



# **Turbulent™ Technology**

- **Mixers**
- **Kneaders**
- **Dryers**
- **Reactors**



***Processing Excellence in Motion***  
***[www.dusatec.com](http://www.dusatec.com)***



# Turbulent™ Technology

*Highest efficiency in mixing, drying, compounding and reacting*

**D**USATEC Turbulent™ technology, with its unique mixing element configuration, commands a special place among well-proven mixing systems. This heavy-duty mixer effectively handles extreme ratios and problematic feedstock mixtures such as those with different bulk densities and granular sizes or solids combined with viscous constituents.

Turbulent technology offers advanced design of mixing elements that provide for superior mixing, shorter processing time, lower energy consumption, ease of cleaning and less maintenance.

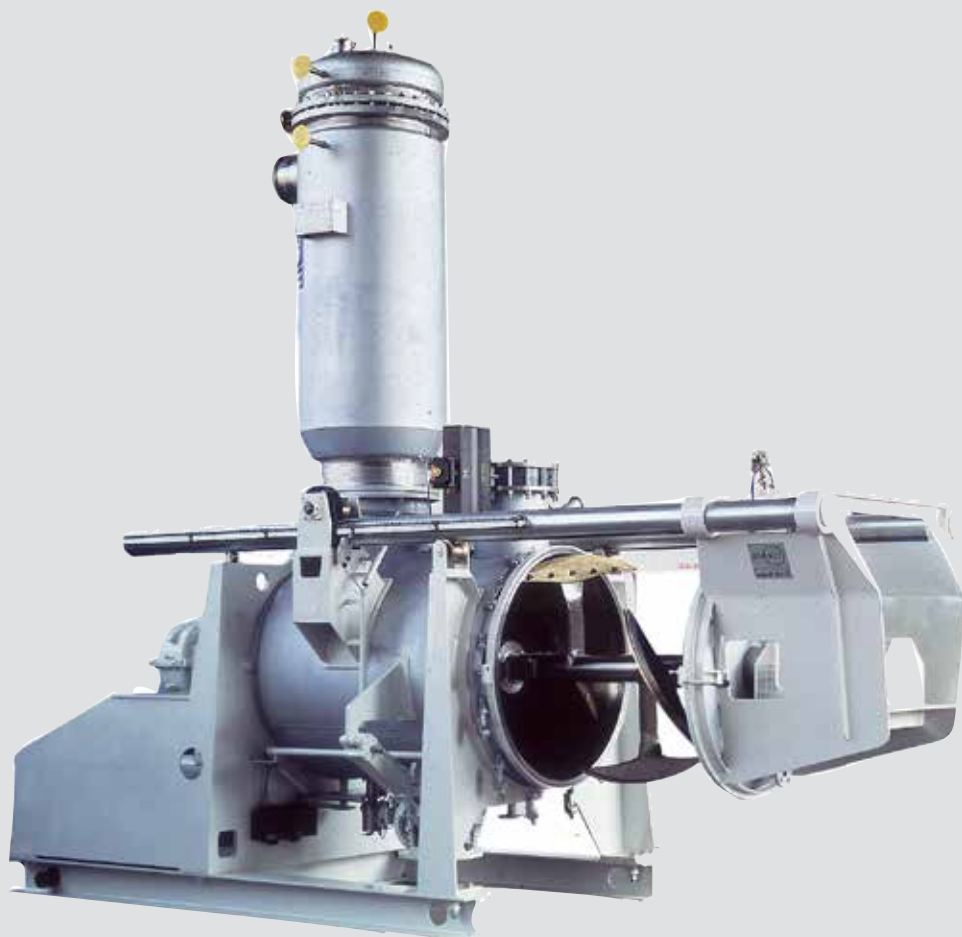
## OPTIMAL RESULTS

The peripheral velocity of the mixing elements in conjunction with their shape and configuration are designed to achieve desired results in only a few minutes in most cases. Even shorter mixing times are possible with the unique Turbulent Annular Layer Mixer. The design, configuration and velocity of the mixing elements can be tailored to achieve optimal production rates with repeatable quality.

