Chemineer

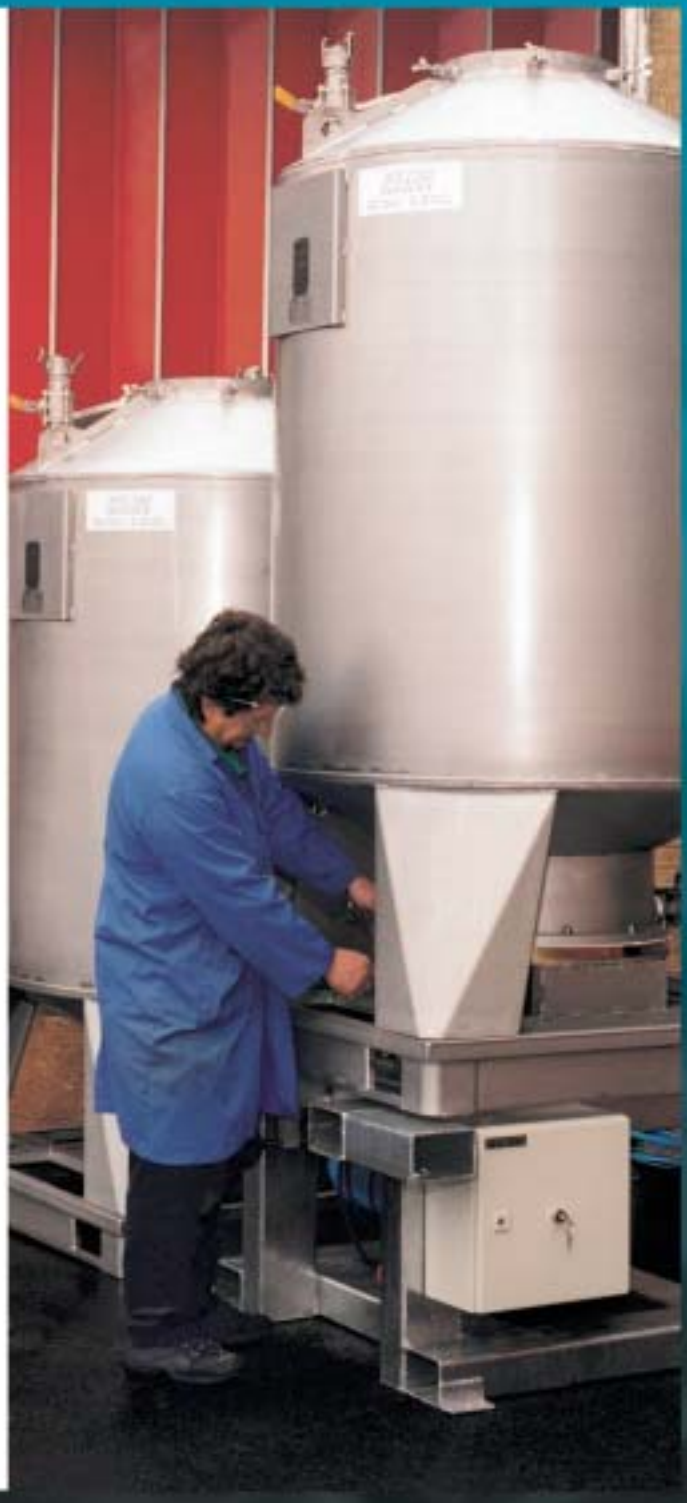
NIMIX® MIXING SYSTEM

A Completely Enclosed Mixing System for Applications Where Cleanliness and/or Sterile Environments are Mandatory

