

# Mixing Technologies

Solutions  
for Sanitary  
Applications



**NOV**

# Meeting the Challenges of Aseptic Processes

Successful aseptic processes involve performance on many levels from the design process through construction, validation and onto process operation. With thousands of installations worldwide, we have the proven experience to consistently provide validation based products, services and system solutions.

We apply our extensive application knowledge and high quality equipment to provide the performance you require in a variety of sanitary applications including:

- Suspending, incorporating or dissolving solids with high flow/low shear impellers
- Blending fluids either in line or within process vessels
- High shear mixing, deagglomeration, dispersion and emulsification
- Maximizing heat transfer with even highly viscous or difficult to process materials

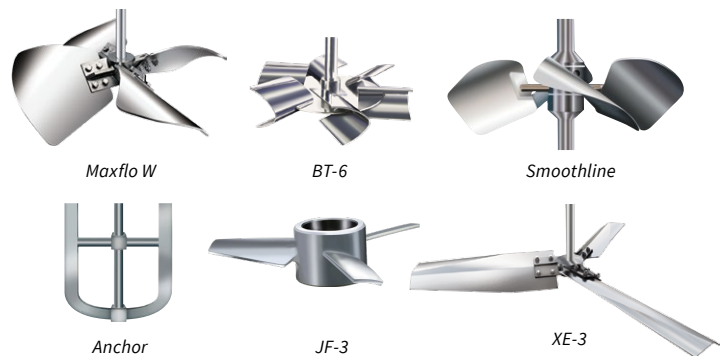


*Cleanability and removing all possibilities for contamination are vital to these processes*

## The Mixing Technologies Difference

The extensive line of Chemineer™, Kenics™ and Greerco™ sanitary products coupled with our responsive service provide numerous benefits to the customer not often found in competitive offerings including:

- **Accelerated commissioning/validation documentation** — including product descriptions, assembly and dimensional drawings/data, surface finish data, material certifications, inspection and test reports and much more
- **Efficient order processing** — procedures specifically designed for aseptic applications to ensure timely execution and delivery
- **Application versatility** — proprietary ChemScale™ method for effective product selection
- **Proven performance and extended service life** — sophisticated product design software and heavy duty components
- **Optimal mixing efficiency** — high performance impeller options and unique flow configurations
- **Ease of maintenance** — designed for thorough clean up and simple seal maintenance to minimize downtime and costs
- **Local support** — commissioning and engineering personnel readily available to assist you



## Impeller Process Technology

Our impeller process technology is effectively applied across your spectrum of applications ensuring successful, repeatable results from lab scale to full scale operations.

Our mixing expertise includes low shear liquid-liquid/solids blending, gas dispersion, high shear blending and viscous mixing. Whether you are in the R&D or production phase, from API reactors to media/buffer prep, we have the expertise to solve your latest mixing challenges.

An impeller brochure is available with additional information.





Model 20 GT



RBT



DT



SSP

Mechanical technology must be combined with process aspects for a truly complete design. Our thorough understanding of fluid mixing dynamics is combined with current ASME-BPE concepts resulting in cleanable, robust designs.

## Cleanability at the Forefront

Mixing surfaces that promote the free draining of liquids, during F.A.T. through to production operations, are vital to having the process validated. We apply this concept to all components in the mixing system including polish, welds, mounting flanges, shafts, in-tank couplings and impellers.