The range of applications includes the blending of dry, free-flowing solids, wetting processes and suspensions, as well as the preparation of pastes and highly viscous materials that previously required heavy-duty Z-arm mixers. Even reaction and drying processes, which conventionally require a sequence of operations on several machines, can be undertaken in continuous sequences on a single DUSATEC Turbulent "All-in-One" reactor.

**Mixing  
Kneading  
Coating  
Wetting  
Dissolving**

**Melting  
Drying  
Reacting  
Granulating**





DUSATEC Turbulent mixing systems have been proven to be effective, rapid and versatile at many installations. Whether the task is to produce a simple dispersion or a difficult mixture, as a continuous or a batch process, at laboratory or large industrial scale, there is no finer mixing technology. More than 100 years of process know-how, experience in manufacturing specialty-processing equipment and advanced process control systems are incorporated in Turbulent technologies for mixing, drying, reacting and compounding.

#### WIDE RANGE OF CAPACITIES

Turbulent mixers/dryers/reactors are available in both batch or continuous designs, with capacities ranging from 2.5 liters to 50,000 liters. The Turbulent technology is designed for a wide array of applications and process conditions, capable of operating at temperatures of up to 350°C and process conditions requiring full vacuum and pressure up to 40 bar.

Three-dimensional movement of the product is ensured via the advanced blade design. Processed product is pushed through the center of the mixing vessel and the force created by the high-speed rotation of the agitator shaft displaces the material to the walls of the mixing

vessel. Intensive axial and radial product exchange is achieved constantly inside the mixer.

A high Froude number increases the mixing quality while decreasing cycle times as a result of the rapid and constant exchange of particles within the mix. Large-area mixing paddles cover the entire surface of the vessel, virtually eliminating dead spots and completely discharge the mixer contents.

The system's turbulent force ensures thorough dispersion of solids as well as efficient heat transfer. The unique agitator design when operating at supercritical speeds is equally suitable for handling dry materials of various particle size and structure, wet solids and liquids and pastes up to kneading viscosity.

#### FOR VIRTUALLY ANY PROCESSING APPLICATION

GMP, CIP and SIP requirements can easily be met with Turbulent technology for applications in:

- Chemicals/fine chemicals
- Pigments & dyestuffs
- Plastics
- Cellulose derivatives
- Synthetic fibers
- Paper
- Ceramics
- Printing inks
- Adhesives
- Precious metals
- Building materials
- Industrial minerals
- Food/confectionery
- Soaps & detergents
- Pharmaceuticals
- Cosmetics
- Biomaterials

With so many custom-built Turbulent systems installed around the world, DUSATEC probably has already designed a system for your application. However, we treat each customer uniquely and design and manufacture a system accordingly. Our experience, technology and your requirements are put together for the perfect solution to your processing needs.

# The Turbulent Advantage

*Customized solutions for the most challenging materials*

**W**hatever the material or mixing ratios, the Turbulent line of mixers, kneaders, dryers and reactors can deliver the results you need. The processing units are capable of mixing, kneading, coating, wetting, dissolving, melting, drying, reacting and granulating materials of different bulk densities, consistencies and viscosities. The systems include:

- Turbulent mixers and compounders
- Turbulent dryers and reactors
- Turbulent SuperFlusher®

These systems are suitable for applications ranging from mixing dry, free-flowing solids to wetting processes and granulations to paste preparations of kneading consistency as well as complex drying and reaction processes.

## **TURBULENT MIXERS AND COMPOUNDERS**

With mixing capacities ranging from 2.5 liters to 50,000 liters, these highly effective systems are available in batch or continuous process designs. Turbulent mixers and compounders are among the most trusted technologies in many industries.