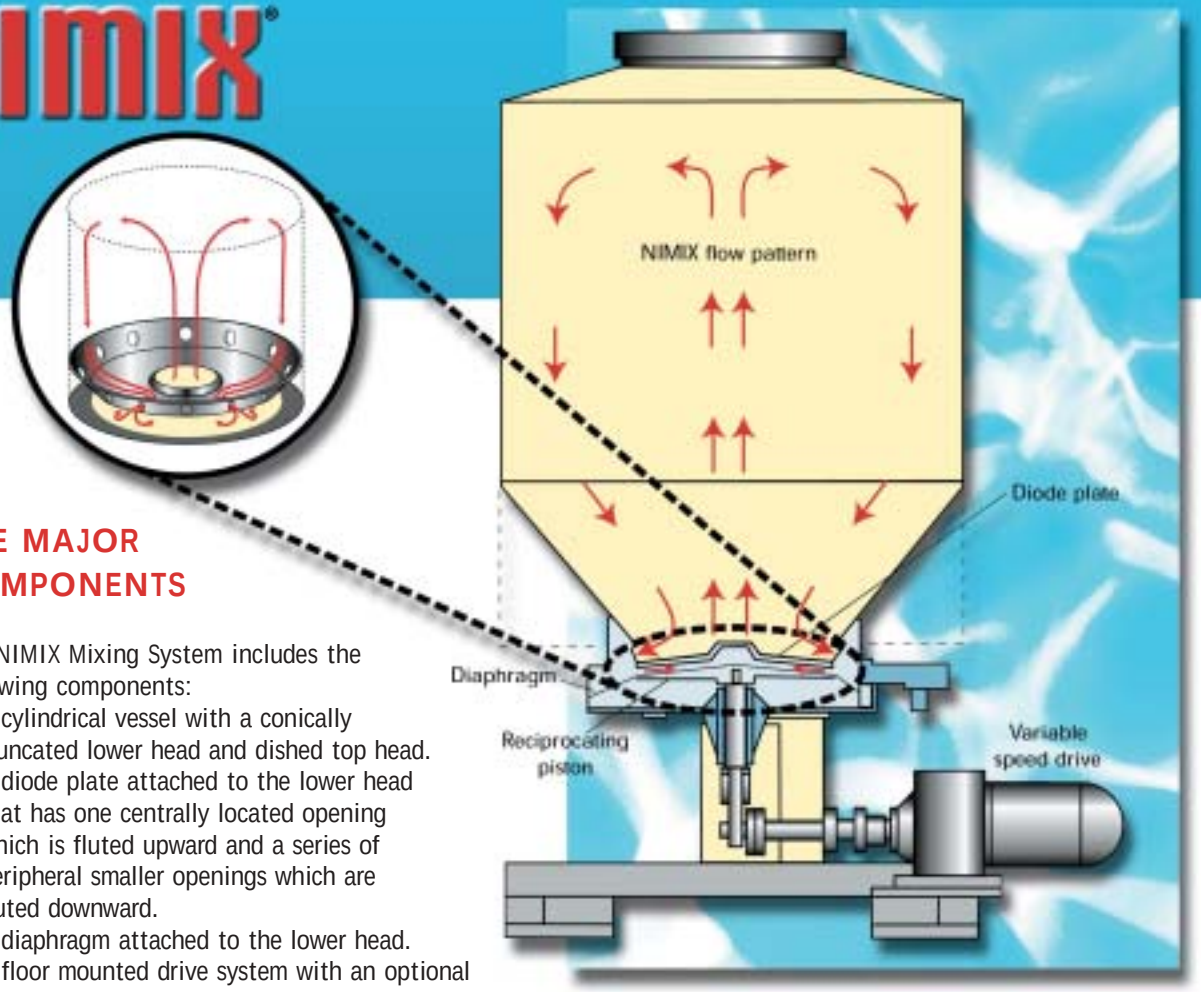
This unique non-intrusive mixing technology has been researched and developed over a 10 year period by the UK-based BHR Group and has worldwide patents. BHR is a highly respected, fluids mixing R&D company and is working with Chemineer, Inc. to bring the benefits of this technology to a wider application base.