## Mechanical Considerations

- Mixing volumes from 10– 40,000+ liters including bioreactors
- Smoothline impellers
- CIP/SIP construction
- FDA or USP Class VI elastomers
- Mobile vessels: Optional right angle drives offer both low head room (14") for doorways and low centers of gravity for tip hazard avoidance
- Small footprint: Inline drive systems for minimum interference with nozzles and process piping
- We will engineer custom size mixers to suit your requirements



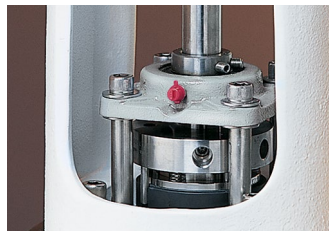
Chemineer HT agitators used in a sanitary environment mixing a consumer product

- Bottom entering designs for applications such as bioreactors
- White polyurethane or all stainless motors and gear drives—lab to full scale
- Direct drive or gear drive designs available
- Operating speed flexibility: Ask for designs below the first critical speed as they eliminate the need for programming speed avoidance ranges
- Wash down duty gear reducers
- Optional shaft drop collar to facilitate seal removal
- Aseptic mechanical seals
  - Dry or wet running
  - Single, double or gas lift off designs
  - Others available upon request
- Lip seals and stuffing boxes
- Seal maintenance: Gear drive swings clear for easy access on Model 20 GT
- Sanitary in tank couplings: Threaded or flanged connections
- Mounting flanges: ANSI, ferrule (tri-clamp), DIN, special
- Anchor nuts with washers when bolting is necessary



## Gear Reduced DT Mixer

- 1 Industry standard, off the shelf, NEMA electric or air motor
- 2 Advanced, heat treated helical gearing
- 3 Gear drive is permanently lubricated with high performance FDA approved grease
- 4 Sealed gear drive prevents both product and lubricant contamination
- 5 Helical, AGMA quality gears provide smooth, quiet operation
- 6 Elastomeric lip seal
- 7 Heavy duty, permanently lubricated and sealed for life bearings
- 8 Chuck coupling with dual set screws or bolted flange coupling (also available), allow for shaft removal without disassembling the unit



*Sanitary, single mechanical seal assembly*



*Single integral steam port in solid stainless steel mounting flange*

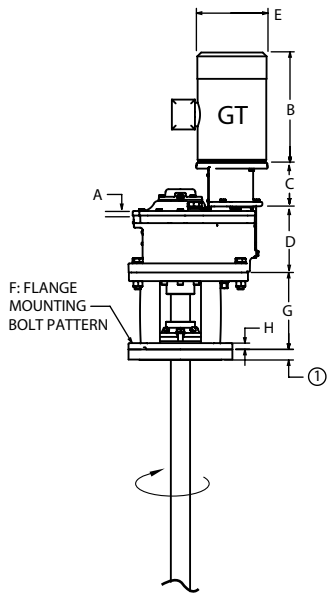
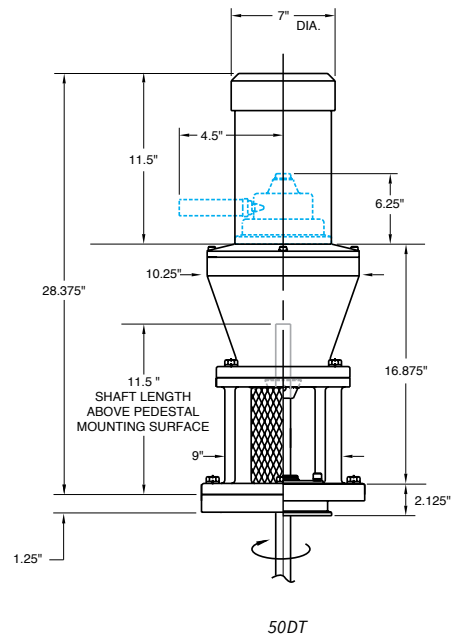
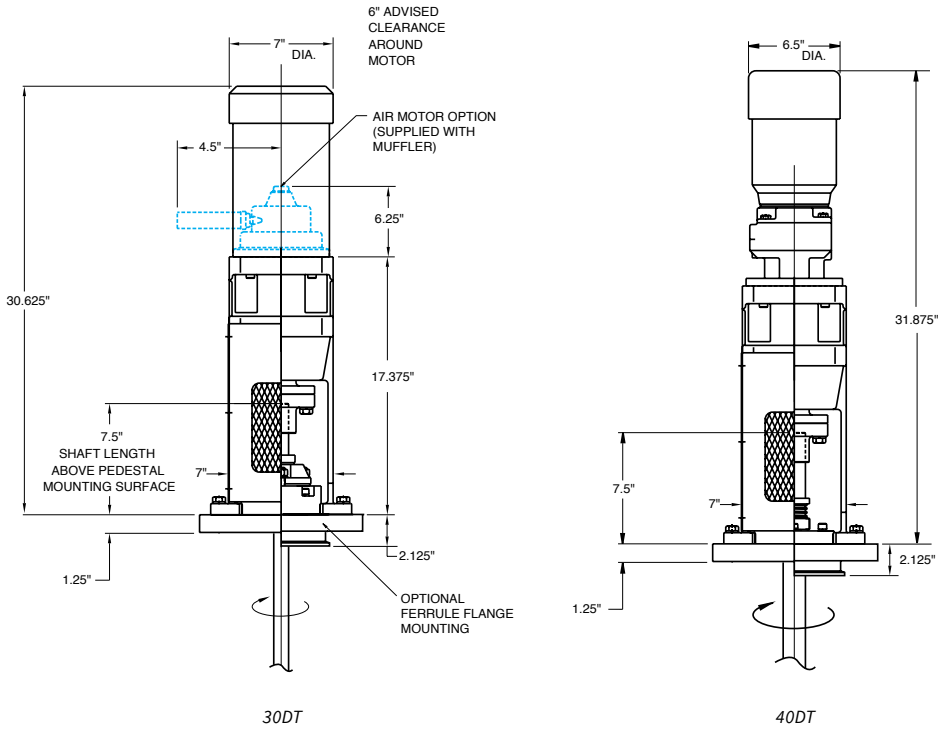


