chemineer provides a dedicated customer-testing center inside its R&D facility. This center has the capability to scale down a process and model it with Chemineer agitators and mixers, as well as custom agitator systems.



The Chemineer test facility has a wide variety of tank geometries and sizes available, along with Chemineer's full line of impellers, high shear products, and static mixers.

R&D Facility

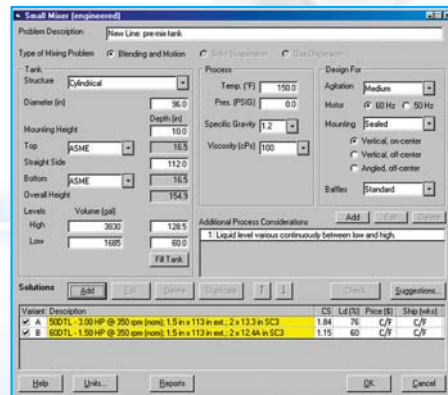
The Chemineer Research and Development facility strives to keep Chemineer at the forefront of mixing technology. Laboratory and research studies are used to enhance the Chemineer Expert Design System (CEDS) to provide continuous improvements to existing designs, to develop new products and application solutions, and to improve your process results. Our cutting edge technical research is presented at mixing seminars and conferences throughout the world.

This facility also provides development and support for new products, including the Maxflo WSE impeller and KMX static mixer.

Chemineer Expert Design System (CEDS)

Chemineer's design program consolidates fluid-flow system design and mechanical agitator design into one program. Chemineer treats every single inquiry as a unique application. Our revolutionary software gives your local Chemineer representative the power to simultaneously evaluate your process, propose a mixing solution, and verify the mechanical integrity of the design with a single program.

Chemineer applies CEDS, CFM, LDA, and DPIV to consistently improve our product line and application design procedure. The result is a more efficient, reliable, and economical mixing solution that is backed by years of experience.





Manufacturing Capabilities

Chemineer takes pride that it is the only mixing company that designs and manufactures its own gearbox specifically suited for mixing applications. Chemineer has earned the reputation over the years for its expertise in process design and wet end technology. Those components coupled with the gearbox form the basis for the production of quality, durable and reliable agitators, which are the trademark of Chemineer equipment.

Chemineer manufacturing locations are strategically located to support the four brands Chemineer produces:

- Dayton, Ohio is Chemineer's flagship factory. The Chemineer brand of top- and side-entering agitators is produced at this location, along with the Prochem belt driven side-entering mixers which are widely used and well accepted as the premier mixer for the pulp & paper market.
- North Andover, Mass. manufactures the Kenics and Greerco brands. In this location the Kenics static mixers, Kenics heat exchangers and the Greerco high shear mixers are designed and manufactured.
- Derby, England is the location of the European manufacturing facility. In this location all Chemineer brands are produced and distributed to customers in Europe, the Middle East and Africa.

Chemineer's high quality standards are enforced at all of our manufacturing facilities. Chemineer's reliability and technology is achieved and maintained through the following programs:

- Quality assurance provides formal written procedures that guide the manufacturing processes
- Standard industry practices are employed to assure compliance with customer's specifications
- Material inspection and vendor qualification are in place to eliminate defects and rework
- NC machining is utilized for precise fit and tolerance
- Each gear drive is mechanically run and dimensionally checked before shipment



Parts and Aftermarket Services

Chemineer offers an extensive aftermarket program designed to extend the service life of mixing equipment. Built upon an extensive inventory for all Chemineer, Prochem and Greerco replacement parts, the Chemineer aftermarket program assures exceptional support.

Chemineer has an extensive network of well-trained, professional field service engineers that are highly skilled in the design, operation and installation of our agitators. The field service engineers are backed by application engineers and aftermarket specialists to provide superior service as well as a force of over 50 representative companies.

Chemineer has developed an Emergency Service program that consists of a network of skilled in-field and in-plant aftermarket service professionals to respond to an emergency 24 hours a day. We know just how critical downtime can be to your operations and we've responded by developing an inventory system that assures the availability of critical parts. Stocked parts can be shipped within 24 hours and custom replacement parts can be shipped in 3 to 5 days to ensure that downtime is minimal. For an after-hours emergency, call **(937) 229-8756**.