Featuring the ability to achieve a homogeneous product and good dispersion in short mixing times, they provide gentle mixing when needed; short batch cycles through quick charging and discharging; intensive kneading using specially designed mixing tools; easy cleaning; and other operating conveniences. Advantages include:

- Production of homogenous mixes i.e. (1:100,000) from



pourable solids

- Mixing and dispersing of near-liquids to pasty suspensions
- Granulation of small grain masses
- Wetting and coating of powders
- Good dispersion in short mixing times
- Gentle mixing if required
- Short batch cycle through quick charging and discharging
- Intensive kneading can be achieved through specially designed mixing tools
- Easy cleaning (available with retractable mixing tools)
- Low spare part stock: simple adaption of mixer parts to changing mix materials through modular design

## **TURBULENT DRYERS AND REACTORS**

Turbulent dryers deliver exceptional results through intensive contact drying of material through dryer walls, mixer shaft and blades; atmospheric drying through hot gas flow; gentle vacuum drying; and short drying times. The Turbulent line of reactors – including the All-in-One reactor – boasts superior performance through short reaction times; optimum heat transfer via large contact areas; mixing by mechanical fluidization of material; and the elimination of dead areas in the reactor and discharge areas. They are also easy to clean and sterilize in place so idle time is minimized. Advantages include:

- Thickening of highly viscous suspensions and solutions, also under vacuum
- Drying of bulk materials





- Stripping of solvents
- Pasteurizing/sterilizing of liquids and solids
- Blending of powders
- Intensive contact drying of material through dryer walls, mixer shaft and blades
- Atmospheric drying through hot gas flow
- Gentle vacuum drying; short drying times
- No problems during the transitions phase from paste to crumbly product state
- Easy cleaning (available with retractable tools)
- Destruction of agglomerates
- Chemical reactions, endothermic and exothermic, as well as biological reactions under pressure or vacuum
- Short reaction times
- Optimum heat transfer via large contact areas
- Turbulent mixing by mechanical fluidization of material
- No dead areas in reactor and the discharge areas
- Easy to clean and sterilize
- Long service life through the use of corrosion-resistant reactor materials (stainless steels, hastelloy, titanium, nickel alloys)

### TURBULENT SUPERFLUSHER

The Turbulent SuperFlusher® is a batch, heavy-duty horizontal mixer designed to mix and knead pigment and other flushes with sufficient energy to drive water out of press cakes. Additionally, the flusher mixing paddle imparts the necessary shear for dispersion and drying and extremely efficient vacuum drying. It allows easy standardization of the dispersion and easy product discharge.

Each step in the operation of the SuperFlusher has been designed to be convenient and time-efficient, enabling the operator through automation to easily produce consistent batches; heavy manpower is no longer needed. Because it is jacketed, the system has the advantage of utilizing all available surfaces for thermal exchange, which means it is extremely efficient in temperature control and results in short batch cycles. The process consists of:

- **Pigment loading.** The staged press cake is charged into the SuperFlusher.
- **Vehicle loading.** The vehicle system components are pre-weighed according to formulation in the integral holding tank and fed at apportioned time and steps.
- **High-efficiency processing.** Special mixing/kneading elements within the SuperFlusher impart the highest shear possible into the batch, ensuring that all of the press cake has maximum exposure to the vehicle system.
- **Water break.** The SuperFlusher easily discharges the separated water from the vessel. Unlike double arm units, it is not necessary to rotate the body to discharge the water. The separated water is discharged through dedicated ports located in the bottom of the SuperFlusher. This ensures that the maximum amount of water is squeezed out.
- **Washing.** This step is facilitated through highly efficient mixing elements, which rip the flush apart and expose it to the wash. Washing is often accomplished with only one short wash cycle.
- **Vacuum drying/grinding.** The SuperFlusher excels in the drying and grind of the flush batch. Its design allows the entire body to be utilized for heat transfer, thereby achieving short drying and grinding times. Special mixing paddles also rip apart the flush and expose all of the surface to the system vacuum to produce a superior flush with increased strength and enhanced grind.
- **Standardization.** The SuperFlusher's special mixing element design makes short work of standardization. The flush may be let down as fast as the vehicles and oils are added, without livering issues. Let-down is accomplished by the increase of mixing speed and/or the reverse of the mixing elements.
- **Discharge/pack-out.** The SuperFlusher offers ease of discharge and pack-out. The flush is discharged through a central bottom valve to waiting bins, supersacks or other type containers.