*SSN*

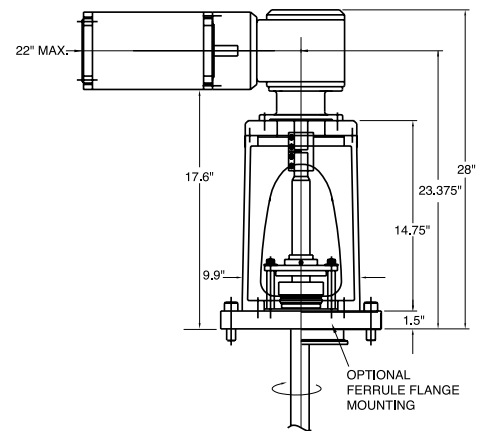
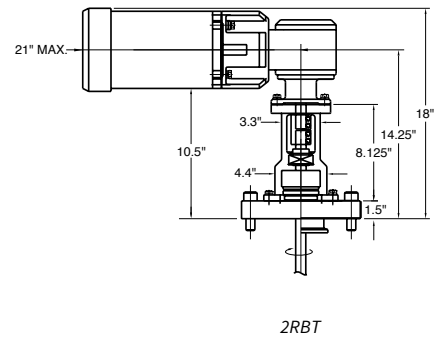
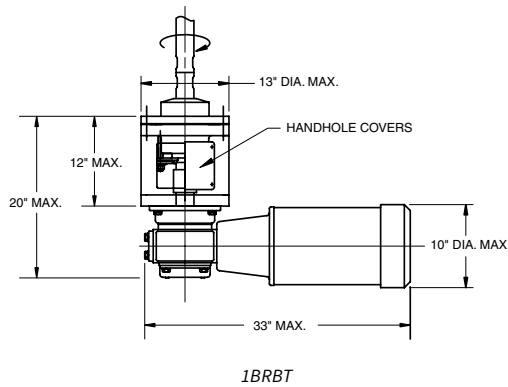