The Chemineer NIMIX® Mixing System offers:

- A totally enclosed "zero particulate" environment, intrinsically safe and emission free
- Powerful top to bottom circulation; handles both Newtonian and non-Newtonian fluids as well as highly loaded slurries
- Solids draw-down with minimal overhead vapor incorporation
- Low shear mixing for shear sensitive materials
- 10:1 turndown capability for small batches
- CIP capability with optional spray-balls
- Separate vessel and drive variants for intermediate bulk containers
- Standard sizes of 100, 1000, 2000 and 5000 liters (26, 260, 530 and 1300 gallons)
- Polish available for food and pharmaceutical applications
- All wetted materials are 316SS and food and pharmaceutical grade PTFE
- Low noise levels (<80 dBA)
- Complete drain-down
- Simple and highly reliable drive system



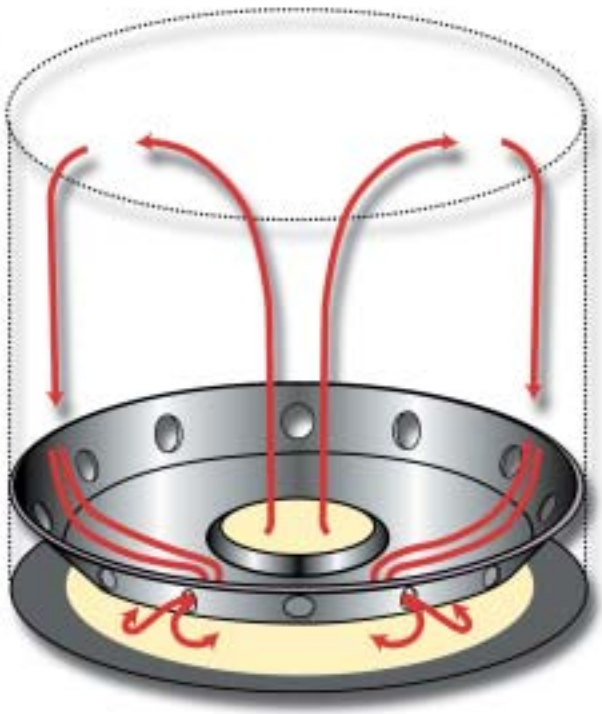
NIMIX®



THE MAJOR COMPONENTS

The NIMIX Mixing System includes the following components:

1. A cylindrical vessel with a conically truncated lower head and dished top head.
2. A diode plate attached to the lower head that has one centrally located opening which is fluted upward and a series of peripheral smaller openings which are fluted downward.
3. A diaphragm attached to the lower head.
4. A floor mounted drive system with an optional VF drive system.

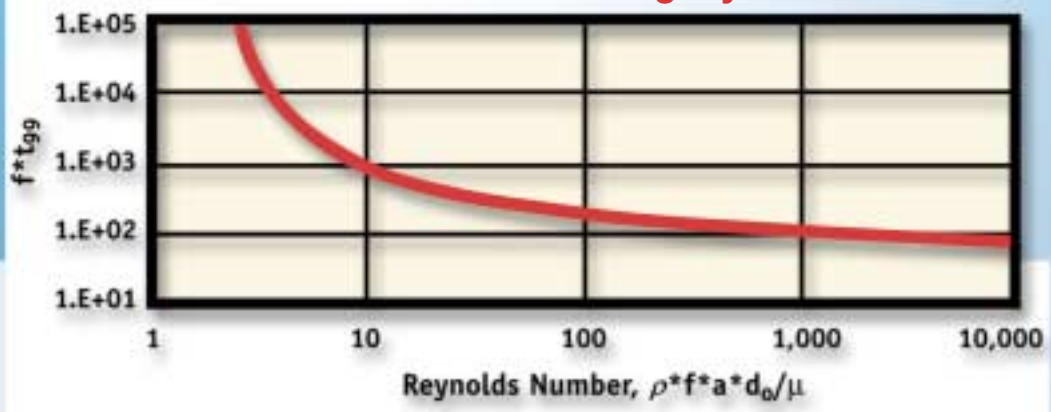


PRINCIPLE OF OPERATION

Mixing is accomplished through a fluid diode principle. When the diaphragm is pulled down, significantly more fluid is drawn through the peripheral openings than through the central opening. When the diaphragm is pushed upward, more fluid preferentially flows through the central opening. This motion causes a flow pattern in the tank with fluid moving centrally upward and down at the wall. Thus, mixing is accomplished without the introduction of a rotating or reciprocating shaft.