Chemineer has established Authorized Service Centers throughout the United States and Canada, keeping service capabilities close to you. We also offer technical seminars in facilities using hands-on demonstrations to train personnel in the latest technologies and techniques.

Chemineer currently has service centers located in Pennsylvania, Ohio, Texas, North

Carolina, California, Georgia, Alabama, Tennessee and New Hampshire, with more on the way.

Chemineer provides a Refurbished Mixer Gearbox replacement program that allows you to trade in your worn out gearbox for a high quality refurbished gearbox, quickly and economically. Chemineer guarantees a fast delivery on HT gearboxes, sizes 1 to 9. Gearboxes are refurbished in-house to meet Chemineer and AGMA standards.

Chemineer will accept a trade in of a worn out gearbox from any original mixer manufacturer, will retrofit our gearbox to the existing wetted parts, and will provide a warranty against material defects and workmanship on the replacement drive. We will also give you a credit toward the purchase of any refurbished gearbox upon returning your old gearbox. For more information see the Aftermarket bulletin #728.



Application Capabilities

Chemineer has compiled extensive experience in mixing applications over the past 50+ years. A few brief examples of ways Chemineer uses our experience in mixing are listed here.

Chemicals

Chemineer has designed agitators in thousands of different Chemical Process applications over the past 50 years. This experience along with our advanced design programs allow us to effectively size equipment in any application. With dozens of alloys available for use as wetted parts, and a large variety of sealing options, our agitators can be adapted to work with nearly any process. Continuing advancements allow us to stay ahead of the competition. For instance, the SC-3 impeller provides a compact design that produces the same flow characteristics as much larger impellers, reducing capital cost.

Water Treatment

Chemineer is able to offer both rotating and static mixers for water treatment applications. As a company, we can supply an entire package using a combination of these different style mixers that will give the most efficient design and effective results. Also, Chemineer

can easily modify the standard gearbox or impeller to offer unique designs such as an up pumping application.

Pulp and Paper

Chemineer uses a thorough, specific, design process for all applications in the Pulp & Paper industry using the basis of a process number. Chemineer's process number design method has proven to efficiently size our agitators for complex pulp & paper applications. Chemineer/Prochem can offer belt or gear driven side-entry or top-entry alternatives. Chemineer has recently developed the Maxflo WSE impeller that has the highest efficiency of any side-entry impeller on the market. Using the Maxflo WSE will lower capital and operating costs for the customer because it draws less horsepower than the competition's designs.

Aerobic Fermentation

Chemineer has a long history of designing agitators for Fermentation and we remain the leader in this industry through our technology. The most critical mixing step in Fermentation is the rate of gas dispersion. Chemineer designs mixers to give the required level of dispersion by properly sizing our dispersion impellers. The combination of using the BT-6 and Maxflo W impellers puts Chemineer ahead of the competition. The BT-6 has nearly six times the gas handling capabilities of many popular gas dispersion impellers. The Maxflo W is the ultimate complement to the BT-6 because the design of this hydrofoil impeller provides high pumping characteristics while still maintaining excellent dispersion capabilities.



FGD

Gas dispersion is extremely important in SO₂ removal and oxidation processes. Chemineer's vast installation base in FGD and gas-phase chemical reactors provides a wide array of experience in all industries pertaining to gas dispersion. This leads to a more efficient and more reliable process solution to any oxidation system. Chemineer solids-suspension procedures, based on particle settling velocities, are second-to-none in the mixer industry.

Top-entering designs typically feature the HE-3 impeller, which provides high-efficiency agitation with the larger impeller diameter to tank diameter ratios required for high solids concentrations. Side-entry applications are an equally reliable alternative to top-entering designs in slurry storage tanks and absorber towers. Chemineer uses a proprietary, slurry lubricated mechanical seal with exposed seal elements to eliminate flushing requirements. The shaft retract feature and seal shutoff system in Chemineer's side-entry mixer minimizes downtime for seal replacement and drive maintenance. The Maxflo WSE-3 side-entry impeller is a leader in the industry for gas dispersion in side-entry applications and generates the high flow required to effectively suspend solids in any application.



Biopharma

Chemineer's Biopharma products are suited to work in the most sterile environments. Highly polished wet ends and debris catching mechanical seals are provided on most applications. Steam-in-place and clean-in-place capabilities can be provided as standard options as well as FDA approved mechanical seal components.