*DTN/NS*

# Dimensions



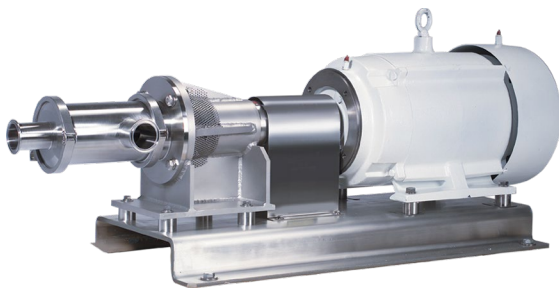
Model 20 GT  
N, NC, NS & NT  
(N, NC & NS Drives Swivel)



## Model 20 GT Dimensions Chart

Case Size	A	B (max)	C (max)	D	E (max)	F	G	H
						Bolt Pattern	Swivel	
21GT	1.18"	17.96"	5.51"	8.47"	11.00"	8" — 150# ANSI (Holes Straddle C.L.)	10.00"	0.75"
22GT	1.38"	27.0"	8.23"	10.75"	16.88"	10" — 150# ANSI (holes on Center Line)	12.50"	0.88"
23GT	1.58"	31.75"	10.83"	14.80"	20.88"	12" — 150# ANSI (Holes Straddle C.L.)	14.06"	1.18"

Greerco products provide flexible, cost efficient inline and batch processing for sanitary, high shear applications. This technology is utilized for a wide range of deagglomeration, dispersion, emulsification and rapid mixing operations. Due to the unique and proprietary nature of the typical high shear application, this equipment is available on a rental basis for lab or full scale trials allowing customers to determine how our technology can be applied to their specific processing needs prior to purchase.



SPLM



WV

WH

### Sanitary Pipeline Mixers

The sanitary pipeline mixer (SPLM) may be applied to a wide range of intermediate and final processing operations. Like most high shear devices, the Greerco pipeline mixer employs a high speed turbine running in close proximity to a fixed stator to perform its shearing operation. However, the Greerco product line offers a unique axial in-axial out flow configuration for processing benefits not seen in an axial in-radial out flow configuration. Product is processed as it passes through one (single) or two (tandem) of these shear zones that result in intense hydraulic and shear forces.

- 316 SS wetted parts, other materials available upon request
- Sanitary ferrule connections
- Mechanical cartridge seals
- Stainless steel base
- Washdown motor
- Discharge port with 270° rotation
- Customer specified seals and motor available

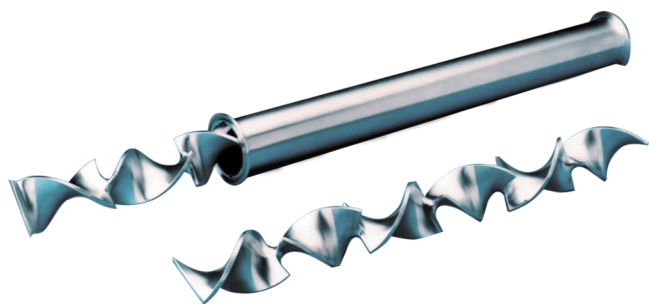
### Colloid Mills

The Greerco colloid mill (WV or WH) is a high speed, high shear mixer capable of batch or inline processing. Although a colloid mill is commonly considered a particle destruction unit, it is actually a dispersion piece of equipment. This machine will blend, emulsify, deagglomerate and produce a thorough wetting of dispersed substances resulting in a completely homogeneous product. Like the pipeline mixer, the colloid mill utilizes a high speed rotor spinning in close proximity to a fixed stator. However, instead of varying the number of rotor-stator combinations to vary shear, the Greerco colloid mill offers the user the ability to adjust the gap between the rotor and stator on the fly via an external hand wheel and visible adjustment dial.