This principle of mixing makes the NIMIX Mixing System ideal for variable batch sizes. There's no need to worry about where the impeller is located and whether or not there will be sufficient agitation to accomplish mixing. This is a major advantage for systems which must be capable of suspending solids until essentially the entire vessel is emptied. Turndown ratios of 10:1 are available with the NIMIX Mixing System.

Dimensionless Blend Time for Nimix Mixing System



BLENDING PERFORMANCE

Mixing studies have characterized the blend time in dimension-less terms. This permits blend times to be computed for any system. The chart above shows a plot of the dimension-less blend time versus the Reynolds number through the opening of the central orifice in the diode plate. The Reynolds number through the diode plate is calculated from:

$$N_{\mathrm{Re}} = \frac{\rho f a d_o}{\mu}$$

where ρ is the density of the fluid, f is the frequency, a is the amplitude, d_0 is the central diode plate orifice diameter. The parameter $f*t_{99}$ is the dimension-less blend time to 99% uniformity.

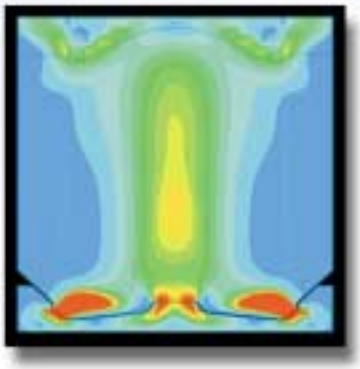
One very distinctive feature of the NIMIX Mixing System is its performance in blending more viscous materials. Impeller driven mixing systems significantly drop off in pumping as viscosity is increased. The pumping chamber behaves somewhat similarly to a positive displacement, diaphragm pump. Flow rate does not change significantly with viscosity. As a result blending efficiencies for the NIMIX Mixing System are superior to those of high efficiency impeller systems at higher viscosities.

The NIMIX Mixing System can make down solids with minimal incorporation of overhead vapor. Simply add the solids to the surface of the liquid and the developed flow pattern will do the rest.

RESEARCH & DEVELOPMENT

Significant research has been conducted on the NIMIX Mixing System. However, users continue to press the envelope, thus requiring a continuous R&D effort. Chemineer maintains a test system where new information is developed on a regular basis. In addition, Chemineer maintains a number of test systems available for lease.

Computational Fluid Dynamics (CFD) is used to better understand the physical nature of the changes taking place. Chemineer also utilizes Digital Particle Image Velocimetry (DPIV) and Laser Doppler Anemometry (LDA) to develop solutions to difficult mixing problems.



250-GALLON INTERMEDIATE BULK CONTAINERS *(see cover photo)*

Intermediate Bulk Container (IBC) Systems provide a separate vessel and drive system. This separation allows one drive system to serve any number of vessels. Such systems are used in one of two fashions:

- **One Product - Different Processing Centers**
  Instead of transporting reactants through pipes, mobile process vessels are transported from one processing stage to the next. Such a scheme eliminates pump transfers and pipe flushing between batches.
- **Multiple Products - One Processing Center**
  This technique permits manufacturing plants to carry out multi-lot, variable-batch production for various products of varying production sizes.

The NIMIX IBC System fulfills the requirements for UN-type approval of a metal IBC according to ADR agreement, RID - regulations and IMDG - code. Substances permitted for transport are liquid substances of packing groups II and III having a maximum density of 2.6 and a maximum vapor pressure of 110kPa (16 psi) at 50°C (120°F). In addition NIMIX systems have passed the 1 hour vibration test in accordance with the US Code of Federal Regulations, 49 CFR, Subpart 0, Paragraph 178.819.

Advantages of the NIMIX IBC System in comparison to mechanically agitated systems:

- Handles batch sizes as small as 26 gallons (100 liters)
- Does not have shafting or baffles to accumulate material
- Completely contains vapors, no particles from seals or intrusion of contaminants
- More efficient at pumping and blending at higher viscosities than high efficiency impellers
- Easily re-suspends settled solids

Look for the Chemineer Symbol of Mixing Excellence

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