The most critical component to certifying your process lies in the documentation package submitted with purchased equipment. Chemineer's pharmaceutical submittal package is structured around the ASME BPE 2002 code to meet all necessary requirements. This equipment turnover package includes material certifications, elastomer and seal component certifications, polishing test reports, quality assurance testing and more — everything you need to certify your new mixer!

Impellers

Impeller Type	Impeller Characteristics		Impeller Applications				
	Shear	Pumping	Blending & Motion	Gas Dispersion	Solids Suspension	Immiscible Fluids	Viscous Blending
SC-3	low	high, axial	X	—	X	—	—
HE-3	low	high, axial	X	—	X	—	—
XE-3	low	high, axial	X	—	X	—	—
JF-3	low	high, axial	X	—	X	—	—
Maxflo W	low	high, axial	X	X	X	—	X
Propeller	low	high, axial	X	—	X	—	—
P-4	moderate	moderate, radial/axial	X	X	X	X	X
S-4	moderate	low, radial	X	—	X	X	X
Maxflo WSE	low	high, axial	X	—	X	—	—
HE-3S	low	high, axial	X	—	X	—	—
BT-6	moderate	low, radial	—	X	—	X	—
CD-6	moderate	low, radial	—	X	—	X	—
D-6	moderate	low, radial	—	X	—	X	—
ChemShear	high	low, radial	—	—	—	X	—
Double Helical Ribbon	high	moderate, axial/radial	—	—	—	X	X
Anchor	high	low, radial	—	—	—	—	X
Screw (Auger)	high	low, radial	—	—	—	X	X
Dispersion Blade	high	low, radial	—	—	—	X	—
Greerco Rotor/Stator	high	low, radial	X	—	—	X	—

For more information see the Impeller bulletin #710.