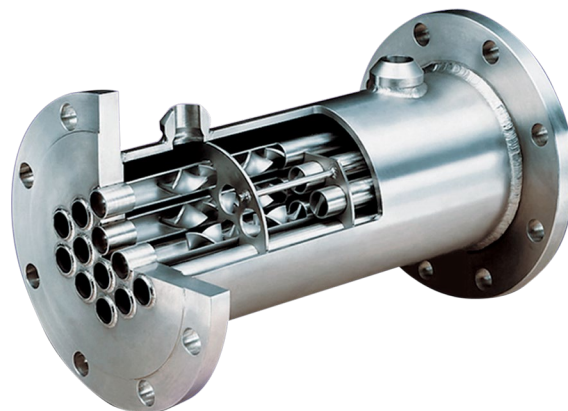
- 316 SS wetted parts, other materials available upon request
- Sanitary ferrule connections
- Jacketed stator housing
- Standard double lip seal shaft sealing (optional mechanical seal configuration)
- Horizontal (inline) or vertical (batch) mounting
- Explosion proof motor
- Several discharge port locations
- Options include stainless bases and white motor paint
- Customer specified seals and motors available

Tabletop colloid mill complete with hopper and recirculation tubing available for small batch and laboratory processing.

Kenics products commonly used in sanitary applications are our inline static mixers and heat exchangers. As the static mixing pioneer, Kenics offers its customers over thirty years experience in the design and manufacture of static mixing products.



KMR



Heat Exchanger

## Sanitary Static Mixers

Kenics sanitary static mixers feature an alternating helical element string that creates flow division and a radial mixing mechanism to disperse and blend any fluid introduced to the mixer. Due to the plug flow characteristics of the design, this self cleaning element design is ideal for sanitary operations. The process fluid is continuously and completely mixed within the pipeline, eliminating gradients in temperature, velocity or concentration without moving parts or any additional maintenance requirements.

- 316 LSS construction
- Sanitary ferrule connections
- Removable element assembly
- 3A certified design/construction
- Optional ASME-BPE compliant documentation
- Mirror finish on elements available
- 32Ra housing finish (standard)
- 0.5" to 4" diameters in stock
- Optional electropolishing available
- Custom housing finishes available

## Sanitary Heat Exchangers

Kenics sanitary heat exchangers feature the Kenics helical element static mixers to improve the heat transfer in a sanitary shell-and-tube heat exchanger. The increased efficiency of the Kenics design offers maximum heat transfer to highly viscous, difficult to process materials. The plug flow design of the mixing elements increases the inside film coefficient by creating continuous surface renewal at the wall of the exchanger tubes. Benefits of the design include reduced fouling, uniform heat history and elimination of thermal gradients.

- Completely customized construction
- Removable element assemblies
- TEMA and ASME code construction
- 3A certified construction available
- Optional electropolishing and passivation
- Sanitary ferrule connections



# Chemineer

Chemineer is a leading provider of process solutions for the oil and gas industry.

Our products and services are designed to improve efficiency and reduce costs.

For more information, please contact your local sales office.

Chemineer is committed to providing the highest quality products and services.

Our dedication to customer service is our top priority.

Chemineer is a leader in the industry and we are proud to be part of the team.

Our products and services are designed to meet the needs of our customers.

Chemineer is a leader in the industry and we are proud to be part of the team.

Our products and services are designed to meet the needs of our customers.

Chemineer is a leader in the industry and we are proud to be part of the team.

Our products and services are designed to meet the needs of our customers.

Chemineer is a leader in the industry and we are proud to be part of the team.

Our products and services are designed to meet the needs of our customers.

Chemineer is a leader in the industry and we are proud to be part of the team.

Our products and services are designed to meet the needs of our customers.

Chemineer is a leader in the industry and we are proud to be part of the team.

Our products and services are designed to meet the needs of our customers.

Chemineer is a leader in the industry and we are proud to be part of the team.

Our products and services are designed to meet the needs of our customers.

Chemineer is a leader in the industry and we are proud to be part of the team.

Our products and services are designed to meet the needs of our customers.

Chemineer is a leader in the industry and we are proud to be part of the team.

Our products and services are designed to meet the needs of our customers.

Chemineer is a leader in the industry and we are proud to be part of the team.

Our products and services are designed to meet the needs of our customers.