# Turbulent™ All-Phase

*Carrying out multiple reactions in one reacting vessel*

**I**ncreasing efforts are being made in the chemical industry to carry out complex processes with heterogeneous reactions and alternating phases, preferably in a single operation on a single piece of equipment. This can be achieved with DUSATEC's Turbulent All-Phase mixing reactor, which features an agitator covering the entire diameter of the vessel and capable of running at above critical speeds. These systems are suitable for applications ranging from mixing dry, free-flowing solids to wetting processes and granulations to paste preparations of kneading consistency as well as complex drying and reaction processes.

Difficult reactions can be routinely carried out under vacuum or pressure in Turbulent All-Phase mixing reactors when comminuting aids are used in conjunction with applied thermal energy. Multiple reactions in most cases may be carried out in a single mixing reactor, which can substantially reduce costs by lessening the loss of material, time and energy associated with moving the feedstock from one processing station to the next. This is one of the major advantages and feature of the Turbulent mixing reactor.

## Agitator Key to Performance

Mixing performance is the most important criterion in determining the efficiency of many reaction processes. This is where the performance-proven Turbulent horizontal rapid mixer is employed for difficult processes. With a modular construction featuring an agitator covering the entire diameter of the vessel, the Turbulent reactor is easily configured to accommodate specific reaction and production rates.

The unique Turbulent agitator shaft is supported by bearings at both ends

and is configured to sweep the entire diameter of the cylindrical reaction/mixing vessel. The result is thoroughly mixed feedstock within a vessel free of dead spots (zones). This has a significant processing advantage especially with highly viscous feedstock.

The material being processed is subjected to an intense turbulence that ensures intimate dispersion as well as highly efficient heat transfer. The unique agitator configuration is equally suitable for handling dry materials of diverse particle size and structure, wet solids, liquids and heavy pastes of kneading consistency. Phase changes when drying filter press cakes, for example, are easily and effectively performed even under difficult conditions. The dispersing effect of the vessel-sized high-speed agitator ensures





uniform integration of solid-liquid systems, especially as the particle surface area increases. In some cases, it is even possible to mix and de-agglomerate to primary particle size without the use of additional comminuting aids.

### Accelerating Reactions and Controlling Particle Size

Individual comminuting units such as chopper rotary cutters or pin-disk impactors can be mounted to the Turbulent reactor vessel. The units serve as comminuting aids to obtain fine powdery reaction products free from agglomerates. These accelerators offer considerable additional advantages by promoting the fluidization of finely divided solids through suspension in a mechanically generated bed. The solids are then homogenized into micro-range, stabilizing systems. Small, varied viscous liquids can be dispersed into high-quality finished products free from agglomerates. Feedstock components are brought into the direct vicinity of the comminuting units as the material is displaced by the continuous sweeping action of the agitator.

### Chemical Reactor and Dryer

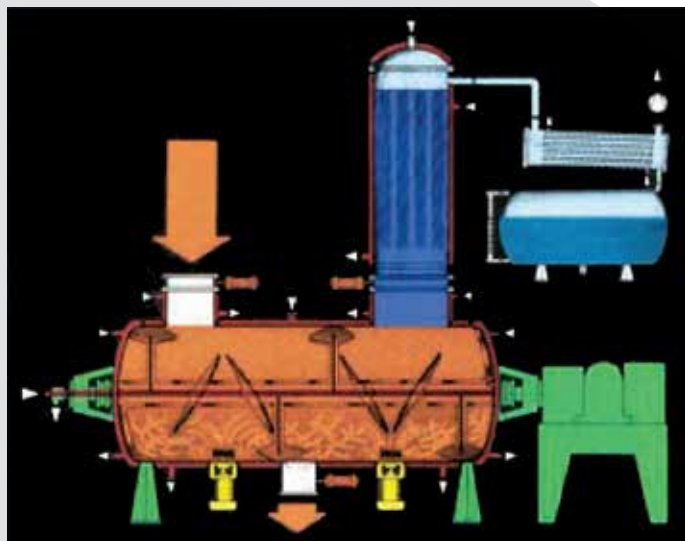
The Turbulent All-Phase mixing reactor is well-suited and particularly effective for thermal separation processes. This applies not only to the liquid byproducts such as water or solvents but also to the drying of the reacted material to fine-powder, free-from agglomerates. The highly efficient use of thermal energy is a result of the heat supplied to the reactor vessel jacket and/or agitator shaft supplemented by the frictional heat generated by the high-speed agitator blades and individual comminuting units. This can contribute as much as one-third of the required thermal energy within the process.