Rotor and Stator



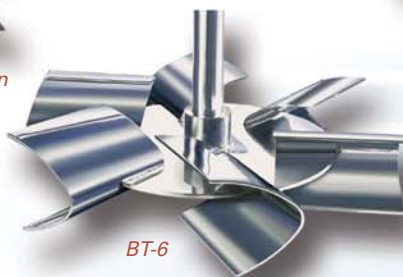
Double Helical Ribbon



XE-3



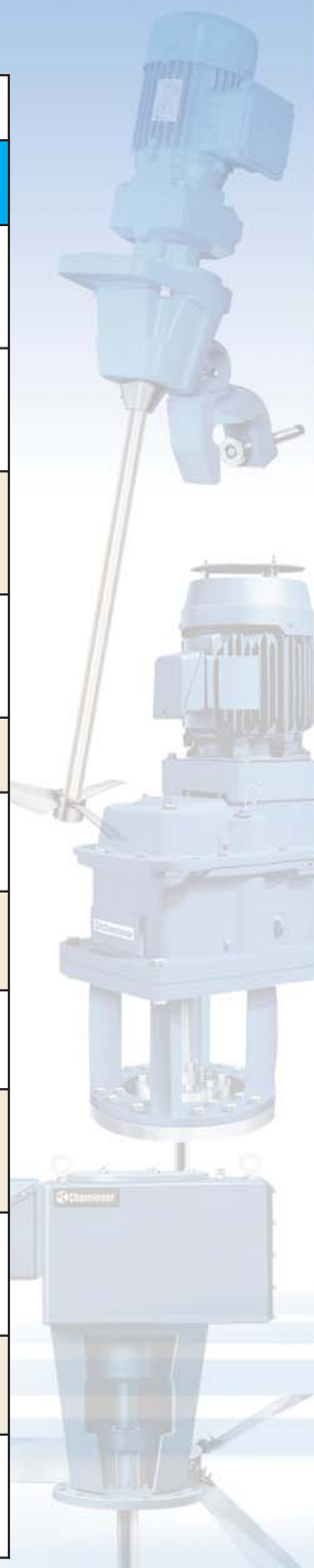
SC-3



BT-6

Products

Chemineer® Products	Features	Benefits	Bulletin Number
Model 20 HT/GT	Top-entering right angle or parallel shaft, wide range of speeds, optimized gear design, quick and easy seal change with swing-out design, reversible rotation, dry well seal	Versatile, modular design to meet wide range of application requirements; cast gearbox with heavy duty output shaft and bearings for reliable performance and long life	705
HT/HTM	Right angle or parallel drive, helical and spiral bevel gearing, wide variety of sealing methods, extreme longevity, high versatility	Robust, simple and designed for ease of maintenance. Available in 13 standard drive sizes from 1 to over 1,000 hp	711/740
HB	Bottom entering with helical and spiral bevel gearing, stuffing boxes or mechanical seals, extreme longevity, high versatility	Robust, simple and designed for ease of maintenance. Available in 13 standard drive sizes from 1 to over 1,000 hp	711
GT	Enhanced cost-efficiency and performance embodied in an advanced parallel shaft design while maintaining maximum reliability	The double and triple reduction configurations allow for a wide variety of speeds at low overall operating costs	706
QED^{Plus}™	Combines quality, economy and durability for unbeatable mixing value	Can handle a wide variety of speeds and impellers at a low cost	722
MR	Combines quality, economy and durability	Can be mounted directly onto the support beams, or with an optional square base plate	720
VL/VM/VH	Medium to large scale direct drive units designed to run at high speeds and produce high shear	Various speed and sealing options available	—
DT/XP	Small mixers with right angle or parallel shaft, direct drive or gear driven versions available	Capable of clamp, pedestal or beam mounting, as well as five distinct types of sealing options	709
BT	Sanitary mixers that offer a variety of design configurations, materials and options needed to meet critical sanitary mixing applications	Right angle and parallel shaft drives as well as an option for a bottom entering design allows this unit to fit with any tank	723
HS	Right-angle drive exclusively engineered for side-entering agitator service, includes Chemineer's standard ruggedness and dependability	Works efficiently when a tank is too large for installation of a top-entering agitator and includes an in-tank shut-off to ease seal maintenance	707
IBC (metric unit)	These unique industrial agitators are designed for use with 1000/800 liter plastic transportable (IBC) containers	Suitable for various applications including blending light viscous liquid, re-suspension of settled solids and dissolution of powders	709E
NIMIX	Unique range of low shear, high solids-loading used for both the manufacture and transportation of a range of fluids	The bottom-to-top mixing flow provides excellent solids suspension with rapid homogenization in a sealed environment, without shafts or seals	727