Chemineer is a leader in the industry and we are proud to be part of the team.

Our products and services are designed to meet the needs of our customers.

Chemineer is a leader in the industry and we are proud to be part of the team.

Our products and services are designed to meet the needs of our customers.

Chemineer is a leader in the industry and we are proud to be part of the team.

Our products and services are designed to meet the needs of our customers.

Chemineer is a leader in the industry and we are proud to be part of the team.

Our products and services are designed to meet the needs of our customers.

Chemineer is a leader in the industry and we are proud to be part of the team.

Our products and services are designed to meet the needs of our customers.

Chemineer is a leader in the industry and we are proud to be part of the team.

# Chemineer

Chemineer is a leading provider of process solutions for the oil and gas industry.

Our products and services are designed to improve efficiency and reduce costs.

For more information, please contact your local sales office.

Chemineer is committed to providing the highest quality products and services.

Our dedication to customer service is our top priority.

Chemineer is a leader in the industry and we are proud to be part of the team.

Our products and services are designed to meet the needs of our customers.

Chemineer is a leader in the industry and we are proud to be part of the team.

Our products and services are designed to meet the needs of our customers.

Chemineer is a leader in the industry and we are proud to be part of the team.

Our products and services are designed to meet the needs of our customers.

Chemineer is a leader in the industry and we are proud to be part of the team.

Our products and services are designed to meet the needs of our customers.

Chemineer is a leader in the industry and we are proud to be part of the team.

Our products and services are designed to meet the needs of our customers.

Chemineer is a leader in the industry and we are proud to be part of the team.

Our products and services are designed to meet the needs of our customers.

Chemineer is a leader in the industry and we are proud to be part of the team.

Our products and services are designed to meet the needs of our customers.

Chemineer is a leader in the industry and we are proud to be part of the team.

Our products and services are designed to meet the needs of our customers.

Chemineer is a leader in the industry and we are proud to be part of the team.

Our products and services are designed to meet the needs of our customers.

Chemineer is a leader in the industry and we are proud to be part of the team.

Our products and services are designed to meet the needs of our customers.

Chemineer is a leader in the industry and we are proud to be part of the team.

Our products and services are designed to meet the needs of our customers.

Chemineer is a leader in the industry and we are proud to be part of the team.

Our products and services are designed to meet the needs of our customers.

Chemineer is a leader in the industry and we are proud to be part of the team.

Our products and services are designed to meet the needs of our customers.

Chemineer is a leader in the industry and we are proud to be part of the team.

Our products and services are designed to meet the needs of our customers.

Chemineer is a leader in the industry and we are proud to be part of the team.

Our products and services are designed to meet the needs of our customers.

Chemineer is a leader in the industry and we are proud to be part of the team.

## Sales Facilities

US Ohio  
+1 937 454 3200  
chemineer@nov.com

US North Andover  
+1 978 687 0101  
navinfo@nov.com

United Kingdom  
+44 1332 363 175  
chemineeruk@nov.com

China  
+86 21 6124 0001  
chemineercn@nov.com

Singapore  
+65 6271 1121  
chemineeruk@nov.com

Mexico  
+52 55 3300 5370  
chemineerventasmx@nov.com

Austria  
+43 1 8923481  
chemineeruk@nov.com

## Manufacturing Facilities

US  
+1 937 454 3200  
chemineer@nov.com

United Kingdom  
+44 1332 363 175  
chemineeruk@nov.com

China  
+86 21 6124 0001  
chemineercn@nov.com

National Oilwell Varco has produced this brochure for general information only, and it is not intended for design purposes. Although every effort has been made to maintain the accuracy and reliability of its contents, National Oilwell Varco in no way assumes responsibility for liability for any loss, damage or injury resulting from the use of information and data herein. All applications for the material described are at the user's risk and are the user's responsibility.

## Corporate Headquarters

7909 Parkwood Circle Drive  
Houston, Texas 77036  
USA