The agitator, by covering the entire reaction vessel diameter and the comminuting units, ensure the rapid mass heat transfer at the contact surfaces. The uniform application of heat to the reaction material is not impeded by agglomerates or by layers of material adhering to the inside surfaces of the reaction vessel. On the contrary, the high degree of fluidization contributes to the drying of solids facilitating the removal of liquids by evaporation. Another advantage of the Turbulent All-Phase Reactor is the ability to carry out reactions at very high or low temperatures, high pressures and/or low vacuum. This is possible through the use of highly specialized mechanical seals that combine operational dependability with ease of service and long seal life.

### Special Technical Advantages

The Turbulent mixing system already offers the advantage of lower production costs by combining several reaction steps.

**Complete and uniform treatment of reaction mixture.** The agitator



configuration eliminates short-circuiting and dead space throughout the reaction mixture during the entire process. As a result, residence time is reduced, and the process sequence is simplified.

**Efficient processing of viscous reaction mixtures.** Reactions in the All-Phase do not require excessive amounts of reactants to induce good flowability. This means reducing the use of solvents as well as the costs of their recovery. The reactor may be sized smaller than conventional tank reactors requiring substantially smaller filter and condenser systems – which minimizes floor space requirements and capital outlay.

**Uncomplicated phase change.** All-Phase mixing reactors permit a separating process to be performed in direct sequence with a chemical reaction within the same vessel, and they enable particle size to be controlled during the drying operation. This can eliminate downstream steps such as solvent scrubbing, micronizing and classifying.

**Favorable energy balance.** The advantage of carrying out multiple reactions in a single reactor is reducing the costs of heating, filtering and recovery while minimizing the handling and conveying of material between process steps. The ultimate result is reduced energy consumption and improved efficiency.

All-Phase mixer reactors for complex reaction and drying processes in chemical manufacturing are definitely more than just a serviceable alternative. Their multiple uses as micro-mixer, chemical reactor and high-speed rapid dryer are indicative of numerous applications.

## DUSATEC – A New Name with a Long-trusted History



**Gisbert Schall**

Fairfield, NJ-based DUSATEC, Inc. is a new name in processing equipment excellence. Although it was founded in 2012, the company's president and its products for decades have been market leaders in industrial processing, serving a global base of manufacturers involved in materials as diverse as paints and coatings, plastics, paper, food, chemicals and others.

DUSATEC is led by Gisbert Schall, president and majority shareholder. As an industry thought leader, he was the visionary behind the founding of Draiswerke, Inc., the North American subsidiary of Draiswerke GmbH. After building the business into the premier name in milling and processing – an achievement based on unrivaled technical service and support, engineering excellence and technological innovation – he eventually sold the company to the Buhler Group of Switzerland before going into retirement.

In 2012, Gisbert came out of retirement to form DUSATEC for the purpose of acquiring the Turbulent™, K-TT, K-TTP, K-TR and Gelimat™ lines from Buhler.

As he has done in building Draiswerke, Inc., Gisbert is following the same guiding principles in building DUSATEC: offer high-quality processing technology with superior operating efficiencies and supported by knowledgeable technical service professionals. With customers located around the world, DUSATEC is committed to tailored solutions based on their specific processing needs and Gisbert's in-depth market knowledge. This approach enables the company to develop practical solutions to existing processing challenges.

DUSATEC continues to offer customers in North America, Asia and EMEA the most innovative and reliable processing technologies in the industry. Manufacturers are invited to learn more about how its superior products can help them improve processing efficiencies, lower costs and enhance throughput.

### The full line of DUSATEC Technologies

#### DUSATEC Turbulent



#### DUSATEC Gelimat



#### DUSATEC K-TT, K-TTP & K-TR Tornado