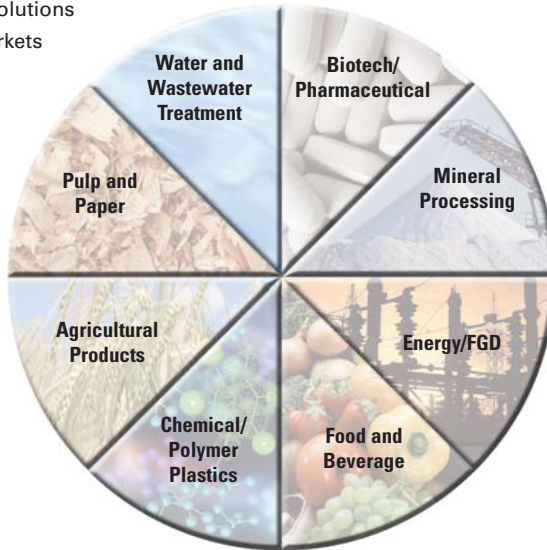


Products			
Greerco® Products	Features	Benefits	Bulletin Number
Colloid Mill	Available in vertical or horizontal mounting positions, these high shear mixers are ideal for batch, batch-continuous or in-line applications	The most versatile line of colloid mills in the industry allows the user to easily modify the shear rate on the fly to achieve the desired process results. Rentals available	121
Homogenizer	High-speed, high-shear batch mixers ideal for fast blending and homogenizing of materials through a wide range of viscosities	Low horsepower requirements, high throughput and a robust design make this unit a cost effective solution for processes requiring high shear, in-tank mixing. Rentals available	123
Pipeline Mixer	Designed for in-line continuous high-speed, high-shear homogenizing, mixing, emulsifying and rapid dispersing	Offers several mixing heads, each having the ability to handle a range of mixing applications. Rentals available	122
Kenics® Products	Features	Benefits	Bulletin Number
KM Static Mixer	Alternating helical elements induce radial mixing, momentum changes and flow splitting, making this mixer suitable for a wide variety of mixing and dispersion applications. Industrial and sanitary versions are available	Over 30 years of installations and detailed design capabilities allow us to offer guaranteed mixing results with minimal pressure drop	800
HEV	The patented tab geometry creates multiple counter-rotating vortices that produce cross-stream mixing and rapid uniformity. Can be designed for virtually any geometry pipe, duct and open-channel requirements	The HEV offers the lowest pressure drop per degree of mixing of any static mixer available. This is the ideal mixer for low viscosity liquid or gas blending applications	811
KMX	Cross-stream mixing and flow splitting allow the unit to handle difficult mixing applications. This patented design easily handles extreme viscosity and volumetric ratios within the laminar flow regime	Sizing procedures and extensive testing allow us to accurately predict mixing efficiencies for the most difficult applications. Provides better mixing per unit length than any other mixer	805
Heat Exchanger	Offers the highest available coefficients for fast, uniform heat transfer by exclusively using Kenics® Static Mixer Technology	Exchangers require less space, less energy and less residence time than standard designs while providing predictable, controlled mixing	808
WVM (metric unit)	Builds on the key advantages of the HEV mixer, but offers more flexible range of options suited for differing conditions	Allows optimization of length vs. pressure drop parameters to suit any application	—
Prochem® Products	Features	Benefits	Bulletin Number
MD	Modular design, featuring innovative shaft bearing cartridges, allows longer operating runs between maintenance periods	Routine maintenance and overhauls can be performed without draining the tank or removing the mixer	720
PB	Combines the proven features of the MD Series with the advantages of a pillow block bearing design	Truly efficient fluid processing plus maximum simplicity of maintenance	720



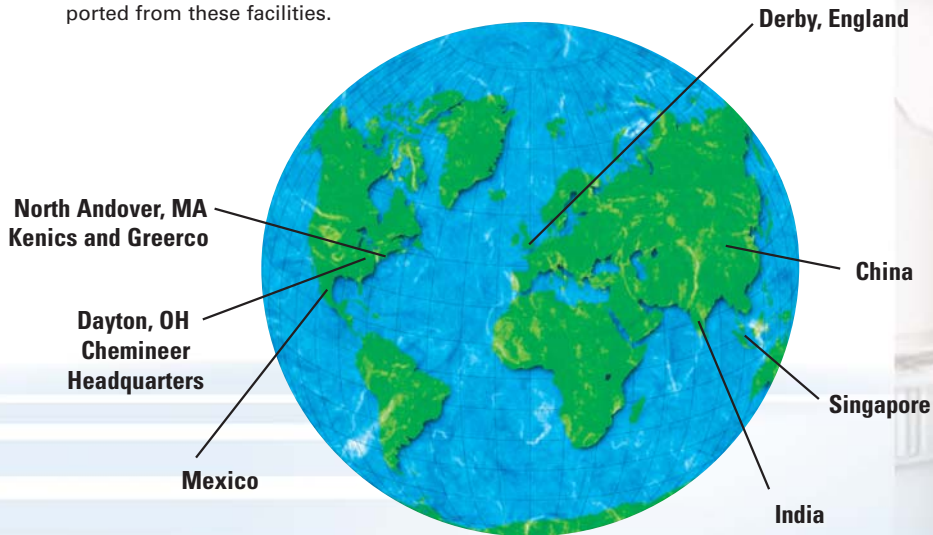
Market Diversity

Chemineer uses the knowledge from many years of experience to design mixing solutions for a variety of markets such as:



Sales Channels

Sales representatives have territories throughout the world and are supported from these facilities.





Fluid Management Group

Chemineer, Inc. is part of the family of businesses that comprise the Fluid Management Group of Robbins & Myers, Inc. The Robbins & Myers Fluid Management Group is a leading provider of innovative fluid management solutions that deliver superior performance, long service life and exceptional value. The Group brings together its global resources — engineering, manufacturing, application expertise and cutting-edge, proprietary technology — to deliver high quality, dependable products, effective system solutions and responsive support services to benefit customers worldwide.

Satisfying a broad range of application needs, the Fluid Management Group focuses its resources on the oil and gas discovery and recovery, chemical process, water and wastewater, food, biofuels, pulp and paper, pharmaceutical and numerous other industries.

The Fluid Management Group's parent company, Robbins & Myers, Inc., supplies highly-engineered, critical equipment and systems for global energy, industrial, municipal, chemical and pharmaceutical markets. Robbins & Myers provides innovative products, application engineering expertise, customer support and a competitive cost structure that create value for its customers.



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